Contract stability and farmer characteristics of contract chilli farming

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ABSTRACT: Contract farming has long been applied in Indonesia but has just revealed its ascending trend in recent times through private sector initiatives. The purchase guarantee and price certainty have induced farmers to join; however, deviation still occurs among them, shadowing the stability in its development process. In this study, an effort has been made to shed some light on the stability of a contract practised by farmers and a private agro-industry in the Jember chilli farming areas. Specifically, this study attempts to find the determinants of farmers' deviation from the contract on the basis of a survey involving a multiple-price list method to elicit individual characteristics drawn from the perspective of behavioural economics. Using probit regression controlled by demographic characteristics, this study found that present-bias preference and individual discount factor significantly affected the likelihood of deviation. The results also suggest that farmers' decision was significantly affected by several farming characteristics, including coordinator's decision, land size, expected price, and chilli farming experience.

1 INTRODUCTION

Price uncertainty has been a major issue in the agriculture sector and may affect both consumers and farmers (Security & OECD, 2011). As the price unpredictably fluctuates over time, contract farming (CF), which offers a fixed-price system, can be applied in order to address such issues (Eaton & Shepherd, 2001). In developing countries, including Indonesia, the implementation of CF has revealed its ascending trend in recent times through private sector initiatives (Prowse, 2012). The purchase guarantee and price certainty have induced farmers to join.

Numerous studies have been conducted to investigate the working of contractual partnership in the agriculture market, which mostly discuss two main issues: impact on farmers and participation motives (Wang et al., 2014). The former focuses exclusively on deliberating how farmers' welfare is affected by CF (Abdulai, 2016; Bellemare, 2012; Igweoscar, 2014; Miyata et al., 2009), whereas the latter focuses primarily on farmers' decision to participate in a contract (Masakure & Henson, 2005; Opoku-Mensah, 2012).

The studies emphasised the various aspects behind contract establishment, yet lacked explanations of any act that might have happened during a contract, such as a decision to deviate by one or both parties. In fact, a lot of deviations exist among CF practices, shadowing the stability in its developing process. If the market price is considerably low compared with the agreed price, farmers honour the agreement and comply. However, when the market price is rocketing, there is a big incentive for farmers to gain significant profit by deviating from the contract and selling their products in the open market. This act may or may not be rational behaviour, as they do not necessarily know the future price.

Variation in market price and future expected price affects farmers' decision to join a contract, whereas deviation may be induced by price shock. In the discipline of behavioural economics, a deviation of choice involving periodical time may be classified as a case of dynamic inconsistency. Farmers may have a self-control problem in committing to a contract because they naively perceive the future with bias. When they tend to underweight the future by ignoring price certainty from the contract, present-bias preference is probably involved and

leads them to impatiently attempt short-term payoff. Such a decision might not be rational because it may deviate from the maximum expected utility.

This study aims to analyse the stability of contract practised by farmers and an agriculture firm. Specifically, it attempts to find the significant determinants of farmers' decision to deviate towards a contract on the basis of a survey of farmers contracting with a private agro-industry in the Jember chilli farming areas. The theoretical underpinning for this study was drawn from the perspective of behavioural economics; therefore, to investigate the deviation in CF, special attention was given to its association with individual characteristics, including time preference and individual discount factor (IDF). Farmer characteristics were also involved to support and enrich the analysis, controlled by the demographic characteristics.

In Indonesia, behavioural economics has not yet developed and lacks empirical local research. However, in many developed countries, this discipline has long been applied by academicians, practitioners, or even governments (Rabin, 2004). This research may not only explain the farmers' deviation phenomenon but also become a stepping stone for further behavioural economics studies.

The subsequent section deliberates the underpinning in the specific field of behavioural economics and reviews several prior studies. Section 3 presents the methodology used to answer the research questions, including the description of the elicitation design as well as the suggested econometric framework. Section 4 presents and discusses the results. Conclusions and suggestions are presented in the last section.

2 ANALYTICAL FRAMEWORK

2.1 CF

CF is a special way to connect the gap between farmers and the agriculture industry whose primary production is not centred on big players but rather handled by small-to-medium scale farmers through agreement with downstream firms (White, 1999). It takes place in the supply chain of agricultural production as part of marketing, providing purchase guarantee and price certainty to farmers. By contracting with an agribusiness firm, farmers can generate higher profits and reach wider end markets (Barrett et al., 2012).

The establishment of a contract between farmers and firms provides not only opportunities but also challenges. On the one hand, as the contract helps farmers manage price and production risks, they may benefit by focusing on improving the production quality instead of dealing with uncertainty. These lead to more efficient use of land and processing capacities. Some studies state that the major determinants explaining the reason why farmers join a contract are reduction on risk (Allen & Lueck, 1995) and transaction cost (Costales & Catelo, 2008; Murrell, 1983).

On the other hand, there is obviously a risk for farmers to suffer potential loss (or be unable to benefit significantly) when the market price dramatically increases. There is also another risk that firms fail to purchase as promised. Sambuo (2014) found that the farming experience, along with farm group and age, has significant influence on farming participation. This may explain how the understanding about the risks of CF, growing with experience, leads to their willingness to join a contract.

The system of CF should be perceived as a mutual trust between farmers and agribusiness. To achieve its stability, CF requires long-term obedience to the agreement from both parties. Manipulative arrangements and exploitative agreements by firms are likely to step down the contract duration to only a limited period and may cause failure in investments. Similarly, farmers need to consider that committing to the contract is likely to be to their long-term benefit. Any dishonest act can lead to a failure of contract, and contract reconstruction after deviation is not likely to happen (Dhillon et al., 2006).

CF in developed countries is considerably different from that in developing countries. Farmers achieve more success in improving welfare in developing countries than in developed countries, especially when much attention is paid by third parties such as the government and

non-governmental organisations (Wang et al., 2014). In developing countries, farmers are able to obtain more advanced technology, reach scale economies, and improve their welfare by gaining more return (Miyata et al., 2009; Tripathi et al., 2005).

2.2 Dynamic inconsistency

A standard model in economics assumes that people maximise their own utility rationally, considering the payoff level of their choice, in a particular probability and consistency over a time period (Bailey, 2010). This maximisation is formulised by Rabin (2004) and modified by DellaVigna (2007) in the form of an inter-temporal utility function:

$$\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{s_t \in S_t} p(s_t) U(x_i^t | S_t) \quad (1)$$

Individual i at time $t = 0$ maximises expected utility subject to probability distribution $p(s)$ of the states of the world $s \in S$. The utility function $U(x|s)$ is determined from the payoff x_i^t that individual i receives. The discount factor δ^t underweights the future utility and is always consistent over time.

Deviation from rationality refers to inconsistency in preference, belief, or choice, and each of these has its own dimension (DellaVigna, 2007). Despite these many kinds of inconsistencies, this study only focuses on the issue of time preference, so-called dynamic inconsistency, because CF involves inter-temporal decisions. Time preference can be disturbed by a self-control problem, in which the value of the discount factor δ^t varies among time periods.

The accentuation on inter-temporal decision is also pointed out in the game theory through the concept of infinitely repeated game, a multistage game model where the same set of agents repeatedly plays the same game, so-called stage game, over a long time horizon (Osborne, 2000). This concept resembles time preference as it also emphasises the salience of the discount rate to check whether the player will stick to the same decision in the repeated-stagegame, such as harvesting in CF. Players (farmers and firms) find subgame-perfect equilibrium in the form of sustainable contract as long as there is no profitable incentive to deviate. Such cooperative strategy ‘to stay on the contract’ can sustainably continue if players are sufficiently patient (do not discount future payoffs too extreme) (Huang, 2010; Osborne, 2000; Tadelis, 2013). Thus, the following equation should be satisfied:

$$v_i^c + \frac{\delta v_i^c}{1 - \delta} \geq v_i^d + \frac{\delta v_i^s}{1 - \delta} \quad (2)$$

where the four components of Equation 2 represent current payoff from cooperate, future payoff if cooperate, current payoff from best defect, and future payoff if defect, respectively.

After a short algebra simplification, the inequity above may be presented as:

$$\delta \geq \frac{v_i^d - v_i^c}{v_i^d - v_i^s} \quad (3)$$

2.3 Present-bias preference

Present-bias preference is a tendency towards inconsistency in a time preference that overweights immediate payoff and underweights long-term payoff. In daily life, it is usually called procrastination or naivety. Present-bias preference is modelled with the value of the discount following a quasi-hyperbolic pattern (Laibson, 1997; O’Donoghue & Rabin, 1999).

$$U_t = u_t + \beta \delta u_{t+1} + \beta \delta^2 u_{t+2} + \beta \delta^3 u_{t+3} + \dots \quad (4)$$

This model is slightly different from the inter-temporal utility function since present bias involves $\beta \delta^t$ as a discount factor at time $t > 0$. Coefficient β is a value between zero and one ($0 < \beta < 1$) which indicates that the discount factor between the present and the next period is higher than the discount between two periods in the future.

Unless $\beta = 1$, individuals act irrationally; however, amidst the people who suffer present bias, some are not fully naive. Thus, O'Donoghue & Rabin (2001) revised their model and allowed a new parameter $\hat{\beta} \geq \beta$, whereas the full naive person possesses $\hat{\beta} \geq \beta$.

To explain the application of the present bias (β, δ) model, let us assume that an action has two consequences: immediate payoff b_1 at time $t = 1$ and postponed payoff b_2 at time $t = 2$. There are some actions that demand particular effort at present and deliver enjoyment later—so-called immediate cost (Rabin, 1999), with payoff features $b_1 < 0$ and $b_2 > 0$. It applies to exercising, searching for a job, and doing homework. Conversely, an immediate reward, such as watching a movie or hanging out, has the features $b_1 > 0$ and $b_2 < 0$.

Then, the model can be written as $b_1 + \beta\delta b_2 \geq 0$. It means that a naive person will tend to avoid 'immediate cost' action ($b_2 > 0$) and be more likely to choose 'immediate reward' action ($b_2 < 0$). Based on the issue explained in Section 1, it indicates that farmers may have present bias as they choose to gain profit by deviating from the contract at the present and ignore price consistency in the future.

In one of the earliest studies about dynamic inconsistency, Strotz (1956) proved that if the optimal plan of future behaviour chosen as a given time is inconsistency then the conflict might not be recognised wisely by the individual, as present bias exists. If, however, the conflict is recognised, the inconsistency can be solved by the strategy of pre-commitment or consistent planning. In a study of credit card holders, Meier and Sprenger (2007, 2010) found that individuals with present-bias preferences have significantly higher amounts of credit card debt, even after controlling for disposable income, credit constraints and other socio-demographic characteristics. Moreover, Laibson (2015) implied that present-biased agents often do not make a commitment because they perceive benefits of commitment as sufficiently low. Their benefit of committing does not surpass the (modest) direct price of commitment and the indirect losses as their flexibility in farming reduces.

3 METHODOLOGY

In order to achieve the aims of the study, a quantitative field research was conducted on the basis of a primary survey of farmers contracting with a private agro-industry. The study population was chilli farmers in the Jember agricultural area who participated in CF with PT Heinz ABC; the unit of analysis was individual farmers. Jember was chosen because it had been reported by the Ministry of Agriculture (2015) as one of the most productive areas in producing chilli. Meanwhile, PT Heinz ABC was chosen as it has the largest share in the chilli sauce market, which is approximately 52%. CF between PT Heinz ABC and the farmers in Jember is a pioneer of vertical integration in the agricultural industry and can be a suitable case to be studied.

3.1 Data

Since we needed to assume that the data were normally distributed, we took 60 chilli farmers from the total of approximately 450 members of Koperasi Hortikultura Lestari's (KHL) network.¹ Although the sample size seems to be limited, it is actually more than 10% of the population. We did not take other samples from other practices of contract chilli farming because it had not been widely implemented in every region in Indonesia. Even if there were other CF practices, they may use different rules and systems that could not be compared.

1. Koperasi Hortikultura Lestari (KHL) was appointed by PT ABC Heinz as the representative to organise CF in Jember. KHL assigned several coordinators to recruit farmers who were willing to join CF. The coordinator's task was to lead farmers in producing and supplying the agreed amount of chilli to PT Heinz ABC. In return, the firm paid the purchase with a determined price. From 2010 to 2015, the proposed contract set the price at IDR 8,000 (approximately USD 0.75). The contract price would not change unless the market price exceeded IDR 15,000 (approximately USD 1.1). PT Heinz ABC provided particular incentives of additional price to compensate the potential loss the farmers had to suffer (Appendix 1).

Personal data of farmers were not available in the administration system; therefore, we could not conduct random sampling or stratified sampling. To alter this issue, we decided to use a snowball sampling technique in which a KHL officer pointed out several coordinators who led us to their subordinate farmers. These samples included farmers who had been expelled from the contract because of dishonest behaviour (deviation from contract). Using direct interviews, we collected data from samples based on the designed questionnaire.

All 60 farmers participated in the survey and were provided a gift package worth IDR 20,000 (approximately USD 1.5) for the time they devoted to this study. The surveyors visited the farmers' place and asked their willingness to participate. They were seated and interviewed to fill the data in the questionnaire. They were not given any chance to look at another person's answers and were also instructed not to do so. The survey took about 30 minutes for each participant.

3.2 Elicitation design

We identified the farmers' decision to deviate from CF based on their confessions to indirect questions in the middle of the interview. We also checked their status with their coordinator or KHL officer to determine whether they were still on the contract. Other personal characteristics data were taken normally from the interview, except for individual time preference data that were elicited using a hypothetical experiment, called a multiple-price list method (Coller & Williams, 1999; Frederick et al., 2002; Harrison et al., 2000). Since it was hypothetical, the farmers would not benefit or suffer from the real payoff over their choice.²

In the elicitation experiment, we analysed subjects' decision on a questionnaire containing two multiple-price lists in two distinguished periods (see [Appendix 1](#)).³ The subjects were asked to make a series of choice between a smaller payoff (IDR X) in period t and a larger payoff (IDR $Y > \text{IDR } X$) in period τ . The value of Y was constant while the value of X varied in two time frames. Y amounted to IDR 800,000 (approximately USD 70), which represented farmers' revenue on each chilli picking time (one harvesting period has several picking times) for a common-sized farming field (approximately 0.25 Ha).

In time frame 1, t indicates the present time ($t = 0$) and τ is a planting period⁴ ($\tau = 1$). In time frame 2, t is the next six planting periods ($t = 6$) and τ is the next seven planting periods ($\tau = 7$). The length difference, d , between t and τ is one planting period for both time frames. IDF was measured depending on respondents' choice at point X^* , where they decided to move from a lower incentive in period t to a higher incentive in period τ . IDF was calculated using the formula $X^* \approx \text{IDF}^d \times Y$, where d represents length difference. Since the difference is one planting period, $\text{IDF} \approx (X^*/Y)^{1/1}$. Using this formula to calculate two time-frame conditions results in two discount measures $\text{IDF}_{\tau,t} : \text{IDF}_{0,1}$ and $\text{IDF}_{6,7}$. In the main analysis, we used the average of both calculations as the IDF variable.

In order to identify the dynamic inconsistency, we compared discount measures yielded from two time frames. Dynamic inconsistency was distinguished into two kinds, present bias and future bias. An individual is classified as present bias if impatience drives him/her to take

2. We readily acknowledge the weaknesses of using the hypothetical elicitation method that may cause bias, although another study proved insignificant difference between the hypothetical method and the actual method in experiment choice (see Carlsson & Martinsson, 2001). In order to reveal the truthful answer, the surveyors used familiar terms related to farming activities in eliciting time preference; for instance, the time sign used in the questionnaire was planting period instead of month. The use of familiar language was inspired by List and Gallet (2001) who found that true preference is more likely to be stated when performing a familiar hypothetical task rather than an unfamiliar one.

3. Since this experiment was more or less representing the contract framework, the enumerators avoided any conversation that may lead farmers to associate this experiment with the contract.

4. One planting period equals approximately four months. In the survey, we mentioned the time indicator in months to make the instructions easier to understand for the farmers.

Table 1. Variable description.

Notation	Variable	Description
<i>dec</i>	Decision towards contract	Binary variable of farmer experience on obeying the contract in the past three years. 1 is to comply and 0 is to defect.
<i>idf</i>	Individual discount factor	The averages of $IDF_{0,1}$ and $IDF_{6,7}$ that were taken from the experiment, ranging continuously between 0 and 1.
<i>Pbias</i>	Present bias	Based on IDF calculation, this is a dummy variable of time inconsistency. 1 for someone exhibiting presentbias preference, otherwise 0.
<i>coord_d</i>	Coordinator decision towards contract	Dummy variable of coordinator's obedience on the contract. 1 is to comply and 0 is to defect.
<i>dem_ch</i>	Demographic characteristics	Demographic characteristics include age (<i>age</i> , in year), education level (<i>edu</i> , in year), monthly expenditure (<i>m_exp</i> , in Indonesia rupiah), and dummy of expenditure shock (<i>exp_s</i> , 1 = exist).
<i>far_ch</i>	Farming characteristics	Farming characteristics include land size (<i>lsize</i> , in hectare), farming experience (<i>famexp</i> , in year), and subjective expected price (<i>se_price</i> , in Indonesia rupiah).

Source: Authors' compilation.

a smaller reward sooner in the present time ($t = 0$). Formally, present bias is $IDF_{0,1} < IDF_{6,7}$ and future bias is $IDF_{0,1} < IDF_{6,7}$ (see [Appendix 2](#)).

3.3 Regression model

To answer the main research question, we conducted a logit regression analysis using the data from the survey. The following model was constructed to find the likelihood of farmers to defect from the contract. The estimated determinants of behaviour were IDF and time preference, yet we still used demographic characteristics as control variables.

$$P(dec) = \frac{1}{1 + e^{-Z}} \quad (5)$$

where

$$Z = \beta_0 + \beta_1 idf + \beta_2 pbias + \beta_3 coord_d + \beta_4 dem_ch + \beta_5 fam_ch + e \quad (6)$$

The specification of the variables is explained in [Table 1](#).

4 RESULTS AND DISCUSSION

We excluded five farmers from the analysis since their participation could not be processed due to some missing data and improper answers to the questionnaire. Some of them also lacked communication with the surveyors because of language barrier. From the remaining 55 observations, 14 farmers were identified as deviating from the contract, so-called deviators, and punished by being prohibited from joining any further contract. The remaining 31 farmers decided to comply throughout the contract period, so-called compliers, and stayed on the agreement no matter how extreme the market price fluctuation. They were not given

Table 2. Descriptive statistics.

Variable	Mean (standard deviation)		Minimum		Maximum	
	Compiler	Deviator	Compiler	Deviator	Compiler	Deviator
Time preference (present bias = 1)	0.365(0.487)	0.5714(0.513)	0	0	1	1
IDF	0.630(0.184)	0.618(0.173)	0.375	0.375	0.9375	0.9375
Short-term IDF	0.591(0.212)	0.566(0.215)	0.375	0.375	0.9375	0.9375
Long-term IDF	0.669(0.222)	0.669(0.225)	0.375	0.375	0.9375	0.9375
Coordinator's decision towards contract (deviate = 1)	0.146(0.357)	0.857(0.363)	0	0	1	1
Monthly expenditure (IDR)	1,362,927 (768,736.8)	1,725,714 (804,044.7)	400,000	900,000	3,000,000	3,000,000
Expenditure shock (exist = 1)	0.365(0.487)	0.285(0.468)	0	0	1	1
Years spent on education	8.634(3.533)	10.428(2.208)	0	6	16	12
Age (years)	42.75(3.53)	40.71(7.48)	20	29	65	52
Subjective expected chilli price (IDR)	7,560.976 (3,581.105)	10,642.86 (4,651.007)	3,000	2,500	15,000	17,500
Years experienced in planting chilli	8.87(10.55)	17.78(10.32)	1	1	40	33
Total land size	0.970(0.909)	0.875(0.859)	0.25	0.25	4	3

Note: Compiler and deviator indicate behaviour towards the contract.

Source: Authors' compilation.

special rewards but were supervised in order to maintain product quality. Further descriptive statistics are shown in [Table 2](#).

4.1 Regression results

The variables were checked using a multicollinearity test, resulting in a low correlation between all the independent variables ([Appendix 3](#)). Any misspecification was treated by obtaining an estimate of robust variance, although some parameters reported larger standard error than in the previous specification. The robust treatment excluded the agenda to test the possibility of the heteroscedasticity problem. The fitness of the model was tested by predicting the outcome of the dependent variable based on regression results ([Appendix 4](#)). The model correctly predicted 92.73% of the values and the rest were misclassified.

As depicted in [Table 3](#), the general test for all the models [ordinary least square (OLS), logit, and probit] shows that the dependent variable was significantly affected by the independent variables, as their *p*-value scores were less than 0.01. However, we decided to focus on the probit regression results since the two others have some weaknesses. OLS was excluded since we could not interpret the magnitude of the coefficient nor were we able to find the partial effect, and logit had sufficiently higher standard error than probit.

In the probit column, some variables (i.e. time preference, IDF, and experience) significantly affected the farmers' decision towards the contract at a significance level of 0.01. Another association was also seen at significance levels of 0.05 and 0.10 on the coordinator's behaviour, monthly expenditure, unexpected expenditure, expected chilli price, and land owned. Education and age were not significant in all the models, yet they were important for controlling the variation of the dependent variable. Almost all the independent variables had a positive correlation with the dependent variable except unexpected expenditure, age, and land use.

Since the coefficient value in the regression results cannot be interpreted in binary outcome regression, marginal effect estimation is needed. [Table 4](#) informs the magnitude of

Table 3. Regression results.

Behaviour towards contract (deviate = 1)	OLS coefficient	Logit coefficient	Probit coefficient
Time preference (present bias = 1)	0.117(0.0964)	2.273(1.430)	1.3008*(0.7297)
IDF	0.295(0.3065)	16.137*** (5.821)	9.252*** (3.094)
Coordinator's decision towards contract (deviate = 1)	0.502*** (0.1498)	5.939*** (1.692)	3.441*** (0.9024)
Monthly expenditure	8.95e-08(8.33e-08)	2.10e-06(1.79e-06)	1.18e-06*(6.87e-07)
Expenditure shock (exist = 1)	-0.126(0.1032)	-5.050*** (1.715)	-2.943*** (0.913)
Years spent on education	-0.00108(0.0186)	0.195(0.224)	0.1175(0.103)
Age	-0.0494(0.0064)	-0.1543(0.1193)	-0.0856(.0598)
Subjective expected chilli price	0.0000157(0.0000137)	0.000278(0.0002114)	0.000158*0.0000861
Years experienced in planting chilli	0.0044(0.00558)	0.1206(0.0838)	0.0688*(0.0385)
Total land used	-0.0841(0.0757)	-2.466** (1.338)	-1.404** (0.5964)
Constant	-0.1127(0.3554)	-14.817(4.996)	-8.654*** (2.729)
Probability > F / Probability > χ^2	0.0000***	0.0040***	0.0009***
R ² / Pseudo R ²	0.5247	0.6366	0.6404

Note: Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Authors' compilation.

Table 4. Marginal effect results.

Decision towards contract (deviate = 1)	Probit marginal effect at the means	Probit average marginal effect
Time inconsistency (present bias = 1)	0.0399(0.0579)	0.1461** (0.072)
IDF	0.2838(0.3360)	1.039*** (0.2872)
Coordinator's behaviour towards contract (deviate = 1)	0.1055(0.130)	0.3865*** (0.0659848)
Monthly expenditure	3.63e-08(4.21e-08)	1.33e-07* (7.55e-08)
Expenditure shock (exist = 1)	0.0036(0.0057)	-0.3306*** (0.0912)
Years spent on education	-0.0903(0.1153)	0.0132(0.0127)
Age	-0.0026(0.0027)	-0.0096(0.0060)
Subjective expected chilli price	4.85e-06(6.18e-06)	0.0000178* (9.33e-06)
Years experienced on planting chilli	0.0021(0.0028)	0.0077** (0.0036)
Total land owned	-0.043(0.049)	-0.1577*** (0.0607)

Note: Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Source: Authors' compilation.

marginal effect from the regression model, expressing additional probability of the dependent variable to occur successfully (farmers deviating from the contract). The table only lists the probit model results; however, both logit and probit actually show the same magnitude of marginal effect.

4.2 Individual characteristics and farmers' decision towards contract

The coefficient of time inconsistency shows a positive correlation indicating that the farmers with present-bias preference are more likely to deviate from the contract. On average, those exhibiting present-bias preference had 14.61% higher probability to disobey. Such individuals possess an ascending trend of IDF, or in other words, they discount short-term payoff sufficiently lower than long-term payoff. The impatience, therefore, leads them to ignore future price stability and to deviate from the contract in the present time instead.

Since the concept of time preference has never been studied to deliberate the working of agriculture contracts, a study of the financial industry can be a good comparison. Meier and Sprenger (2007) found many individuals exhibiting present bias among credit card holders who have significantly higher default rate than people with consistent time preference. The extension of the study also supports previous results, as Meier and Sprenger (2010) found that persons with inconsistent time preference are more likely to borrow and their debt level is significantly larger than dynamically consistent individuals. This finding is controlled by demographic characteristics, credit constraints, and interest rate.

IDF was found to have a positive association with farmers' decision to deviate from the contract. This seems to be unusual since we predicted that the larger the IDF, the more patient the individual to stay on the contract. Moreover, such a finding is actually quite surprising as previous research in the financial service area failed to prove the significance of IDF (Harrison et al., 2000; Meier and Sprenger, 2007). However, this could be rationalised by some arguments. First, farmers may perceive that the future value of deviating from the contract is sufficiently higher rather than accepting the contract agreement; so, if such future is discounted slightly, it may induce farmers to deviate. This argument is imperfect because it indirectly claims that farmers exhibiting small IDF, indicating impatience, tend to comply with the contract.

Second, IDF elicitation in this study might not exclusively reflect the behaviour of farmers in a contractual partnership. Some studies have used discount rate as predictive variables of particular behaviour related to time spans, including smoking (e.g. Harrison et al., 2010), exercise (e.g. Malmendier & Della Vigna, 2006), alcoholism (e.g. Vuchinich & Simpson, 1999), and credit card debt (Meier & Sprenger, 2010); however, Chabris et al. (2008) found that discount rates are weakly correlated with such field behaviour or even have no correlation at all.

Third, farmers may not behave rationally as they do not always take decisions based on their preference. This study emphasises solely on the dimension of time preference, excluding the other types of preference, namely, risk preference and social preference. In addition, no attention was paid to another aspect of irrationality involving inconsistency of belief and choice (Della Vigna, 2007). Their decision of whether to comply with the contract might be determined by other important factors.

4.3 *Farming characteristics and farmers' decision towards contract*

Despite the ambiguous result of discount factor, more attention should be given to other important findings as farmers' decision to deviate from the contract is not based only on their consideration alone, but somehow considerably depends on their coordinator. On average, the farmers were 38.65% more likely to deviate if their coordinator also deviated from the contract. Such a percentage has the largest effect compared with other variables. As the coordinator represents the social capital of the contract establishment, this finding seems to be reciprocal with the explanation of the role of trust and social capital as studied by Polman and Slangen (2008). They found that besides farm and farmer characteristics, motivational issues, including the perception of institutional design, the use of extension services, and trust in the government, are important for agriculture contract development, although not all types of contracts are significantly influenced. Here, the coordinator has a salient role to maintain such motivational issues.

Land size coefficient, showing a negative sign, indicates that the wider the land used to crop chilli, the less likely the farmers are to deviate from the contract. Farmers with sufficiently large size of land are able to mitigate the risk of price volatility by land use diversification; that is, either by planting another kind of commodity in the same land or by not using the whole land for CF and sparing the rest for the open market instead. This finding resembles that of some contract participation studies. Farmers with larger farms are more likely to join CF (Barrett et al., 2012; Wang et al., 2011). It is commonly believed that they are more likely to be offered CF as firms want to reduce transaction costs.

The estimate result also shows a significant positive association between expected price and the decision towards the contract. On average, when the farmers perceived future

expected price a thousand rupiahs higher, their probability to deviate from the contract increased by 1.78%. Nevertheless, we cannot interpret this for every level of expected price since the partial effect might be different.

Another significant variable is the number of years of farming. Farmers who have experience in chilli farming for longer periods are more likely to deviate. The probability of such a decision to occur increased by 0.77% as the experience increased by one year. Experience trains farmers to better understand the risk of price volatility and production; therefore, such an advantage leads them to leave the contract and to face the risk in the open market. In participation studies, the association of experience is found ambiguously in positive, negative, and quadratic relationships (Wang et al., 2014).

4.4 *Demographic characteristics and farmers' decision towards contract*

Monthly expenditure appeared to positively affect farmers' decision to deviate. Those who have larger expenditure are more likely to deviate. The more the expenditure, the more the income needed to overcome it. They may perceive that selling to the open market is more lucrative than achieving a constant return from the contract.

Expenditure shock had a negative sign on its coefficient indicating that farmers reporting to have spent their income on unexpected expenditure are less likely to deviate. On average, such individuals had 33.06% lower probability to deviate compared with those who had spent their income normally. Farmers experiencing shock probably do not want to bear more risk by dealing with the volatile price in the open market. Staying in the contract gives them a safe place if another shock happens unpredictably. This finding is not consistent with those of some studies that found a positive association between shock and change in inter-temporal decisions (e.g. Bíró, 2013; Smith & Love, 2007).

The results show that age did not significantly affect farmers' decision towards behaviour and neither did education level, measured by years spent in educational institutions. Such results were also found in several contract-participation studies, such as Bao et al. (2013), Bellemare (2012), Simmons et al. (2005), and Wang et al. (2011).

5 CONCLUSIONS

Despite the purchase guarantee and price stability provided by the firm in CF, dishonest behaviour among farmers who violate the agreement still occurs. Such decision does not only disturb the supply chain in the agricultural industry but also undermines potential welfare gained for farmers. This issue shades the stability of CF, which has only recently shown its emerging trend. Understanding farmer characteristics is very important for the development and mass implementation of CF; therefore, this study attempts to find significant determinants of farmers' decision towards the contract.

This study found that individual characteristics played a significant role in affecting farmers' deviation from the contract. Farmers with present-bias preference are more likely to defect from the contract and so are those who exhibit higher IDF. The former indicates that short-term impatience leads farmers to decide irrationally, whereas the latter has several explanations, including the perception of future payoff, lack of preference understanding, and distorted elicitation method.

Moreover, the results suggest that farming characteristics are also important and significant predictors in analysing farmers' deviation. Coordinators play a salient role in building social capital to achieve contract stability as their choice could skew farmers towards one decision. Other significant variables of farming characteristics were land size, expected price, and experience.

A broader conclusion from the results is that, in actual condition, showing that farmers have more narrow-sized land and the government induces more new farmers may reflect positively on the further development of CF. Concerns over quality when involving

new farmers should not become an issue as the process of quality control is managed by KLH. Thus, cooperatives play an important role as an intermediary agent in this contract.

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Appendix 1: Pricing mechanism

If the market price exceeds IDR 15,000, PT Heinz ABC provides a special incentive.

$$\text{Incentive} = 0.7 \times (\text{market price} - \text{grower price})$$

Since the incentive was equally divided between Koperasi Hortikultura Lestari (KHL) and the farmers, the contract price change becomes:

$$\text{contract price} = (\text{incentive} : 2) + \text{default contract price}$$

For instance, the price of chilli per kilogramme in the market is IDR 19,500, whereas the grower price is IDR 13,500. PT Heinz ABC, therefore, provides a bonus of IDR 4,200. This changes the contract price agreed by farmers.

$$\begin{aligned} \text{contract price} &= 0.7 * (19,500 - 13,500) + 8,000 \\ \text{contract price} &= 10,100 \end{aligned}$$

Appendix 2: Time preference elicitation method (multiple price list)

Appendix [Tables A1](#) and [A2](#) list two types of choices. For each decision, you are expected to choose between a smaller bonus in a shorter period (choice A) or a larger bonus in a longer period (choice B). [Table A1](#) provides the decision choices in the time frames of ‘today’ and ‘in 4 months’, whereas [Table A2](#) uses time frames of ‘in 2 years’ and ‘in 2 years, 4 months’.

Table A1.

Time frame 1	Choice A (today)	Choice B (in 4 months)
Decision 1	Granted IDR 750,000	Granted IDR 800,000
Decision 2	Granted IDR 700,000	Granted IDR 800,000
Decision 3	Granted IDR 650,000	Granted IDR 800,000
Decision 4	Granted IDR 600,000	Granted IDR 800,000
Decision 5	Granted IDR 500,000	Granted IDR 800,000
Decision 6	Granted IDR 400,000	Granted IDR 800,000

The farmer is presented with the following questions: Based on your expectation, in the next two years, will you still work in agriculture sector? What could change at that time? How much will a kilogramme of chilli cost?

The enumerator should make casual conversation that leads the subject perception to the next two-year period.

Table A2.

Time frame 2	Choice A (in 2 years)	Choice B (in 2 years, 4 months)
Decision 1	Granted IDR 750,000	Granted IDR 800,000
Decision 2	Granted IDR 700,000	Granted IDR 800,000
Decision 3	Granted IDR 650,000	Granted IDR 800,000
Decision 4	Granted IDR 600,000	Granted IDR 800,000
Decision 5	Granted IDR 500,000	Granted IDR 800,000
Decision 6	Granted IDR 400,000	Granted IDR 800,000

Appendix 3. Matrix correlation

```
. *multikol
. corr $ylist $xlist
(obs=55)
```

	dev	tp	idf	kin	edu	uexp	exp	age	eprice	exprc	tland
dev	1.0000										
tp	0.1815	1.0000									
idf	-0.0298	0.0273	1.0000								
kin	0.6599	0.0371	-0.1163	1.0000							
edu	0.2373	0.1221	-0.0803	0.2984	1.0000						
uexp	-0.0734	0.1593	0.2862	-0.0178	0.0844	1.0000					
exp	0.2027	0.0160	-0.1777	0.2076	0.3889	0.1403	1.0000				
age	-0.1005	-0.1185	-0.0421	-0.0624	-0.4169	0.0929	-0.0565	1.0000			
eprice	0.3331	-0.0338	-0.1845	0.3777	0.0675	0.0800	0.0650	0.1265	1.0000		
exprc	0.3522	0.0290	-0.1017	0.3883	0.2041	-0.0200	0.4686	0.2703	0.1989	1.0000	
tland	-0.0473	-0.2097	-0.0577	0.0622	0.2803	0.0160	0.5609	-0.1426	-0.0122	0.2345	1.0000

Appendix 4. Goodness of fit test

```
. estat classification

Probit model for dev
```

Classified	True		Total
	D	~D	
+	11	1	12
-	3	40	43
Total	14	41	55

```
Classified + if predicted Pr(D) >= .5
True D defined as dev != 0
```

Sensitivity	Pr(+ D)	78.57%
Specificity	Pr(- ~D)	97.56%
Positive predictive value	Pr(D +)	91.67%
Negative predictive value	Pr(~D -)	93.02%
False + rate for true ~D	Pr(+ ~D)	2.44%
False - rate for true D	Pr(- D)	21.43%
False + rate for classified +	Pr(~D +)	8.33%
False - rate for classified -	Pr(D -)	6.98%
Correctly classified		92.73%