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Who Bear the Most Risk? Risk and Risk Shifting in Indonesian Broiler Contract

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Abstract

Contract between grower and integrator has been used extensively in broiler industry all over the world. One important advantages of contract is risk management, in which contract shifts a portion of grower risk to integrator. Thus, this paper attempted to measure the amount of risk shifted from grower to integrator and the consequences of this benefit to grower. Using a panel data of actual production records of 46 Indonesian broiler growers for the period of January 2014 through December 2017, we systematically measure the amount of risk shifted to integrator and its consequences to grower. The results showed that 78.43% grower risk is shifted to integrator. However, to acquire this benefit grower receive 15% less income. Furthermore, grower face the possibility of losing their asset and stopping their production as the consequences of entering contract.

Keywords : Risk shifting, broiler contract, panel data

JEL Classification: D82; L24

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Introduction

Contract between integrator and broiler grower has been used extensively to coordinate production both in developed and developing countries.[1] In the USA, 97% of grower contracted out their production (Macdonald, 2014). Similarly, the percentage of grower in Indonesia who produce broiler under contract is 55.69% (BPS, 2014). Although much smaller than those in the US, it is significantly higher than the use of contract in other commodities.[2] The type of contract commonly used is production contract (PC). In PC, integrator provides and sets the specification of feed, day old chick, and medication used by grower and also provides technical assistance. While grower provides labor and housing facilities according to integrator requirements. At the end of each production period, integrator buys grower production at agreed price and pays farmer after deducting the input cost.

The advantages of PC for grower are lower need for operating capital since integrator provides key input, access to technical assistance, and risk management (Goodhue & Simon, 2016). However, because integrator provides input on a credit based, the price paid by grower is higher than the market price. Furthermore, grower should provide a collateral (land certificate) and a power of attorney for integrator to sell the collateral in case of grower cannot pay the input cost.[3] Moreover, when the fund received from selling the collateral is less than

[1] Integrator is a contracting firm in broiler industry. Ussually it is a feed mill who marketed their feed to grower through contract, or non feed mill firms who has feed quota with a particular feed mill and contracting directly to grower, thus they are called integrator.
[2] Livestock: dairy (12.15%), cattle (0.28%) (BPS, 2014); Horticulture: Chili (7.67%), Chili sauce (8.03%), onion (3.05%), manggo (6.24%), banana (5.09%) (BPS, 2015a). Plantation crop (2.9%) (BPS, 2015b).
[3] Article (5) point 4 on Memorandum of Agreement between integrator and grower

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input cost, grower should allow integrator to use grower housing facilities to produce broiler without rent, and each kilogram of produced broiler used to paid a specified amount of grower debt. Integrator allowed to use the broiler house until grower's debt paid completely.[4,5]

The arrangement above shows that there is a risk shifting between integrator and grower. Grower shifts their marketing risk to integrator since integrator guarantee the price and sale of produced broiler. On the other hand, integrator shift their marketing risk to grower by selling grower collateral or using grower's broiler housing facilities in case grower cannot pay the input cost.[6] The previous studies attempted to analyze risk shifting mechanism in production contract are few and outdated. Knoeber & Thurman (1995) used actual record of broiler contract grower and measure the amount of risk shifted to integrator. They found that price risk accounted for 84% of total risk in broiler production and is shifted to integrator. Similarly, Martin (1997) used actual records of hog grower and founded that PC reduces grower risk by 36-70%. However both of these studies didn't explain the consequences of this reduced-risk benefit to grower. As stated by Bellemare (2018) that it is important to not only asses how contract benefits grower but it is also important to know what grower should give up to receive those benefit. Thus, the main purpose of this paper is to quantify the amount of risk that is shifted between grower and integrator and also analyzes the consequences of this risk shifting for grower.

[4] Article (5) point 6. Each kilogram of paid Rp 100 of grower debt.
[5] The contractual arrangement was provided as supplementray material for this paper.
[6] In truth, integrator core business is in selling feed and other input to grower.

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This paper is important in two ways. First it analyse the risk shifting feature of contract which benefit grower and also analyze the consequences (*the cost*) of this benefit to grower. Second, broiler meat is an important food and produced mostly under contract, thus the study of broiler contract is important to food security. Finnally, the rest of the paper is structured as follows. The next section describes the data used and the method employed. The third section presents the results of this study. The last section discusses the findings of this study compared to the previous literature.

Data and Method

The data used in this study has the similar structure with those used in Knoeber & Thurman (1995). The data contains production information for 40 growers under contract to one integrator in Jember, East Java, Indonesia from January 2014 to December 2017. The period consists of 24 production cycles. Each cycle lasts for 42 days in average and there is a 3 weeks gap between the consecutive cycles. The number of production cycle is varied between grower, with a maximum of 24 cycles and a minimum of 4, so it forms an unbalanced panel data. There are 5 growers managing more than one house (1 grower has 3 houses while the other 4 have 2 houses each), since each house has it's own production information, thus each of them was treated as an individual grower. In total, there are 46 growers consisting of 802 observations. Tabel 1 provides an overview of the data.

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Table 1 Desriptive statistic of data

Variable	Mean	S.D.	Max	Min
Bird placed (birds)	5,087	2,866	14,000	2,000
Production cycle	17	7	24	4
Grower revenue (Rp/kg)	1,989.99	545.69	3,696.3	1,162.14
Production (kg)	10,087.44	6,055.61	28,382.1	3,640.16
Body Weight (kg/bird)	2.11	0.11	2.42	1.87
Feed used (kg)	17,108.59	10,697.5	50,900	6,129.17
Price of DOC (Rp/bird)	5,250	846.99	5,250	5,250
Price of feed (Rp/kg)	6,841.67	296.23	6,841.67	6,841.67
Contract price (Rp/kg)*	16,170.83	837.43	17,300.00	15,200.00
Market price (Rp/kg)*	15,461.19	3,044.31	21,211.54	9,953.23
Mortality rate (%)	7.17	1.55	11.48	3.80
Feed Conversion Ratio	1.68	0.079	1.80	1.42

* selling price at harvest
Source: Authors calculation, 2018

Grower payments consist of two components, fixed and bonus payment. Fixed payment comes from the sale of broiler at contract price. Bonus payment paid to grower only when current market price is higher than contract price. The amount of bonus is 30% from the difference between contract and market price. Grower net revenue is the sum of those payment deducted with cost of inputs. Specifically grower revenue can be modelled by Equation 1.

$$R_{it} = \alpha_c q_{it} + [0, \beta(\alpha_m - \alpha_c) q_{it}] - C_{it} \quad (1)$$

Where α_c is contract price, q_{it} is production of grower i in period t, α_m is broiler market price, there is a truncation of 0 and β (0.3) in bonus specification which subject to market conditions and C_{it} is the cost of input, if market price is higher than contract price grower will get $[\beta(\alpha_m + \alpha_c) q_{it}]$ in premium, otherwise he receives nothing.

Equation 1 used to construct actual payment series for 46 growers. In the actual payment, grower protected from market price risk and bear only production

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risk.[7] Market price risk then is shifted to integrator. We calculated the standard deviation for each series as the measures of grower income variability. To measure the actual amount of risk shifted to integrator we constructed another series by this equation.

$$R_{it} = \alpha_m q_{it} - (0.9) C_{it} \quad (2)$$

Equation 2 used to construct the simulated payment for independent grower. In the simulated payment, grower bear both production and market price risk. However, the cost of input for independent grower is lower than contract grower.[8] The standard deviation for the simulated payment is the measure of grower income variability that is affected by production and market price risk. Finally, we calculated the ratio of simulated payment standard deviation to actual payment. A ratio larger than one means the variability of grower revenue would have been larger if he didn't produce broiler under contract and *vice versa*.

Results

The ratio of simulated payment standar deviation (SD) to actual payment SD was used to identify whether there is a risk shifting between integrator and grower. A ratio larger than one implies that income variability (risk) of independent grower is larger and the majority of this risk is shifted to integrator through contract. The ratio distribution (Figure 1) revealed that contract shifts a

[7] We do not differentiate between common production risk and idiosyncratic risk, since grower is not protected from these risks. Thus, we quantify them as production risk.
[8] Actually there is a profit margin of 10% integrator charges to grower. Thus, the price of inputs provided by integrator is 10% higher than the market price.

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portion of grower risk. The average ratio is 5.29, indicating that the variability of grower income will be 5 times larger without contract.

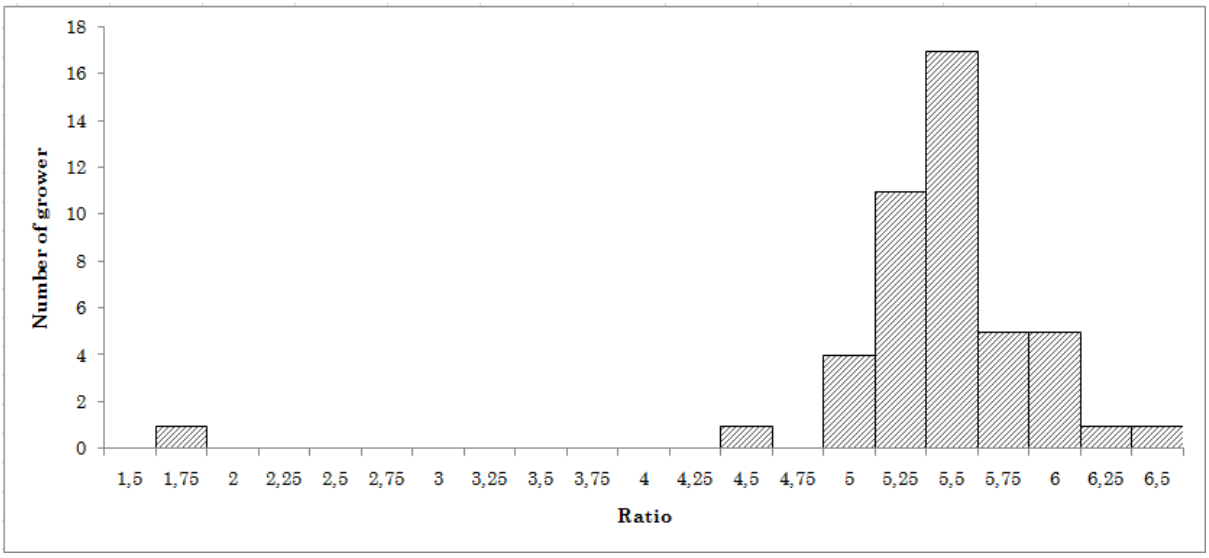

Figure 1 Distribution of standard deviation ratios

The average ratio of all 46 growers were used to measure the actual amount of risk shifted to integrator. The average SD of independent grower is 1578.476, it represents payment affected by production and price risk. Without price risk, the average SD is 340.5042, indicating less variability for contract grower. The difference in SD is the amount of risk shifted to integrator and accounted for 78.43% of total risk (Table 2).

Table 2 Average standard deviation of actual and simulated revenue

	Value	Risk (%)	Description
Average S.D. of simulated revenue	1578.476	100	Total broiler production risk
Average S.D. of actual revenue	340.5042	21.57	Production risk
Amount of risk shifted	1237.972	78.43	Market price risk shifted to integrator

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The comparison between actual and simulated payments (Figure 2) of one representative grower with 24 production cycles revealed that the revenue of independent grower tend to be more fluctuative than those of contract grower. Independent grower grower has a wider payment range, higher high values and lower low values, and experienced negative periods. Conversely, contract grower has a narrower payment range, relatively lower but stable payments, and has no negative period. The average, maximum and minimum payment of contract grower are Rp 2371.332/kg, Rp 1602.457/kg, and Rp 3041.568/kg and Rp 2790.129/kg, Rp −2118.22/kg, and Rp 7700.712/kg for independent grower respectively. Simulated payment SD is 2800.867 and 410.3716 for contract grower. It was found that contract grower receives 15% less payment. However the variability of their income is 6 times smaller than independent grower. It shows that there is a *trade-off* between the magnitude and stability of income.

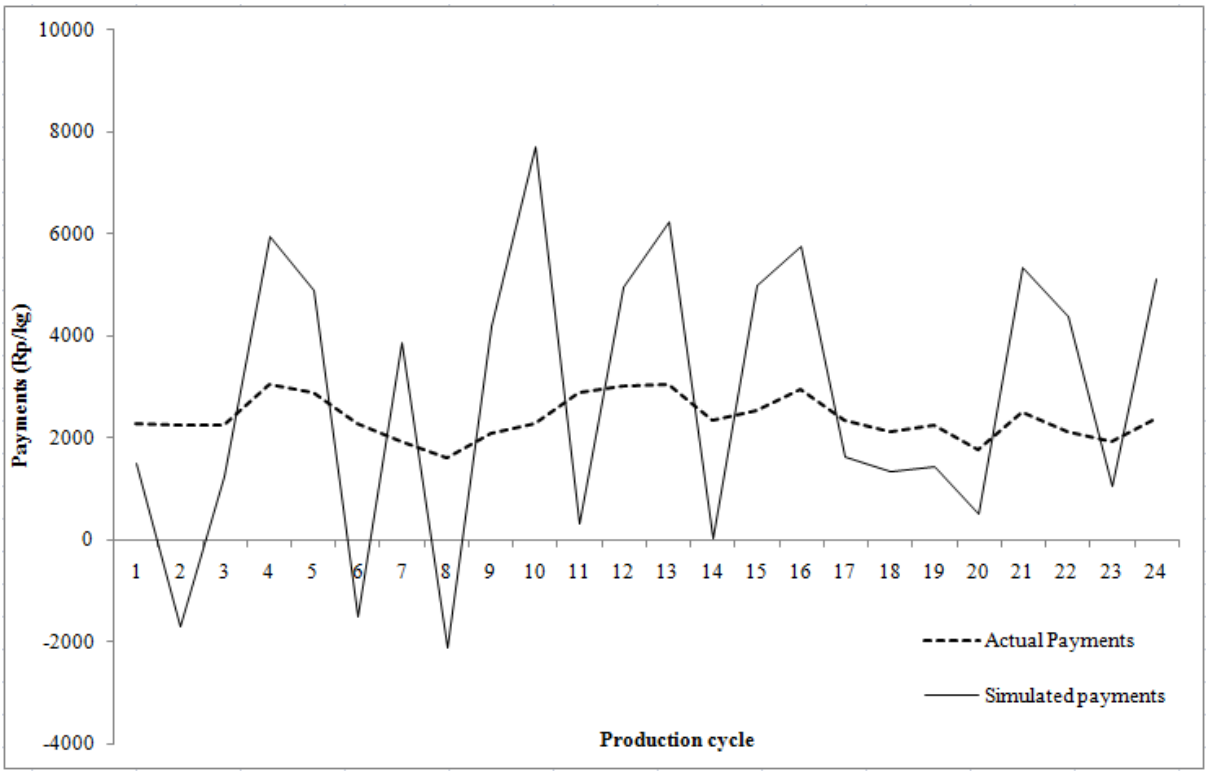

Figure 2 Simulated and actual payments

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Discussions

The main purposes of this study were to measure the amount of risk shifted from grower to integrator and to identify the consequences of this benefit to grower. The results demonstrate that a large portion of risk (78.43%) is shifted to integrator. However, contract grower should receive 15% less income compared to independent grower. The finding is consistent with Knoeber & Thurman (1995) and Martin (1997) which showed that contract shifts a large portion of grower risk to integrator. Furthermore, the consequence of risk shifting on grower income is consistence with the finding of Chavas & Holt (1996), Menapace, Colson, & Raffaelli, (2013), and Picazo-Tadeo & Wall (2011) which stated that in order achieve stability, grower are willing to receive less income. The stability of income is important in broiler production since the timeframe for each production period is short and also the frequency of production is high.[9]

The next important topic is who bear the most risk. To answer this question it is needed to look deeper at the contractual arrangement. Broiler contract is risk shifting contract, it means not only grower risk is shifted to integrator but there is also integrator risk that is shifted to grower. Integrator risk is realized when grower cannot pay input costs. Grower cannot pay input costs only when there is a production failure which caused by production risk. When that happened, grower will lost the asset they used as collateral. moreover there is a possibility that grower cannot continue the production of broiler, since integrator will use their housing facilities in case the fund received from selling collateral is less than the grower debt. However, we cannot measure this risk since the available data

[9] In average there are 6 production cycles annually.

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contain only the survived growers. This is the consequence of risk shifting contract in which the party who bear the shifted risk end up bearing all the risks and the associated adverse outcomes (Hamid, Mirakhor, Ng, & Dewandaru, 2017).

This study contributed to the growing literature attempted to further analyze the benefit of contract farming (CF). As systematic literature review on contract farming conducted by Ton, Vellema, Desiere, Weituschat, & D'Haese (2018) found that the positive income of CF on farmer income has potential bias since non-significant results are underreported and also all studies assessed the CF that has already survived. Similarly Otsuka, Nakano, & Takahashi (2016) stated that the benefit of CF is less clear because CF is labor intensive, thus sacrificing farmer potential income from other sectors. Finally, Bellemare & Bloem (2018) concluded that CF most likely improve farmer welfare but it is required to conduct a more rigorous analysis to know it for sure. Finnally, to coclude our discussion, CF is an important tool to transform agricultural sector into more industrialized structure. However, it should be studied and regulated critically so that all parties can reap its benefit.

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