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The impact of seasonal rice price changes on rice self-consumption in farm household of rural Java

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Abstract. Seasonal rice price changes are very volatile and not predictable. This price changes have a heterogeneous impact on public consumption. The problem of seasonal rice price changes is not only experienced by consumers, but also in the farmers side as producers. The objective of this study is to provide a detail overview and description of the changing seasonal rice self-consumption of farm households in rural Java in response to seasonal rice price changes and income shocks to anticipate seasonal scarcity. This paper constructs a theoretical model to address such seasonality of food deprivation by using one year of seasonally farm household panel data, empirically tests the extent to which farmers in rural Java can smooth their rice self-consumption from season to season in response to income shocks. The result shows that rice farmers increase their rice self-consumption when prices are high.

1. Introduction

Seasonal rice price changes are very volatile and not predictable, including in Java, the main producer of rice in Indonesia [1]. This price changes have a heterogeneous impact on public consumption. The problem of seasonal rice price changes is not only experienced by consumers, but also farmers as producers. This study will focus on the impact of seasonal rice price changes on the rice-self consumption of farm household in rural Java. Java Island produces the highest amount of paddy in Indonesia more or less53% of total production. Specifically, in Java Island, 16% of total production comes from Central Java. The total harvested area in Central Java is 17.474.67 km^2 or 14.41% of the total harvested area in Indonesia [2].

Most of population in rural Java live in households and they are cultivate paddy tp produce rice. The majority of households that consumed home-produced rice produce enough rice to meet the needs at some point through the year. In the typical agricultural sector in rural Java, the rice harvest season begins in rainy season or season I. Some areas in rural Java experienced with the lowest incidence of insufficient stocks occurred following the peak of the harvest. The change of rice price will affect to the household income. Previous study [3] found the rice price will influence the farm household welfare in the long-run. Farmers as producers face the problem of seasonal rice price change, not only experienced by consumers in the urban area.

The objective of this study is to provide a detailed overview and description of the changing seasonal rice self-consumption of farm households in rural Java in response to seasonal rice price changes and income shocks to anticipate seasonal scarcity.

2. Theoretical Framework

In this study, the farm household is assumed to maximize its utility subject to its constraints, namely a production function, a time and a budget constraint. Let equation (1) be the utility function, which is quasi-concave with positive partial derivatives.

$$\underset{C,X,l}{Max} U(C, X, l, z) \tag{1}$$

The factors are household consumption of commodity rice, with *I* denoting income, *l* is leisure and *z* is household characteristics (e.g. household age, number of family member, number of family laborers). Income equals to the self-sufficiency ratio, such that

$$I(\text{remittance}) = \text{Pr}.C + Px.X \tag{2}$$

With *Pr* denoting price of rice, *C* is food consumption (rice), *Px* is price of non-food commodity, and *X* is non-food commodity. Here, total income spends for *Pr.C + Px.X*, so, no saving for household.
The production of rice is assumed to be influenced by level of food (rice) and non-food commodity consumed, total labour for farming L^f, current input *M* (e.g. seed, fertilizer, chemical and tractor rent), fixed capital $\overline{K}$, land T (operated land or planted land) and parameter condition which affect production δ (e.g. cropping pattern, irrigation system).

Although the total income of household equations derived from the household production model, as mentioned above, by doing the contain of all predictions of conventional utility maximizing models, we can get the optimal total income of household and partial derivative of optimal total income with respect to rice price.

$$\frac{\partial I^*}{\partial \text{Pr}} \gtrless 0 \tag{3}$$

The effect of a rice price change on total income will thus depend on the income effect and the substitution effect. When rice price decreases, the farmer need to decrease income in order to keep purchasing power constant. Then for normal good, a decrease in income will lead to a decrease in demand. An increase in rice price means that demand of rice will go down due to substitution effect. If the rice price goes up, it is like a decrease in income, which for normal good means a decrease in demand. The optimal total income of household may increase or decrease due to the change of rice price. As a consequence, the farmer may decrease or increase the marketed surplus of food (rice).

According to the previous finding [5], when poor farmers produce a marketed surplus of food, it may happen that this surplus fall when the price of food rises. For this reason, this study examines the effect of self-consumption as well as a marketed surplus of food. The marketed surplus of food (ms_a) is defined as follows.

$$ms_r = F - C \tag{4}$$

The response of marketed surplus to price is:

$$\frac{\partial ms_r}{\partial \text{Pr}} = \frac{\partial F}{\partial \text{Pr}} - \frac{\partial C}{\partial \text{Pr}}\bigg|_{u=constant} - ms_r \frac{\partial C}{\partial I^*} \tag{5}$$

where
Pr = rice price
ms_r = surplus of food (rice)
F = production of rice
C = consumption of rice

The first term on the right-hand side is the supply response in production and is positive. The second term is unambiguously positive. The third term, for a normal good, is negative. In this study, rice is assumed as a normal good [6]. While the net will generally be positive, poor households may have such a high income elasticity of food consumption that the entire expression is negative. This effect will be reinforced by low elasticity of supply response and a low substitution effect between food and other goods. All responses to the rice price change will affect to their rice self-consumption from season to season in response to income shocks.

3. Method

3.1. Empirical Model

Based on the theoretical framework, to estimate the changing seasonal rice self-consumption of farm households in rural Java in response to seasonal rice price changes and income shocks to anticipate seasonal scarcity, this study will use the empirical model as follows:

$$RSC = \alpha_0 + \alpha_1 Educ + \alpha_2 Age + \alpha_3 Land + \alpha_4 Yield + \alpha_5 Income + \alpha_6 Riceprice + \alpha_7 Occupation + \alpha_8 Season + \alpha_9 \mathrm{Re}mit\tan ce + u \quad (6)$$

Where:
RSC : Rice self-consumption
Educ : Number of successive years in school of household head
Age : Age of household head
Land : Total hectares of agricultural land (farm land) in the given year
Yield : Total production in kg/season
Income : Total income of household
Rice price : Price of a kilogram of rice
Occupation : Dummy occupation of household
If the member of family have off-farm job = 1, otherwise = 0
Season : Dummy of season
If the household planted paddy in season 1 = 1, otherwise = 0
Remittance : Total money and in kind remitted by household members and relatives to the farm household

3.2. Analysis Methods

The panel data analysis is applied to estimate the changing seasonal rice self-consumption of farm households in rural Java in response to seasonal rice price changes and income shocks to anticipate seasonal scarcity. The null hypotheses of individual effect are rejected. Consequently, the Ordinary Least Square (OLS) method is not used for analysing seasonal rice self-consumption. After applying the Hausman test to investigate the kind of effect that exists (fixed effect or random effect) on rice self-consumption function, the result indicated that we should use random effect model to estimate the changing seasonal rice self-consumption ([7];[8]).

4. Result and Discussion

This study conducted in Cilacap and Grobogan which is the largest area for paddy cultivation in Central Java. Table 1 illustrated the farm household characteristic in both districts. The farm size in Grobogan district is larger than in Cilacap, therefore the agricultural income of farm household in Grobogan is higher as well. However, the rice self-consumption in Cilacap is larger than in Grobogan.

The results of estimating equation (6) are summarized in Table 2. The estimated parameters of age, are significantly positive for equation. These findings suggest that human capital of household contribute to increase of rice self-consumption. The older household head tend to keep the production for rice self-consumption.

The estimated parameters of land, yield, income, and remittance are significantly negative to the rice self-consumption. This result indicates that an increase in land, yield, income and remittance lead a decrease in rice self-consumption. The rice farmers prefer to sell their product to the market rather than to keep for their consumption when they have larger land, yield, income and remittance. In contrast, the estimated parameter of rice price is significantly positive for rice self-consumption. This implies that the increase of rice price has a negative effect on marketed surplus of rice production. Rice farm household would keep their production when rice price increases. It is suggested that rice farmer in the study areas are net rice consumers [9,10]. The variable of occupation and season do not have any effect to rice self-consumption.

Table 1. Household Characteristic

Characteristics	Cilacap District	Grobogan District
Number of farm households	51	50
Number of family labor (person/hh)	5.07	4.02
Area of agriculture owned land (ha/hh):	0.26	0.55
Paddy field	0.22	0.37
Farm size (ha/hh)	0.26	0.55
Yield of paddy (ton/planting)		
Session I	1.3	3.7
Session II	1.1	2.2
Session III	-	8.6
Average Farm Household Income (IDR/year):		
Agricultural income	5.449.902	28.193.300
a. Rice income	5.449.902	19.135.600
b. Non-rice income	0	9.057.700
Off-farm income	24.883.529	68.171.700
Remittance	1.587.255	410.000
Farm household income	31.920.686	96.775.000
Farm assets (excluding land):		
Cow and buffalo (head/hh)	0.29	0.86
Tractor owned (number/hh)	0.02	0.088
Sprayer (number/hh)	0.71	0.88
Thresher (number/hh)	0	0.04
Rice self-consumption (kg/sesion) :		
Session I	602	227
Session II	470	395
Session III	-	0

Source : Farm Household Survey, 2017
Note : Exchange rate in 2017 was US$1= IDR 13.382

Table 2. The Changing of Rice Self-Consumption

Independent variable	Coefficient	Standard Error
Constant	-695.6886**	(320.0284)
Education	17.4787	(14.0382)
Age	8.0478**	(3.972812)
Land	-0.1075***	(0.0299)
Yield	-0.1438***	(0.049)
Income	-9.27e-07**	(4.44e-07)
Rice price	0.0739**	(0.0328)
Occupation	133.8937	(112.0421)
Season	115.2349	(82.5940)
Remittance	-.00002**	(.00001)
R^2	0.9555	
Wald chi^2	38.75***	
Hausman Test	0.8749	
Number of observations	178	

Source: Farm Household Survey, 2017

5. Conclusion

The estimation results of rice self-consumption functions show that rice price had positive influence on rice self-consumption or in other words rice price had negative impact on marketed surplus of rice. This indicates that if price increase, rice farmer will increase their rice self-consumption. The result shows that some farmers increase their rice self-consumption when prices are high. However, we still need to examine carefully whether the increase of rice production off sets the increase of rice consumption or not, rice price fluctuation does not affect the household welfare or not, and Indonesian government do not need to import rice more or not.

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