Contribution of Vegetable Urban Farming to Household Income in the City of Yogyakarta

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Abstract. Urban farming adopted technological advancement in agriculture, beautify the environment as well as resilient future farming. Within household level, this paper examine endowed income through vegetable urban farming, its share to total household income and its determinants in Yogyakarta. Purposively sampled 2 most active districts in urban farming practice and then sampled household randomly. Descriptive analysis is used to describe urban farming activity and its characteristics in Yogyakarta. Furthermore, several statistical approaches are used, income measurement, one sample t-test and multiple liner regression. The results shows that urban farming brings positive return to household. It returns in amount of Rp 112.883/year and total generated household income annually is Rp 46.579.988/year. Vegetable urban farming contributes 0,24% out of total household income. It is considered very small contribution due to the production scale is relatively small, 4 polybags of cayenne pepper, 10 polybags of big chili, and 11 polybags of mustard greens in one year average. Farmer's age, education level, and number of plants give positive effect to vegetable urban farming. Meanwhile, seed prices brings negative one.

Keywords: Income · Household income · Contribution · Vegetable urban farming

1 Introduction

The high urban population is a common problem in large cities in Indonesia. BPS [1] recorded the percentage of the population in urban areas in 2015 reached 53.3%, then in 2020 it had reached 56.7% and in 2025 60% (estimated). UN-Habitat also estimates by 2030 60% of the world's population will live in urban areas. In Indonesia, in 2045 it is estimated that 82% of Indonesia's population will live in urban areas [2]. The pushing actors are natural population growth and urbanization speed. Limited land for housing will be the main issue along wider agricultural land is demanded in order to provide sufficient food supply.

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Yogyakarta province, in 2019, the population number was 3,842,932 with 1.15% per year population growth rate. Under the growing population growth rate, the agricultural land conversion has positive tendency. In contrary, the food production requires larger land in supplying growing consumers' needs as the population increases. According to statistical data, Yogyakarta has been experiencing decrease of agricultural land. In rather detail, in 2012, 2014 and 2016 there was 76, 65, 60 hectares respectively. Malthus' theory was developed which states the number of humans increase exponentially while the food increases arithmetically [3]. This indicates the increase in food production is not proportional in comparison to population growth which might results in food crisis [4].

Smith et al. [5] suggested that 800 million people worldwide are actively engaged in agricultural practices in urban areas. Urban agriculture/farming can approximately produce on average of 15 to 20% of world food production. According to Zezza and Tasciotti [6] in Ammatillah [7] the level of community in urban agricultural activities in developing countries shows varying levels, ranging from 11% in Indonesia to almost 70% in Vietnam and Nicaragua. Urban agriculture also accounts for 3–20% of total agricultural production, as low as 3% in Malawi and peaking at 20% in Madagascar and Nicaragua.

In other perspective of urban farming, the prompting factors to the cost and income are divided into two, internal and external factors [8]. Based on results of Gupito [9], influencing factors towards farm income are *land size, price of seeds, TSP fertilizer, urea, manure, Phonska fertilizer and hired labor*. In addition to that, the most elastic factors and give significant effect are land size and price of seed. Similar to the later one, Mawardati [10] found that level of production, land size, capital, selling price, labor determines positively on farm income. However, the significant factors are level of production and selling price.

2 Methods

The basic method used is descriptive analysis. This research was conducted in 2019 involving 60 farmers (households) in Yogyakarta generated from Jetis and Danurejan Sub District. The purposive sampling technique is used under certain criteria, namely farmers who have planted large chili, cayenne pepper, and mustard greens for more than one year. Personal interview, observation, recording, and literature is used in data collection.

Farm income obtained by subtracting the total revenue with the total cost [11]:

$$I = TR - TC \tag{1}$$

where,

I = Farm Income (Rp).
TR = Total Revenue (Rp).
TC = Total Cost (Rp).

To find out the contribution of farm income (vegetable urban farming) to household income can be calculated by using the following formula.

$$\text{Contribution of Income} = \left[\frac{\text{I}}{\text{Total Household Income}}\right] \times 100\% \quad (2)$$

Categorized into (Leslie and Suhatmini, 2011):

a. Income contribution, <25%, small;
b. Income contribution, 25–49%, moderate;
c. Income contribution, 50–75%, large;
d. Income contribution, >75%, substantial.

The multiple linear regression equation models

$$\text{Ln Y} = \text{a} + \text{b}_1 \text{LnX}_1 + \text{b}_2 \text{LnX}_2 + \text{b}_3 \text{LnX}_3 + \text{b}_4 \text{LnX}_4 + \text{b}_5 \text{LnX}_5 + \text{b}_6 \text{LnX}_6 + \varepsilon \quad (3)$$

where,

Y = Urban agricultural income.
A = Constant.
$b_1 - b_7$ = Coefficient.
X_1 = Age (Years).
X_2 = Education (Years).
X_3 = Number of plants (n).
X_4 = Price of pot (Rp).
X_5 = Price of seeds (Rp).
X_6 = Number of Commodities (n).
ε = Error (error term).

3 Results

3.1 Urban Farming Income

The average generated urban farming income is Rp. 112.883/year (Table 1). It consists of Jetis Sub District's income (Rp. 121.957/year) and Danurejan Sub District's

Table 1. Average urban agricultural income.

Information	Danurejan Subdistrict (Rp)	Jetis Sub District (Rp)	Yogyakarta (Rp)
Revenue	189.107	278.532	229.775
Total Cost	86.906	156.875	116.892
Income	102.201	121.957	112.883

Source: Primary Data Analysis

(Rp. 102.201/year). This difference due to the number of plants cultivated by each household and the usage of agricultural inputs (pesticide and fertilizers). According to Gusfarina [12], the first motivation among the households in the city to utilize home compound for planting vegetables and/or fruit is providing themselves relatively healthier food, such as free pesticide residues, better quality and freshness. The second one is beautify its surrounding, less heat and more comfort. The third is social/community reason, such as joining farmer group. Fourth is taking advantage of leisure time. This is in accordance with Specht et al. [12] which shows the highest public acceptance of commercial urban cities with environmental and social goals is positively influenced, while production-based or technology-intensive agriculture is rejected. In order to develop urban farming far more further a target on healthier food and health issue in general fits. The least, however, relatively gives negative impact on its financial matter, as Poulsen [13] acknowledged.

3.2 Contribution Urban Farming Income to Household Income

Contribution measures how big its share in comparison to total household income. Table 2 shows the contribution of urban farming income in Yogyakarta by 0.24%. This figure is fairly small according to Leslie and Suhatmini [14], <25%. The very small share is mostly reflected by the number of vegetables planted. The average number of vegetables planted cayenne pepper as much as 4 polybags/year, big chili 10 polybags/year, and mustard 11 polybags/year. In addition to that, urban farming is still going under subsistence orientation. According to Mubyarto [15] subsistence agriculture is a farming system in which the main goal of a farmer is to meet the needs of his life and his family.

According to De Bon et al. [16], urban agricultural actors are divided into four categories. First, home subsistence farmers, farmers who cultivate narrow land or yards for subsistence purposes only. Second, strategic predominant subsistence, namely actors who are on the outskirts of urban areas with a wider area of land so that several plants can be cultivated. The three commercial types who produce plants for sale so that they used as a source of family income. The four entrepreneurs are large-scale urban agriculture actors.

Each farmer has different goals in carrying out agricultural activities in urban areas so that the contribution of agricultural income to household income is also different. There are previous findings regarding the contribution value of the usage of home yard on the outskirts of urban areas to household income. Marhalim [17] found 4.47% contributed

Table 2. Contribution of urban farming to household income.

Location	Income of Urban Farming (Rp)	Income of Total Household (Rp)	Contribution (%)
Sub Distric Danurejan	102.210	47.240.727	0,22
Sub Distric Jetis	121.957	45.538.760	0,27
City of Yogyakarta	112.883	46.467.105	0,24

Source: Primary Data Analysis

to household income. This value is similar to Yulida [18] with 3.37%. Farmers are still subsistence. According to Setiawan [19] the contribution of the home yard to family income in Trisoyo Village is rather bigger than the previous ones, it 13.91%. In detail in Setiawan research setting, the contribution is divided into low (<30%) medium (30–45%), and high (>45%). A total of 88.2% farmers belongs to subsistent orientation, while 5.9% of medium-contributing and 5.9% of high-contributing farmers. These three studies are in contrast to Ammatillah's [7] finding on the role of urban agriculture in DKI Jakarta at 69%. The striking difference is farmers in DKI Jakarta produce large-scale production in urban farming activities or are categorized as commercial farmers or entrepreneurs because they cultivate for living. Ammatillah [7] states that 75% of farmers put farming as a main job and 25% depends more on non-farming income.

3.3 Factors that Affect Urban Agriculture Income the Determinant of Urban Farming Income

The urban farming income functions as an additional amount to higher household income. In addition to that, this activity that carried out in the city of Yogyakarta has another goal, as a hobby in maximizing leisure time, especially for housewives or retirees. According to Suratiyah [8] the internal factors that influence farm income are age, education, land area size, number of workers, and capital, while the external perspective are availability of inputs, input prices, output demand, and output prices. In this study, the explanatory were age, education, number of plants, price of pots, price of seeds, and number of commodities, while urban agricultural farming income considered as dependent variables.

The determinant were tested by using multiple linear regression analysis. In a sequence of robustness, BLUE (*Best Linear Unbiased Estimator*) condition must be obtained. The following assumptions test were conducted.

3.3.1 Normality

The normality test investigates whether the error value is normally distributed or not. The distribution can be determined by comparing the Jarque-Bera probability with alpha value indicating it is smaller or greater. Table 3 shows that Jarque-Bera probability value is 0.07. That value is greater than alpha (5%), which means fail to reject H_0. It means that it is normally distributed.

Table 3. Normality test.

Criteria	Result
Jarque-Bera	5,0847
Probability	0,0786

Table 4. VIF (Variance Inflation Factors) values.

Variable	Centered VIF
Age	1,2309
Education	1,0782
Number of plants	2,0615
Pot price	1,1458
Seeds price	2,9919
Number of commodity	3,4186

Source: Primary Data Analysis 2019

Table 5. Heteroscedasticity test.

F-statistics	1,1225	Prob. F	0,3831
Obs*R-squared	29,087	Prob. Chi-Square	0,3567
Scale Explain SS	24,571	Prob. Chi-Square	0,5985

Source: Primary Data Analysis 2019

3.3.2 Multicollinearity

Multicollinearity test was conducted to determine the existence of relationship among independent variables by using VIF method (*Variance Inflation Factors*). Its presence or absence is by checking on the VIF value. If the VIF value more than 10 then it indicates that there is multicollinearity disorder. Table 4 shows that VIF values of all variables is smaller than 10. This shows that there is no multicollinearity disorder among independent variables.

3.3.3 Heteroscedasticity

The homoscedastic is a condition of error term constant variance. This test clarifies this condition and White Cross Term test is used. To detect its occurrence, it is provided by Chi Square Obs*R-Squared probability value. Table 5 shows that it is 0.3567. The value is greater than alpha (5%), which means fail to reject H_0 and homoscedastic property exists.

3.3.4 Regression

Based on multiple regression result, we can get empirical model as follows.

$$\begin{aligned} Y = {} & 12.228 - 0.286\ \text{Age} - 0.118\ \text{Education} - 0.096\ \ \text{Number of Plants} \\ & + 0.455\ \text{Price of Pots} + 0.831\ \ \text{Price of Seed} - 1.090\ \ \text{Number of Commodities} \end{aligned}$$

Table 6. Regression results.

Variable	Sign	Coefficient	Standard Error	*t-Statistic*	*Probability*
Constant	+	−0,971	2,905	0,334	0,739
Age	−	1,101**	0,391	2,601	0,012
Education	+	1,065***	0,329	3,244	0,002
Number of Plant	+	0,621***	0,169	3,665	0,000
Price of Pot	−	−0,002	0,012	−0,172	0,863
Price of Seeds	−	0,696*	0,414	1,682	0,099
Number of Commodities	+	−0,642	0,505	−1,269	0,210
R-Squared	0,586		Mean Dependent Var		11,037
Adj. R-Squared	0,536		S.D. Dependen Var		1,228
S.E. Regression	0,836		Akaike Info Criterion		2,598
F-Statistic	11,42		Schwarz Criterion		2,854
Prob. (F-Stat)	0,000		Durbin-Watson Stat		2,697

Source: Primary Data Analysis 2019
* significant at the level of confidence 90% ($\alpha = 10\%$)
** significant at the level of confidence 95% ($\alpha = 5\%$)
*** significant at the level of confidence 99% ($\alpha = 1\%$)

Adjusted R^2 is 0.53 which means 53% of the variation of the dependent variable (urban farming income) can be explained by independent variables as well as simultaneously independent variables brings significant explanation to urban farming income. For each independent variables, individually give certain effect to urban farming income. An increase in the number of *Age* increases urban farming income as much as 1.10%. Further, urban farming income will be increasing 1.06%, 0.62%, 0.696% in responding an increase in Education, the Number of plants, and Price of Seeds respectively. Meanwhile, the Number of Pots and the Number of Commodities give negative and positive respectively but they do not give any significant effect to urban farming income (Table 6).

4 Conclusion

1) Urban agricultural income in Yogyakarta city show positive value of Rp. 112,883/year.
2) Total household income in Yogyakarta City, Rp. 46,579,988/year. The contribution of urban farming income to total household income is only 0.24%. This figure is low due to the number of plants cultivated by household was in small number. For instance, cayenne pepper (4 polybags/year), while large chilies (10 polybags/year), and mustard green (11 polybags/year).
3) The determinant of urban farming income are age, education, the number of plants, and the price of seeds. Age and the price of seeds give negative effect, education and the number of plants give positive effect to urban farming income.

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