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The Impacts of Rice Price Subsidy on Nutrition Intake of The Poor

A Case of RASKIN Program in Indonesia

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This study examined the impacts of RASKIN Program in Indonesia for the intakes of total calories and three macronutrients of poor households. The impacts are classified into two: poor households who consume rice up to 15 kilograms in a month and more than 15 kilograms a month. Due to the indication of endogeneity problem on subsidy amount received, Instrumental Variable (IV) method is applied. Using the IFLS data which cover the period before and after the subsidy program was implemented, the results show that RASKIN subsidy significantly has positive impacts on the total calorie intake for both types of households, yet has smaller impact on carbohydrate intake of the households whose rice consumption is over 15 kilograms per month.

Keywords— Food-price subsidy, rice consumption, nutrition intake.

I. INTRODUCTION

The impact of a targeted food price subsidy to resolve undernourishment for "below poverty-line" groups has been debated for decades. While [1], [2], and [3] insisted that a subvention in food price would bring a positive impact on poor households, in developing countries, with regards to improving their nutritional state. However, some recent empirical studies have claimed otherwise. The studies of [4] and [5] that focused on the subsidy in China and India, respectively, argued that there is no evidence for food price assistance improving the nutrition intake of the poor households. Furthermore, they added that while some changes were found in the consumption pattern, a significant effect on nutritional intake has not been observed yet.

Undernourishment or malnutrition is generally believed to be the outcome of poverty. The World Bank [6] stated that food expenses are the major expenditure with more than 80 percent of total expenditure for the poorest families in developing countries. It implies that the reduction in food expenses is the key to improve the nutritional condition. That is the reason why more developing countries, including Indonesia, adopt food price subsidies to control the poor people's nutrition from foods, due to the continuous increase in the world food price [2]. It is not astonishing that a number of studies on the correlations between income and nutrition have been carried out to date.

Aligned with the food subsidy programs in major developing countries, the RASKIN Program (abbreviation of *Beras untuk Masyarakat Miskin* or Rice Price Subsidy for the poor) is provided in Indonesia as a national program to overcome the problem of poverty through national food security. The program started in 1998 when an economic crisis occurred globally. The purpose of the RASKIN program, which was initially known as OPK (*Operasi Pasar Khusus* or Special Market Operation), is to strengthen poor households' ability to fulfill their basic needs for food. The reason why rice is focused on in the program is as the main carbohydrate source that is widely consumed across regions in Indonesia, by up to 95% of Indonesian people [7].

Since the food subsidy program generally absorbs a huge amount of government budget, the efficiency of the RASKIN program in overcoming undernutrition of the poor in Indonesia is still debated. In this situation, some studies have attempted to examine the impact of RASKIN program on nutrition intake. References [8] and [9] studied the changes in people's nutrient intake with this program in Indonesia using the secondary data from Statistics Indonesia. By using the Almost Ideal Demand System (AIDS) model, the studies demonstrated that an increase in RASKIN price decreased the food expenditure of the poor. Nevertheless, none of the studies performed a thorough analysis using the data widely covering the periods before and after RASKIN program and taking into account the endogeneity of subsidy received by the household.

In addition, following [5], the impacts of the food price subvention on the consumption of the subsidized food were predicted to theoretically vary between the following two types of households: the households who consume less than the maximum amount of the food allowed to be purchase, and those who consume more than the amount. While both the substitution and income effects are brought about by the consumption of the food with its price change for the former households, only the income effect occurs for the latter. This theoretical conclusion proposes to split the sample into two empirical analyses, but there is no study that has analyzed the differences in the impacts regarding RASKIN program in Indonesia.

The aims of this study are mainly, to investigate the impact of RASKIN as a rice-price assistance program in Indonesia, on nutrition intake of the targeted poor households for three macronutrients; carbohydrate, protein, and fat, and to demonstrate the difference in the impacts between the above two types of households. By using the data from the Indonesia Family Life Survey (IFLS), the impacts of RASKIN program on the poor's nutrition intake could be demonstrated clearly.

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II. LITERATURE REVIEW

Several previous studies examined the impacts of food price subsidy on the poor's general nutritional condition, meanwhile [1], [10], and [5] attempted to break down the evaluated nutrition effects specifically into three micronutrient intakes; carbohydrate, protein, and fat. While it is of the greatest concern in the literature with regards to the food-price assistance given by the government to improve the welfare of the poor through nutrition, this specification can provide a further step in understanding the poor's reaction to the subsidy through their nutrition intake.

Some recent studies observed the effects of the subsidy program and pointed out that the amount of subsidy received by poor households was likely to be endogenous, because the subsidy that each household received and their nutrition intake were considered to be jointly determined. Therefore, the amount of subsidy might be explained by the status of the household [11] [5]. In conjunction with these studies, [12] examined the impacts of RASKIN subsidy, using the data of 1997-1999, on the calorie intake of the poor by applying an instrumental variable method to overcome the problem of endogeneity in the subsidy amount.

Food price subsidy for poor households changes the price of the food, which directly serves the subsidized goods at a lower price into their consumption bundle. RASKIN program in Indonesia allows the targeted household to buy up to 15 kilograms of rice per month as the maximum amount. Before the subsidy was introduced by the government, the initial budget line of the household is represented by line AB in Figure 1. After the subsidy was given, the budget line changes to line ACD, because while households are allowed to buy up to x_{max} (15 kilograms) of rice at lower price cp, they need to purchase rice at price p for the excess over x_{max}.

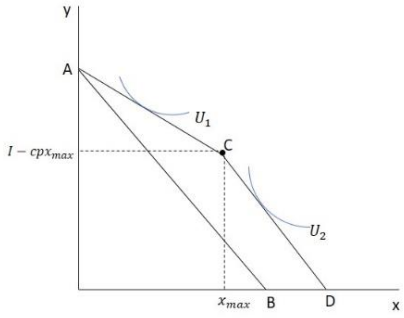

Fig. 1. Change in Budget Constraint from Food Price Subsidy
Source: Author's analysis.

This graphical description implies that the subsidy program exerts two different types of impact on the households who consume less than 15 kilograms of rice a month and those who consume over 15 kilograms of rice, respectively. First, the households who purchase up to x_{max} amount of rice after the implementation of RASKIN program, attaining U_1 on the new budget line, are faced with price reduction shown by the decrease in slope of budget constraint line, which can involve both of substitution and income effects. For this group of households, the price is the subsidized price. Second, the households who purchase more than x_{max} amount of rice per month and reach U_2 in the subsidy system purely receive an additional income. Since RASKIN program raises their income by $p(1-c)x_{max}$, only an income effect is brought to this type of households. The differences in the impact of the RASKIN program between the above two types of households suggest to split the sample into two for empirical analysis.

III. DATA AND METHODOLOGY

The data used in the study was primarily taken from the IFLS of RAND Corporation. There are 1,982 households as a total number who purchased RASKIN rice among 4,495 households who were always in the poor status during the 5 surveys in the sample. IFLS also compiled detailed data on household expenditure over the past month. Regarding this study, the data on household consumption of foods and non-foods are used. Not only total calorie intake, but also three macronutrients intakes: carbohydrate, protein, and fat are used as dependent variables in the empirical models of this study. They are all measured in calorie per capita. Elaborated data on monthly food consumption in each household are transformed into the nutrition intakes data, using the conversion factors obtained from *Daftar Komposisi Zat Gizi Pangan Indonesia* of Indonesia Health Department [13].

One big concern on RASKIN subsidy program is the eligibility of subsidy receivers. The data from Statistics Indonesia recorded that implementation of RASKIN subsidy program since the year of 2002-2010 always exceeded the allocation for the targeted households. Therefore, the amount of the subsidy received by the eligible receivers is lower than the set amount [14].

Due to data limitation, the food consumption data recorded in the survey is the food purchased for the family divided roughly among its members, which does not necessarily report individual actual consumption. In addition, the food items used to calculate the nutrient intake are limited to a certain group of foods that are considered as representative of the most common foods consumed by Indonesian people. The items include rice, meat, chicken, fish, and also vegetables, commonly consumed in Indonesia, such as morning-glory and spinach.

In order to examine the causal impacts of RASKIN program on nutrient intake of the poor for three macronutrients; carbohydrate, protein, and fat, the instrumental variable (IV) is used. Based on some previous studies, the food price subsidy is generally considered to be endogenous to nutrition intake, because the received subsidy is also decided by each household, resulting in a correlation with the error term.

To overcome the endogeneity problem in RASKIN subsidy, this study employs the IV suggested by [5]. In Indonesia, a new policy of *Kartu Perlindungan Sosial*/ Social Security Card (KPS/SSC) was introduced in 2013, which was assigned to the households who were eligible as RASKIN receivers. This card was issued by the government to increase the accuracy of RASKIN receivers and avoid the subsidy received by the non-poor. First, the following logit model is estimated using the data of IFLS5 carried out in 2014.

$$\ln\left[\frac{\Pr(SSC_i = 1)}{\Pr(SSC_i = 0)}\right] = \alpha Z_i \qquad (1)$$

where SSC_i is the dummy variable that takes 1 if the household i was given a KPS/SSC card as of 2014, Z_i is the characteristics of households, and α is its coefficient parameters. The household characteristics include household head's age, marriage status, number of household members, gender of household head, education level of household head,

house location, expenditure per capita in a month, rice consumption in a month, and durables ownership. The result of this regression is used to predict the probability that each household has KPS/SSC for every year.

Therefore, the IV used is created by multiplying the predicted probability and a dummy variable, *post*, which takes 1 for the year after RASKIN program was introduced and 0 otherwise, which is denoted by $raSSC_{it}$.

$$raSSC_{it} = prSSC_{it} \times post \quad (2)$$

This $raSSC_{it}$ is used as an IV in this study showing the eligibility to receive RASKIN rice after the implementation of the program, which is interpreted as a kind of benefit exogenously given with the program.

As the first stage of the estimation, the effects of RASKIN program on subsidy received by poor households are examined. Per capita rice-price subsidy amount received by household *i* in period *t* ($subcap_{it}$) is represented by:

$$subcap_{it} = \frac{q_{it}(p_{it}^{m} - p_{it}^{s})}{N_{it}} \quad (3)$$

where $q_{it}$is the quantity of RASKIN rice purchased in each month, $p_{it}^{m} - p_{it}^{s}$ is the difference between the market price of rice (p_{it}^{m}) and price of RASKIN rice (p_{it}^{s}) reported by household *i*, and N_{it} is the number of household members.

The following model is applied to analyze the impacts of RASKIN program on the amount of subsidy in each eligible household.

$$subcap_{it} = \beta_1 raSSC_{it} + \beta_2 prSSC_{it} + \beta_3 Z_{it} + \varepsilon_{it} \quad (4)$$

where Z_{it} is the characteristics of household *i* in period *t*, β is their coefficient parameters, and ε_{it} shows the error term. Therefore, the model to examine the impacts of the subsidy program on nutrition intakes of the poor is specified as:

$$Y_{it} = \gamma_1 subcap_{it} + \gamma_2 prSSC_{it} + \gamma_3 Z_{it} + \varepsilon_{it} \quad (5)$$

where Y_{it} is the per-capita nutrition intake of household *i* in period *t*, which is classified into three macronutrients (carbohydrate, protein, and fat), and γ is the coefficient parameters.

As describe above, $subcap_{it}$ is considered to be endogenous to the nutrition intakes. Therefore, this model is estimated by IV using $raSSC_{it}$ as the instrumental variable. In order to examine whether $raSSC_{it}$ is endogenous or not, a Sargan-Hansen test of exogeneity is performed.

The focus of this study is directed toward the poor and aims to examine the impacts of the food price subsidy on targeted households. The samples selected are the households categorized into the poor all over the five waves of IFLS. The poor's classification used in this study refers to the poverty line set by the Statistics Indonesia, which is based on the total expenditure per capita in a month. By this selection, it can be expected that the bias caused by including the non-poor households who illegally receive RASKIN rice into the sample would be reduced.

The sample is also classified based on total rice consumption in a month (including RASKIN, if any) into the two groups: households who consume up to 15 kilograms of rice in a month and those who consume more than 15 kilograms of rice per month. As described previously, the households belonging to the former group by whom rice purchased is all RASKIN rice face a price reduction of rice; income and substitution effects occur for their rice consumption. At the same time, for the households of the latter group who would additionally purchase rice even at a market price, only income effect arises from the implementation of the subsidy program. Since RASKIN program may differently affect these two types of households, it needs to study the impacts by splitting the sample into the above two.

IV. Results and Discussion

In order to observe the effects of the food price subsidy program on the total calorie and three macronutrients intakes of the households, the models are estimated with four different dependent variables: per capita monthly calorie intake, per capita monthly carbohydrate consumption, per capita monthly protein consumption, and per capita monthly fat consumption. Data distribution shows that 94% of poor household heads in the sample have lower level of education, whereas only 0.24% of the sample has higher education level. It infers that most of poor household heads have a lower education level, and also likely live in rural area.

Effects of Food Price Subsidy on Nutrition Intake

Following the previous studies, this research attempts to estimate the models for three different types of specifications to see if the results vary across the specifications. One is a linear specification which is defined by the level form of both the three macronutrient intakes and subsidy amounts; the second is transforming only the nutrition variable in logarithm form (log-linear model); and the third one is the log-log model in which both the nutrition and subsidy variable are calculated in logarithms. In estimating the log-log models, the data of 0 for the subsidy are treated as 0.001. All the models are estimated using IV. The linear OLS models are also estimated for the sake of comparison.

First, the study discusses the estimated impacts of the RASKIN program for the intakes of total calories and the three macronutrients for the whole sample. The results on Table I show that the subsidy program made significant positive impact on all nutrition intakes and in every specification including the linear OLS model. It implies that the estimated effects are robust to the assumed specifications, which strongly insist that there is a positive impact on the nutrition intakes of the poor. These results are consistent with the previous studies of [1], [2], and [3], which stated that the food price subsidy could increase the nutrition intakes of the three macronutrients of the poor, as well as their total calorie intake.

Next, the study focuses on the similarity or difference in the impacts of the RASKIN program on nutrition intakes between the two groups: the group of the households who purchased less than the maximum amount of subsidized rice (15 kilograms per month) and the group of the households who purchased more than the maximum. As shown in Table II the impacts on total calorie intake of both types of households are significantly positive; and they do not vary among the specifications. Numerically, although there is no big difference between them, the impact of subsidy on households whose monthly rice consumption is lower than 15 kilograms is a little bit higher than that of the other group. The estimation results of model (1) show that for every increase of Rp.100 in subsidy amount per capita is likely to increase the total calorie intake by 5.3 and 4.5 kilos, for the group of households with monthly rice consumption is up to 15 kilograms and above 15kg, respectively. The results of

model (4) also indicate that an increment by 10% in subsidy amount raises 1.41% of the calorie intake for the former group, while the same increase in subsidy results in the increase of 0.76% in calorie intake for the latter.

TABLE I. ESTIMATED EFFECTS OF SUBSIDY ON NUTRITION INTAKES (WHOLE SAMPLE)

Variables	(1) **OLS**	(2) **IV linear**	(3) **IV log-linear**	(4) **IV log-log**
Calorie per capita	0.0357***	0.0559***	0.000757**	0.136***
	(0.000452)	(0.0138)	(0.000374)	(0.00470)
Test of Exogeneity	-	4.446**	543.843***	1.855
Carbohydrate per capita	0.00183***	0.00152**	0.000301**	0.0582***
	(2.87e-05)	(0.000626)	(0.000152)	(0.00554)
Test of Exogeneity		0.257	83.977***	0.000
Protein per capita	0.000844***	0.00139***	0.000683**	0.123***
	(1.13e-05)	(0.000361)	(0.000337)	(0.00378)
Test of Exogeneity		5.233**	63.911***	1.401
Fat per capita	0.000171***	0.000276***	0.000671**	0.121***
	(2.26e-06)	(7.06e-05)	(0.000331)	(0.00384)
Test of Exogeneity		4.796**	607.302***	2.087
N	2,705	2,705	2,705	2,705

Source: Author's analysis based on data from IFLS 1-5.

Turning to the intakes of the three macronutrients, it can be observed that there is a clear difference in impact on carbohydrate intake between the two groups, while those on protein and fat intakes hardly vary. As depicted in Table II, the results indicate that the impact of the subsidy program on the carbohydrate intake of the households who purchase over 15 kilograms of rice per month is not significant in every IV model, although those of the other group are significantly positive. However, since the exogeneity is not rejected in this case, it can be seen the significant positive estimate obtained in the linear OLS as its impact.

Here, assuming the linear specification, this study compares the impacts of RASKIN program on carbohydrate intake on the two types of households. The impact on carbohydrate intake on the households who consumed more than 15 kilograms of rice a month is given as 0.000651 from the OLS estimate, which shows the half value of the impact on the other group (0.00119) obtained from the linear IV estimation. Since only the income effect on rice consumption arises from the implementation of RASKIN program for the households whose rice consumption per month is over 15 kilograms, if rice is an inferior good, the carbohydrate intake is expected to be relatively smaller compared to households who consumed less than 15 kilograms of rice a month. The empirical results obtained in this study support the theoretical consideration described above.

V. CONCLUSION

From these results, it can be concluded that the RASKIN program has substantially improved the nutritional condition of poor households with the increase in their intakes of carbohydrate, protein and fat, as well as total calories. Although the impact of the program on the total calorie intake is just 5 kilocalories per Rp.100 of subsidy, it shows a concrete effect of the program, while nutrition intake of Indonesian people exhibits a declining tendency in recent years. At the same time, this observed small impact is also considered to be derived from the fact that the poor households purchased a lower amount of RASKIN rice, compared to the amount assigned by the government. From this point of view, the improvement in subsidy system and distribution mechanism would be required.

The limitation of this study is the restriction on the instrumental variable. Since a KPS/SSC card is given to poor households considered to be in a lower nutritional condition, there is a possibility of having the card is jointly determined with their nutrition intakes in substance after the RASKIN program. Therefore, this type of IV employed in this study might not be able to be used for the data having less information before the subsidy program.

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TABLE II. COMPARISON OF REGRESSION RESULTS

VARIABLES	IV				IV , Rice consumption >15 kg				IV , Rice consumption ≤15 kg			
	Calorie per Capita	Carbohydrate per Capita	Protein per Capita	Fat per Capita	Calorie per Capita	Carbohydrate per Capita	Protein per Capita	Fat per Capita	Calorie per Capita	Carbohydrate per Capita	Protein per Capita	Fat per Capita
Subsidy per capita	0.0559***	0.00152**	0.00139***	0.000276***	0.0452***	0.000572	0.00136***	0.000238***	0.0526***	0.00119***	0.00125***	0.000254***
	(0.0138)	(0.000626)	(0.000361)	(7.06e-05)	(0.00653)	(0.000563)	(0.000414)	(5.68e-05)	(0.00426)	(0.000187)	(0.000114)	(2.50e-05)
probability of having SSC/KPS	-42,881	1,916	-1,223	-231.2	4,792*	1,048***	14.15	19.67	2,424**	110.6**	51.83*	9.036
	(38,331)	(1,737)	(1,002)	(195.9)	(2,755)	(237.4)	(174.7)	(23.93)	(1,085)	(47.72)	(29.08)	(6.366)
Expenditure per Capita	-0.00428	0.000216	-0.000118	-2.19e-05	8.78e-05	9.84e-05**	2.00e-06	2.42e-06	3.39e-05	4.11e-05***	3.58e-06	1.05e-06
	(0.00373)	(0.000169)	(9.75e-05)	(1.91e-05)	(0.000459)	(3.95e-05)	(2.91e-05)	(3.99e-06)	(0.000194)	(8.54e-06)	(5.21e-06)	(1.14e-06)
Middle education	-1,605	60.60	-45.25	-8.638	103.2	41.33***	-1.766	0.335	63.96	1.636	1.182	0.114
	(1,338)	(60.62)	(34.99)	(6.838)	(140.0)	(12.06)	(8.882)	(1.216)	(50.38)	(2.216)	(1.350)	(0.296)
Higher education	-1,791	59.31	-50.36	-9.625	-	-	-	-	68.26	-1.546	1.100	0.0571
	(1,482)	(67.14)	(38.75)	(7.574)					(214.8)	(9.450)	(5.759)	(1.261)
Household member 2	493.3	-12.67	13.46	2.632	797.8***	58.89***	17.99	3.348*	143.1***	10.43***	3.107***	0.604**
	(658.9)	(29.85)	(17.23)	(3.368)	(230.8)	(19.88)	(14.64)	(2.005)	(40.78)	(1.794)	(1.093)	(0.239)
Household member 3-5	-393.6	10.13	-10.90	-2.011	207.2***	27.76***	1.577	0.503	82.48***	5.664***	1.707**	0.316**
	(607.7)	(27.53)	(15.89)	(3.106)	(61.71)	(5.318)	(3.915)	(0.536)	(25.03)	(1.101)	(0.671)	(0.147)
Household member 6-8	-257.4	-0.682	-6.797	-1.223	82.38**	13.67***	-1.596	0.0782	19.49	2.377***	0.308	0.0435
	(554.1)	(25.11)	(14.49)	(2.832)	(41.64)	(3.588)	(2.641)	(0.362)	(19.13)	(0.841)	(0.513)	(0.112)
Male	182.0	-10.50	5.224	0.973	-54.27	-11.67**	0.0558	-0.184	-57.29**	-2.790***	-1.262**	-0.279**
	(162.9)	(7.380)	(4.259)	(0.832)	(57.25)	(4.933)	(3.631)	(0.497)	(22.37)	(0.984)	(0.600)	(0.131)
urban	249.2	-12.27	7.125	1.343	-207.3***	-9.891	-6.736	-1.289**	-18.12	-0.528	-0.335	-0.0500
	(237.7)	(10.77)	(6.217)	(1.215)	(70.61)	(6.084)	(4.479)	(0.613)	(29.34)	(1.290)	(0.786)	(0.172)
House ownership	-131.6	12.12	-3.790	-0.641	36.03	3.507	-0.277	0.115	42.68**	4.429***	1.539***	0.364***
	(170.2)	(7.710)	(4.450)	(0.870)	(49.72)	(4.284)	(3.154)	(0.432)	(18.37)	(0.808)	(0.492)	(0.108)
Land ownership	-883.2	38.07	-24.84	-4.732	110.4	19.52***	4.210	0.751	50.06*	2.263**	1.014	0.174
	(770.9)	(34.93)	(20.16)	(3.940)	(69.39)	(5.979)	(4.401)	(0.603)	(25.88)	(1.138)	(0.694)	(0.152)
Vehicles ownership	-40.61	2.849	-1.549	-0.282	-87.50**	-1.625	-5.163**	-0.759**	-0.672	0.399	-0.240	-0.0577
	(57.17)	(2.590)	(1.495)	(0.292)	(35.51)	(3.060)	(2.252)	(0.308)	(12.20)	(0.537)	(0.327)	(0.0716)
Appliances ownership	-1,279	55.92	-36.45	-6.924	108.6	29.88***	-0.230	0.466	52.27	2.252	0.837	0.103
	(1,143)	(51.81)	(29.90)	(5.844)	(88.80)	(7.651)	(5.633)	(0.771)	(33.75)	(1.484)	(0.905)	(0.198)
Observations	2,705	2,705	2,705	2,705	272	272	272	272	1,999	1,999	1,999	1,999
R-squared	0.910	0.938	0.889	0.897	0.174	0.299	0.020	0.036	-2.187	-0.043	-1.177	-0.835
Number of id	846	846	846	846	125	125	125	125	704	704	704	704
Adjusted R-Squared	0.867	0.908	0.836	0.847	-0.841	-0.563	-1.185	-1.150	-4.024	-0.644	-2.432	-1.893
F-statistic	586.6	850.7	474.4	509	2.923	1.944	1.033	1.285	7.915	7.088	6.652	6.085

Source: Author's analysis based on data from IFLS 1-5.

Note: The full household's characteristics are also included in the regression above. The symbols ***, **, * denotes that the coefficient is statistically different from zero at 1%, 5%, and 10%, respectively. (-) : omitted variables.