IS INPUT SUBSIDY STILL USEFUL FOR INDONESIAN AGRICULTURE? AN EMPIRICAL REVIEW OF RICE PRODUCTIVITY AT THE HOUSEHOLD LEVEL

Gilang Wirakusuma
Agricultural Socio-economics Department, Faculty of Agriculture, Universitas Gadjah Mada
gilang_wirakusuma@ugm.ac.id

Abstract

Government policies in the form of input subsidies have become an essential instrument for improving the performance of the agricultural sector and overcoming the limitations of resources owned by farmers. However, there are still questions about how effective this policy can be in boosting agriculture performance. This study aims to examine the impact of channeling input subsidies on agricultural productivity. Using the 2014 Agricultural Census microdata, 26,079 rice farm households were included in the analysis. Propensity Score Matching (PSM) is used to examine the impact of input subsidies on agricultural productivity represented by the productivity of rice farming. PSM was chosen because it can overcome the selection bias that could potentially arise in the analysis process. The analysis showed that the PSM model succeeded in reducing bias and confirmed that input subsidies had a significant effect on the productivity of rice farming. Thus, the input subsidy policy is an important and relevant instructor to improve the performance of the agricultural sector.

Keywords: productivity, *Propensity Score Matching, rice farm households, input subsidies*

JEL Classification: Q1, H2, D6

Abstrak

Kebijakan pemerintah dalam bentuk subsidi input menjadi instrumen penting untuk meningkatkan kinerja sektor pertanian dan mengatasi keterbatasan sumber daya yang dimiliki petani. Namun demikian, masih terdapat pertanyaan mengenai seberapa efektif kebijakan ini dapat mendorong peningkatan kinerja industri pertanian. Penelitian ini bertujuan untuk menguji dampak penyaluran subsidi input terhadap produktivitas pertanian. Dengan menggunakan data level mikro Sensus Pertanian 2014, 26.079 rumah tangga tani padi dilibatkan dalam analisis. Propensity Score Matching (PSM) digunakan untuk menguji dampak subsidi input terhadap produktivitas pertanian yang direpresentasikan oleh produktivitas usahatani padi. PSM dipilih karena dapat mengatasi bias seleksi yang berpotensi muncul dalam proses analisis. Hasil analisis menunjukkan bahwa, model PSM berhasil mengurangi bias dan mengkonfirmasi bahwa subsidi input berpengaruh signifikan terhadap produktivitas usahatani padi. Dengan demikian, kebijakan subsidi input merupakan instrumen yang penting dan relevan untuk meningkatkan kinerja sektor pertanian.

Kata kunci: produktivitas, Propensity Score Matching, rumah tangga tani padi, subsidi input

Klasifikasi JEL: Q1, H2, D6

INTRODUCTION

An agricultural subsidy is a very strategic policy component to support the achievement of development goals that are not only related to improving the performance of the farming sector but also concerning the joints of life in a country. As shown by some literature, both in developed and developing countries, the policy instrument in the form of agricultural subsidies is a program that is always implemented (Kirwan, 2009; Koo & Kennedy, 2006; WTO, 2001). The allocation of government spending is used to ensure increased food production, grow farmers' incomes, and strengthen national food security (Ricker-gilbert & Jayne, 2011)

Although the agriculture subsidy program is one of the policy priorities, this agenda still leaves the question of whether the subsidy will have more impact on improving the performance of the farming sector compared to public investment in this industry. The general argument that is used as a reference for flushing the subsidy funds is that farmers will not be able to compete with imported agricultural commodities and they will potentially receive economic, environmental and social benefits from subsidy programs (Henningsen, Kumbhakar, & Lien, 2009; Salunkhe & Deshmush, 2012). Besides, the effectiveness of the program also needs to be linked to its impact on poverty alleviation progress, food security, and trade (Cui, Wu, & Tseng, 2016; Fan, Gulati, & Thorat, 2008; World Bank, 2008).

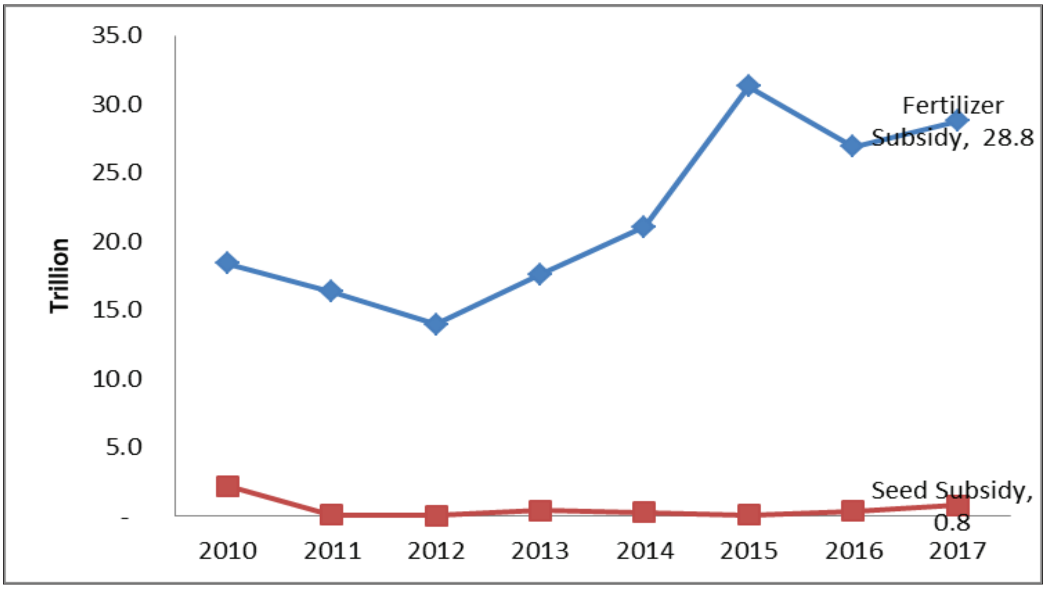
Subsidy programs, like other development policies, can fail to achieve their goals. The failure of subsidies, as presented by several studies, is caused by high costs and wrong approaches in the distribution of recipient groups (Kaur & Sharma, 2012; Nindi, 2015; Shively & Ricker-Gilbert, 2013).Also, the disbursement of subsidies that exceeds the actual amount of needs results in inefficiencies (Nindi, 2015; Ricker-Gilbert, Jayne, & Shively, 2012). In agricultural production activities, for example, excessive and massive input subsidies can encourage the use of inputs which exceed doses or allocations that lead to wasteful costs.

Indonesia, as an agricultural and archipelagic country, is still very dependent on the farming industry. In terms of economic value, the agricultural sector contributes around 12% of the Gross Domestic Product (GDP), although the proportion indicates a relatively declining trend over the past decade. Meanwhile, in the aspect of employment, around 31% of the Indonesian workforce works in the agricultural sector (Badan Pusat Statistik, 2019a). However, most agriculture households in Indonesia are small farmers. The number of smallholder households in Indonesia is 15,809,398 or 58.07% of the total agricultural households in Indonesia (Badan Pusat Statistik, 2019b). They control this sector and grow most of the food commodities.

Furthermore, 75% of poor people in rural areas depend on their livelihoods in various activities in the agricultural sector (McCulloch, 2008). As the experience of existing studies shows, increasing agricultural productivity growth and encouraging development programs related to the agricultural sector have been proven to reduce poverty levels in Indonesia (Rusliyadi, Jamil, Othman, & Kumalasari, 2018; Susilastuti, 2018), especially in rural areas where 58% of the population is classified as poor. Thus, the agricultural subsidy is a very relevant policy instrument to be studied.

Based on data from the Ministry of Finance (2019), the government has allocated a Food Security Budget. In the budget, the agricultural subsidy fund is one of the allocation components. Figure 1 shows the realized value of the agricultural subsidy budget, in this case, fertilizer and seed subsidies. Fertilizer subsidy is a top priority in pouring agricultural subsidy funds. Fertilizer subsidy reached Rp. 28.8 trillion in 2017, which was relatively higher compared to its allocation in the 2010-2017 periods. Meanwhile, seed subsidies amounted to Rp 0.8 trillion in 2018.

Many researchers have examined the impact of introducing input subsidy policies on agricultural production. These studies generate different conclusions in explaining the relationship between input subsidies and increased production and productivity. Several studies found that input subsidies significantly drive increased agricultural production and productivity (Alston & James, 2002; Nasrin & Bauer, 2018; Rizov, Pokrivcak, & Ciaian, 2013). Meanwhile, other literature confirms that input subsidies have a significant and negative correlation with both (Blancard, Boussemart, Briec, & Kerstens, 2006; Ciaian & Swinnen, 2009; Kumbhakar & Bokusheva, 2009). These findings are very dilemmatic, given that increasing productivity is an important component for strengthening the rural economy. Increased agricultural productivity, in terms of higher output, stimulates beneficiary multiplier for the rural economy (Hanmer & Naschold, 2000). Productivity growth, in turn, reduces poverty by decreasing food prices, relaxing households' expenditures, and generating opportunities in non-agricultural work (Mellor, 1999).



Source: Ministry of Finance (2019) (modified)

Figure 1. Realization of Fertilizer and Seed Subsidies Budget for 2010-2017

This research was conducted to find out whether agricultural subsidies have a positive impact on agriculture productivity at the household level. Various studies have been carried out to identify the effect of input subsidies on the improvement of the majority of agricultural productivity by conducting regression or non-parametric analysis that does not pay attention to the balance comparison between the sample and non-sample of subsidy recipients. This method will cause a selection bias in data analysis. For this reason, the Propensity Score Matching (PSM) approach is used to overcome the selection bias problem arising from the analysis of the relationship between subsidies and production. PSM is a statistical matching technique that tries to estimate the effect of a policy or intervention by calculating the covariance value between recipient and non-recipient. PSM aims to reduce bias due to ambiguous variables that are part of the estimation of treatment effects to compare samples received with those that did not (Rosenbaum & Rubin, 1983).

LITERATURE REVIEW

The basic concept of agricultural subsidies is to increase the benefits of allocating farming resources to the performance of agrarian projects. Agricultural subsidies are generally distributed in the form of discounted input prices, for example, subsidies for fertilizers, seeds, machinery, pesticides, or credit facilities. Such subsidies are input subsidies that aim to provide financial support to reduce the financing burden borne by producers, in this case, farmers. Besides reducing production costs, such support also have the side effect of increasing economies of scale, reducing risks and rural poverty, as well as supporting related industrial activities. The benefits of subsidies that are carried out on target and under the intended use also influence innovation, increased investment, expansion of employment, protection of low-income people, and improvement of environmental services (Bach, Kohlhaas, Meyer, Praetorius, & Welsch, 2002; De Moor & Calamai, 1997). Thus, subsidies can not only guarantee the availability of adequate food but also contribute to the economic, social, and environmental aspects of a country.

Furthermore, besides the benefits arising from the subsidies, there is also a drawback of inefficiencies that might occur in this policy. Transfer of input subsidies to farm households runs the risk of reducing the value of economic benefits due to high distribution and administrative costs. Distribution often encounters unexpected obstacles and causes delivery delays in terms of quality and quantity (Filipski & Taylor, 2011). In addition, input subsidies also have the potential to hamper agricultural production performance when subsidies are accessed by farm households that have sufficient resources to support production activities. Meanwhile, farmers with limited resources are relatively difficult to access the input subsidy program (Chirwa & Dorward, 2014).

A study conducted by Nasrin and Bauer (2018) assessed the impact of micro-level fertilizer subsidies on efficiency in Bangladesh. This study uses primary data collected through interviews with 300 farm households located in three districts of northern Bangladesh. Data Envelopment Analysis (DEA) reveals that farming is inefficient in combining inputs by minimizing costs, even though it is technically more efficient. The results prove that fertilizer subsidies have a significant impact on increasing the efficiency of small scale agriculture but not significantly suitable for large scale agriculture. Furthermore, increasing the allocation of fertilizer subsidies will bring a significant increase in productivity for small farmers.

Relatively similar results were also found by Ramli et al. (2012). By using a system dynamic model approach at national-level data, the study results show that fertilizer subsidies do indeed have a significant impact on the rice and rice industries. Fertilizer subsidies increase yields and hence increase rice production. Elimination of fertilizer subsidies reduces rice production and, consequently, reduces the level of self-sufficiency.

Further research on the effect of subsidies was also carried out by Malan et al. (2016). Using time-series data in several African countries, the impact of subsidies is analyzed by descriptive analysis techniques. The findings state that increasing subsidies actually reduce productivity and further inhibit increased crop production. Similarly, Rizov et al. (2013) found that the impact of subsidy in the European Union is negative on agricultural productivity. This study uses a structural semi-parametric estimation algorithm that directly incorporates the effects of subsidies into an unobservable productivity model.

Moreover, In Indonesia, a study conducted by Mulyadiana et al. (2018) evaluates the fertilizer subsidy policy with a descriptive analysis approach and multiple linear regression. The study used primary data obtained through interviews in Karanganyar District. The results of this study state that based on four indicators, subsidy distribution is not effective because the distribution of fertilizer subsidies to farmers still experiences some errors. Furthermore, the results of the regression analysis show that the effectiveness of the fertilizer subsidy policy has a positive correlation and a significant effect on rice production. Thus, if the subsidies program run effectively, it will support an increase in rice production.

In addition, Mantau et al. (2019) examine the impact of government policies on producer protection in Gorontalo Province. The analysis use Policy Analysis Matrix (PAM) method, where Producer Subsidy Equivalence (PSE) is used to measure relative incentives for producers (farmers). The results show that there are subsidies for government input and protection working effectively for rice commodities, but producers (farmers) do not receive direct or indirect incentives from the government. Meanwhile, using the same method, PAM, Juniarsih et al. (2013) conducted a study aimed at examining the impact of corn seed subsidy policies on farmers' production and income. The study used primary data collected through interviews in Maros District. The study concluded that the distribution of corn seed subsidies had a positive and significant impact on the production and income of corn farms.

RESEARCH METHODS

Data and Location

The sample used in the analysis was rice farm households because most of Indonesian agricultural households are rice farmers (Bappenas, 2014). The data was obtained from the 2014 Agricultural Census Data Center Statistics Agency. Meanwhile, the East Java Province was choosed because it has the largest cultivation area and rice production in Indonesia, which is 1.55 million hectares of land and 13.1 million tons (Badan Pusat Statistik, 2015). A total of 26,079 samples were selected by multistage random sampling by taking into account the location and distribution of samples in each district/city in East Java.

Accurately testing the impact of the input subsidy policy program requires an evaluation that confirms the causal relationship between the intervention and the desired objectives. Estimating the relation need a counterfactual sample, that is, the group of household farmers who receive subsidies and the comparison group that does not receive subsidies. From 26,068 selected samples, a total of 17,038 were farm households that did not receive supports, and the remaining 9,041 were subsidy recipients. In this study, subsidy recipient was defined by the information given by the farmers whether they received the agricultural input or not. The input subsidy variable, in this study, includes fertilizer and seed subsidy accumulatively. Since unavailability detailed information, this study cannot specify how many respondents who access fertilizer subsidy, seed subsidy, or both.

Data Analysis

Propensity score matching

Random Utility Theory (RUT) explains that the decision of farmers to use the input subsidy program is random. The outcome variable in this study is productivity considered a linear function of the explanatory variable and the binary subsidy variable:

$$Y_t = \beta X_t + \gamma T_t + \varepsilon_t \quad (1)$$

In this equation, Y indicates the outcome variable, X denotes the explanatory variables, T is the binary variable of input subsidy, β and γ are coefficient vectors, and ε is the error term. However, from Equation 1, because γ measures the impact of input subsidy (treatment variables) on productivity (yield variables), farmers are randomly assigned as recipients rather than recipients of subsidy. However, subsidy programs are rarely delivered randomly. In other words, this common fact will increase the probability that ε is correlated with X or T and can lead to biased estimation in terms of selection bias.

This study uses propensity score matching (PSM) to eliminate the problem of selection bias. Variable D_i is an indicator of whether farm households i receive input subsidies or not. The potential outcome of receiving subsidies is the productivity of rice farming (tonnes/ha) represented by Y_i. Thus, the average treatment effect (ATT) in recipient households is calculated with the following formulation:

$$\Delta_{ATT} = E(D = 1) = E(D = 1) - E(D = 1) \quad (2)$$

Where Δ_{ATT} is the average treatment effect of recipients of subsidies; $E(Y(1) \mid D = 1)$ is the expected value of rice production for households receiving subsidies; $E(Y(0)) \mid D = 1)$ is the expected value of non-subsidized household rice production.

However, the calculation of ATT requires a qualified counterfactual relationship. PSM helps build a counterfactual relationship from households that do not receive subsidies. To control selection bias, statistically, the comparison group (not the recipient of the subsidy) must be equivalent to the treated group (the recipient of the subsidy), and all observable covariates must match between the two. Rosenbaum and Rubin (1983) propose to match the propensity score, *p(X)*, which is the probability of accepting conditional characteristics in all covariates, *X*. Furthermore, PSM requires conditional independence assumption (CIA) and supporting variables for identification (Heckman & Leamer, 2007). If this assumption is fulfilled, the PSM estimator for Δ_{ATT} is formulated as follows:

$$\Delta_{ATT}^{PSM} = E_{(D=1)}\{E[Y(1)|D = 1, p(X)] - \{E[Y(0)|D = 0, p(X)]\} \quad (3)$$

The meaning of the formulation is that the PSM estimator is only the difference in the average yield of each group that is precisely weighted by the distribution of the propensity score. In this study, PSM is estimated using the Probit Model. PSM explanatory variables are determined based on theory and previous empirical studies (Chirwa, Matita, & Dorward, 2011; Heckman & Leamer, 2007). Therefore, PSM is estimated with the following structural equation:

$$Prob(D_i = 1) = F(\delta_0 + \delta_1 land_i + \delta_2 age_i + \delta_3 gend_i + \delta_4 fs_i + \delta_5 edu_i + \delta_6 cap_i + \delta_7 ext_i + \delta_8 fg_i + \delta_9 fer_i + \delta_{10} seed_i) \quad (4)$$

Equation 4 shows that PSM is estimated with explanatory variables that are considered to be determinants of the area of rice cultivation (*land*: m^2), age of head of household (*age*: year), sex of head of household (*gend*: = 1, if male; = 0, if female), number of household members (*fs*: person), education of household head (*edu*: = 1, if graduated from at least senior high school; = 0, if below senior high school), main source of capital (*cap*: = 1, if equity; = 0, if not equity), agricultural extension participation (*ext*: = 1, if participating; = 0 not particiating), participation in farmer groups (*fg*: = 1, if participating; = 0, if not participating), total value of fertilizer cost (*fer*: 000 IDR/ha), and total value of seed cost (*seed*: 000 IDR/ha).

In estimating PSM, this study uses a Kernel Matching (KM) matching algorithm. The KM approach can be seen as a weighted regression of counterfactual results. Weight depends on the distance between each individual from the control group and participant observation that is estimated to be counterfactual. One major advantage of this approach is the lower variance, which is achieved because more information is used. The difference between KM and other approaches is that the latter includes, in addition to the intercept, a linear term in the propensity score of a treated individual. This is an advantage whenever a comparison group of a large number of observations is distributed asymmetrically around the treated observation, e.g., at boundary points, or when there are gaps in the propensity score distribution (Caliendo, Caliendo, & Kopeinig, 2005). Thus, the KM algorithm model is very suitable for this study since it involved large sample sizes.

RESULTS AND DISCUSSION

Descriptive statistics

Based on the information contained in Table 1, in terms of household characteristics, the age of heads of households in the two groups of households is relatively the same, which is around 52 years. Likewise, with the size of the household, the two groups are also relatively similar in which the number of household members is around 2-3 people. Education, which represents the capacity of household heads, both in the recipient and non-recipient household groups, only about 10-11% have completed at least a senior high school level. This result shows that the majority of heads of rice farming households in East Java Province have low education. In terms of participating in extension activities and farmer groups, more subsidy recipient households participated than non-subsidized groups. Meanwhile, in terms of household domestic food availability, the majority of the recipient and non-recipient groups have food stocks.

Evaluation of the PSM model

Figure 2 shows the results of the matching observations through the common support approach. The diagram in the figure shows that most of the samples are included in the matching, as many as in the treated / recipient group (9,039) and the untreated / comparison group (17,038). There are no observations that were not involved in the matching process (off-supported). Furthermore, information about the sample equivalence compared in the PSM analysis is shown in Figure 3. Before the matching stage, the recipient group and not the recipient of input subsidies have a striking difference in the flow distribution of the propensity score and potentially lead to selection bias. Meanwhile, after matching through a covariate balance, the samples involved in the comparison have equal characters. This equality will localize conclusions that focus only on the impact of input subsidies on the productivity of rice farming.

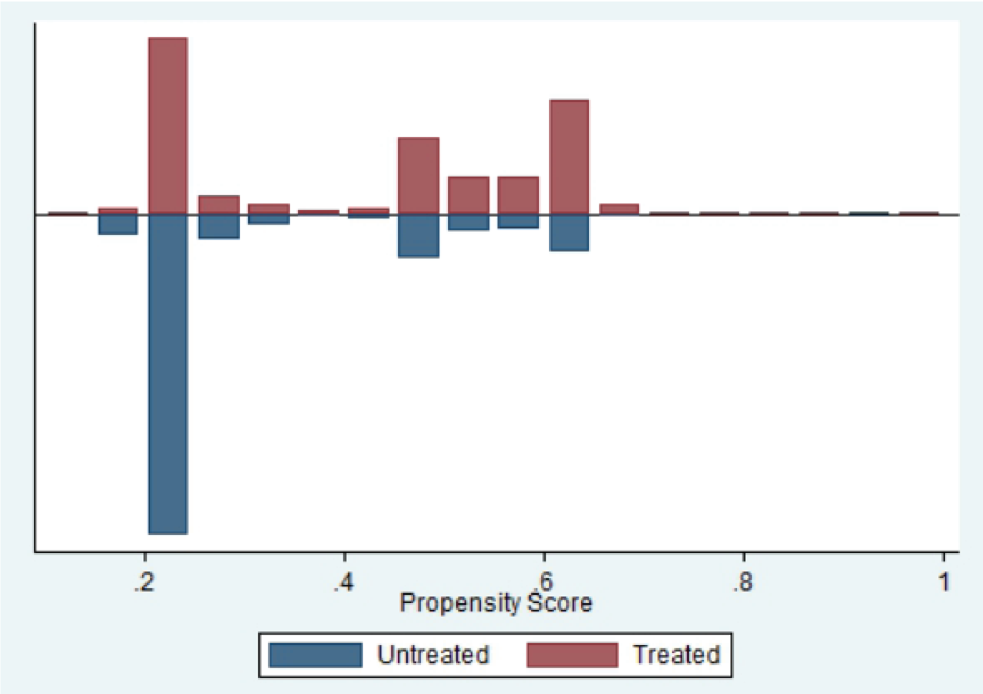
Does subsidy increase the productivity of rice farms?

Before discussing in detail the examination results of the impact of input subsidies on rice farm productivity, this study tried to compare the differences in the cost of agricultural inputs, which are components of input subsidies, namely seeds and fertilizers. Because of limited information on seed and fertilizer actual volume, this study used the nominal value of both inputs (000 IDR/ha). The Two-Group Mean-Comparison Test was employed to carry the test out. Samples were

Table 1. Descriptive statistics of operational variables

Variable	Recipients		Non-recipients	
	Mean	S. D.	Mean	S. D.
land	5,049.05	9,053.51	4,556.27	7,382.79
gend	0.897	0.303	0.867	0.338
age	52.650	12.468	52.268	13.195
fs	2.70	1.49	2.58	1.49
edu	0.1106	0.3136	0.1040	0.3052
cap	0.8369	0.3694	0.8627	0.3441
ext	0.3497	0.4769	0.1324	0.3389
fg	0.5666	0.4955	0.2395	0.4268
fer	782.2759	1,437.33	987.778	2,479.608
seed	244.9364	330.9267	275.5683	319.1861
Productivity (*Y*)	4,853.27	2,065.32	4,623.67	2,765.82
Observation	9,041		17,038	

Source: Data computation (2019)

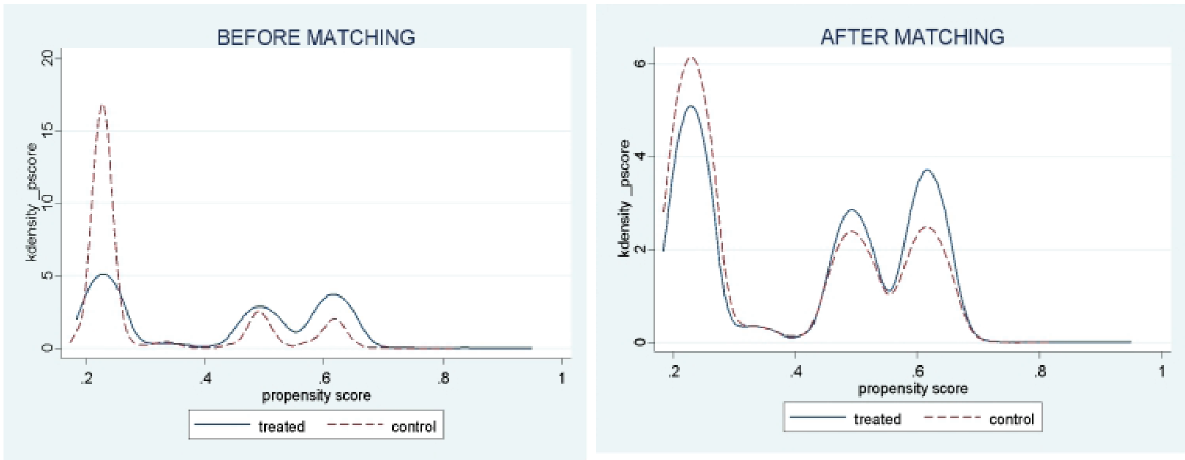


Source: Data computation (2019)

Figure 2. Histogram of the distribution of matched groups of subsidy recipients (treated) and non-recipients (untreated)

distributed in two groups; those are recipients and not recipients.

According to the results presented in Table 2, the mean-comparison test indicated the difference between seed and fertilizer costs paid by input recipient and non-recipient subsidies. In terms of seed, the recipient group spent less money than the non-recipient and the difference in cost of this seed is statistically significant. Similarly, testing the differences in the cost of fertilizer between the two groups, the cost of using fertilizer per hectare in the recipient group was less than the cost of use by non-recipients. This fact shows that recipients of input subsidies will be able to relax their expenses. Savings on fertilizer and seed costs, assuming farmers do not reduce the volume of use of both inputs, encourage farmers ability to allocate more budget for accessing advanced technology and intensifying other to raise the farm productivity (Nasrin & Bauer, 2018; Rizov, Pokrivcak, & Ciaian, 2013).



Source: Data computation (2019)

Figure 3. Distribution of propensity score balance before and after matching

Tabel 2. Mean-comparison test on seed and fertilizer cost

	Group	Obs.	Mean	Std. Dev.	Diff.
Seed	Recipient	17,038	244.936	330.9267	30.632***
	Non-recipient	9,041	275.568	319.1861	
Fertilizer	Recipient	17,038	782.276	1,437.330	205.502***
	Non-recipient	9,041	987.778	2,479.608	

***: significant at α=1%;

Source: Data computation (2019)

In the impact analysis, the first step in the form of a Probit model is carried out to calculate the propensity score in each sample. Explanatory variables which are thought to determine the probability of access to input subsidies have a relationship that is relatively in line with the hypothesis, for example, membership in farmer groups, area of rice farming, participation in counseling, age of head of household, number of household members, and education level (Table 3).

Tabel 3. PSM Probit Estimation

Variable	**Coeffiecient**	***z-stat***
land	-3.35e-06	-2.03 **
gend	-0.016397	-061
age	0.0011063	1.66*
fs	0.0215446	3.76***
edu	-0.100234	-3.62***
cap	-0.0316932	-1.35
ext	0.3145108	13.28***
fg	0.7221721	35.52***
fer	-0.0000523	6.55***
seed	-0.0000136	-1.05
_cons	-0.8283451	-16.06***
Prob. Chi² = 0.000		
Observasi = 26.079		

***: significant at α=1%; **: significant at α=5%; *: significant at α=10%

Source: Data computation (2019)

Kernel Matching Algorithm is used in the PSM analysis to examine the impact of the subsidy on the productivity of rice farms. Through this method, as shown in Table 4, it is revealed that the average bias that occurs in data without matching 2.27195. Meanwhile, the smallest corrected bias value is 123.834, and the largest is 168.303. Thus, it can be proven that the PSM analysis with the Kernel Matching model can correct bias greater than the bias found in the unmatched data.

The ATT on testing the impact of input subsidies on rice farm productivity is shown in Table 4. In the analysis, it is known that the number of samples at the input subsidy recipient is less than that of the non-recipient. The impact of channeling input subsidy is measured by the ATT value, which shows a positive value of 139.3502. This result means that input subsidy can encourage the productivity of rice farms around 0.139-0.140 tons/ha. These results are consistent with the theory that input subsidy can improve agricultural productivity. Subsidy schemes carry benefits by reducing the costs of using fertilizers and other inputs. The use will expand, thus leading to increased production primarily if subsidized inputs are used by households that face input market failures or input price volatility (Druilhe & Barreiro-Hurlé, 2012). On another aspect, the subsidy can promote farmers' credit positions or reduce borrowing costs for investment, thereby increasing their productivity. Besides, the generated positive effects can also caused by the avoidance of lower risk due to subsidies so that farmers may be more interested in multiplying capital, adopting new technologies, and ultimately adjusting better agricultural productivity (Rizov et al., 2013).

The main purpose of transferring subsidy input is to ease the financial constrain faced by the farm household in operating the business. The results of this study confirm that access to subsidized inputs can give better yield. Thus, it is clear that improving farm performance is better when the government does not rely solely on public investment allocated by farm households in the form of equity. As stated in the introduction, the majority of rice farm households are small farmers who have limited resources, especially capital. Therefore, it is necessary to provide subsidy input to accelerate performance improvement, in this case, farm productivity.

Moreover, if the subsidy ends and the agricultural market is deregulated, agriculture will change. For example, land use will change according to farmers' preferences based on economic considerations, and subsequently, some agricultural businesses will experience a fall in performance or losses, while others will grow rapidly. This circumstance is very potential to occur because agriculture will depend entirely on market mechanisms. Farm households, who have limited financial resources, will 'head-to-head' battles with large-scale farming actors who have enough resources to invest and are more resistant to market contraction.

CONCLUSIONS AND RECOMMENDATIONS

Input subsidy is one of the policy components used to intervene in the process of agricultural production. It aimed to develop economic benefits both for farmers at the micro-level and for stability at the macro level. With the Propensity Score Matching (PSM) model, the impact of channeling input subsidies on rice farm households on productivity was identified. The PSM model is proven to be able to overcome selection bias that occurs if the analysis does not involve matching samples based on their respective characteristics. The analysis shows that the input subsidy policy can significantly boost the productivity of rice farms. Thus, the distribution of input subsidy is one of the drivers of the food supply in Indonesia;

Table 4. Corrected bias by the Kernel Matching model

Observed	*Bias*	S.E.	(95% Conf. Interval)		
139.3502	2.27195	17.29382	91.335	187.365	*Normal*
			123.834	168.303	*Percentile*
			123.834	168.303	*Bias-Corrected*

Source: Data computation (2019)

Table 5. The impact of input subsidies on productivity

Number of Treated (Recipients)	*Number of Control* (Non-recipients)	ATT	S.E.	t-stat
9,041	17,032	139.350	17.294	8.058***

***: significant at α=1%

Source: Data computation (2019)

in this case, the provision of rice as a staple food for the people.

As the characteristics of rice farm households, it is known that the households have a farm tenure that is less than one hectare, led by heads of households with relatively old age and low education, and relies on personal funding to run their farms. Based on this fact, policies in the form of input subsidy are needed to support the limited scale of production and ownership of resources. Moreover, subsidy programs successfully influence the increased of production as well as the ability of the community's food supply, so that the threats to market stability and staple food scarcity can be avoided.

Further research on the impact of farming input subsidy on far performance can still be significant by putting additional analysis on the input intensification, which cannot be done by this study due to lack of specific information about input utilization. Understanding more about the differences between input intensification of the subsidy recipient and non-recipient will potentially support the result of current studies and explain more about subsidy program effectiveness. Furthermore, future research will be more contributive if it can compare and evaluate the input subsidy and other incentive policies, especially when the government is challenged by a constrained budget.

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