Avalaible online at http://journals.ums.ac.id, Permalink/DOI: 10.23917/jep.v23i2.19081

Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan, 23 (2), 2022, 155-169

The Effect of Taste on Papuan Local Consumption

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Received: 11 July 2022 | Revised: 19 July 2022 | Accepted: 12 October 2022

Abstract

This study aims to determine the effect of tastes on local food consumption in an econometric analysis of the food demand structure in Papua Province. This study used the 2019 National Social and Economic Survey (SUSENAS) with 13.151 households conducted by Statistics Indonesia (BPS). The method used is Quadratic Almost Ideal Demand System (QUAIDS) with Iterated Linear Least Square (ILLS) estimator. The results show that education, household size, location, age, the job of the head of the household, and income group affect local food consumption. When urbanization, education, and income increase, they tend to reduce local food consumption and shift food choices from local food because it is difficult to obtain. The influence of taste from the socio-demographic side has different taste factors between urban and rural. Therefore, the government needs to increase understanding through education about food diversity and good nutrition because local food has a higher nutritional content than rice or other foods. In addition, it is necessary to increase the horizontal diversification of local food, provision a market for local-food distribution, and increase income because the economic condition in Papua is still low, so they are vulnerable to food security.

Keywords: Local Food; Papua; Taste; QUAIDS-ILLS.
JEL Classification: C51; D12

How to Cite: Pardede P. G. R., Ananta A. (2022). The Effect of Taste on Papuan Local Consumption, 23(2), 155-169. doi:https://doi.org/10.23917/jep.v23i2.19081

DOI: https://doi.org/10.23917/jep.v23i2.19081

1. Introduction

Food as source of carbohydrate in Indonesia are dominated by rice commodities even though Indonesia has many other local food sources such as sweet potatoes, cassava, taro, and sago. One of the provinces in Indonesia with a non-rice main food consumption is Papua Province, which sourced its carbohydrate from local food such as sweet potatoes, cassava, taro, and sago. However, consumption of local food has continued to decline from 2015 to 2019 by 16 percent for sweet potatoes and 19 percent for sago, where the average growth of sweet potato production per year is 19 percent which can fulfill food consumption demands in Papua Province (Statistics Indonesia, 2015). Meanwhile, the need for rice consumption in Papua Province exceeds rice production by 147 thousand tons (2018) and 73 thousand tons (2019).

In economic theory, preference factors affect the pattern of food consumption. This preference is related to the different tastes in household social-demographic conditions (Nicholson et al., 2008). According to several studies, the social demographic such as lifestyle, urbanization, job, education, number of household members, gender, and age (Goldscheider, 1987; Bopape et al., 2007; Pangaribowo et al., 2011; Widarjono, 2012; Mottaleb et al., 2018; Onyeneke et al., 2020) affect the pattern of food consumption, but the effect differs between regions and households. So far, research related to food patterns in Papua Province is still using qualitative methods, a small sample, and the development of local food

in terms of availability (Wasaraka, 2011; Akzar et al., 2020). However, it is essential to look at the taste factors that affect local food consumption in Papua Province, which has never been studied.

The socio-demographic characteristics are such as the number of members in a family that tends to increase food consumption (Widarjono, 2012; Wijayati et al., 2019). Then urban and rural areas from several studies stated that there are differences where local food is consumed more in rural areas compared to urban areas. Employment status also affects food consumption where household heads who work in the agricultural sector have higher food consumption because their sectors are close to agriculture than household heads who work in the non-agricultural sector (Pusposari et al., 2012). Education influences food consumption because higher education tends to understand nutrition and diverse food consumption. Thus, education has a negative impact on rice consumption and has a positive effect on local food tubers' consumption (Najmudinrohman, 2015; Rauf & Lestari, 2009; Sunaryati, 2016; Wijayati et al., 2019). Then the influence of the age of the household head whereas the head of the household gets older tends not to change their initial consumption pattern (Wijayati et al., 2019). In addition, male household heads tend to have a negative relationship with staple food consumption and are less diverse.

In addition, previous research on food patterns in Indonesia with socio-demographic factors in the demand system used the Almost Ideal Demand System (AIDS) model (Moeis, 2003; Teklu et al., 1987; Wijayati et al., 2019). The advantages of this model are an estimate with several related commodities, consistent with consumption expenditure data that estimates without quantity data and uses a semi-log econometric model. However, the weakness of this model is that it assumes a linear relationship between income and total expenditure. Therefore, it is valuable to use the QUAIDS model (Quadratic Almost Ideal Demand System) since researchers (Banks et al., 1997; Bopape et al., 2007; Poi, 2012; Widarjono, 2012; Mottaleb et al., 2018) has found there is a non-linear relationship between income and expenses. In addition, the Iterated Linear Least Square (ILLS) was utilized because the estimator's Ordinary Least Square (OLS) and Seemingly Unrelated Regressions (SUR) have not overcome the endogeneity problem between budget share and total expenditure (Lecocq et al., 2015). The previous studies used the QUAIDS-ILLS method in Indonesia only for specific commodities like cigarettes, meats, and not food commodities (Nugroho et al., 2015; Murjani, 2021).

Therefore, this study aims to see the effect of taste factors on local food consumption in Papua Province by using the estimation regression of the QUAIDS-ILLS model using the Stata 16.0 application. The novelty of this research is the use of input of social-demographic in-demand system equation in Papua and the use of QUAIDS model with an Iterated Linear Least Square (ILLS) estimator.

2. Research Method

The demand system model is an application model of a microeconomic theory that is significant for people's welfare analysis. The first model is a linear expenditure system based on the cost of the level index introduced by Stone (1954). The weakness is the assumption of additive preferences that did not cover the possibility of substitution and estimated the marginal budget share is constant where changes in income cause the estimated value of income elasticity to increase or did not accommodate inferior goods. Then the Rotterdam model was developed to examine the problem of homogeneity and symmetry in the demand system. The weakness is a marginal budget constant that causes opposite results. The AIDS model resolves the marginal budget share constant (Deaton et al., 1980). However, the AIDS model does not accommodate the non-linear relationship in the Engel curve between total expenditure and income. Then the demand system model was refined through the Quadratic Almost Ideal Demand System (QUAIDS) by (Banks et al.,

1997; Poi, 2012; Ansah et al., 2020; Vargas-Lopez et al., 2021). This model accommodated the non-linear relationship between total income and expenditure. In addition, the last model used the Ordinary Least Square (OLS) and Seemingly Unrelated Regressions (SUR) estimators that have not overcome the endogeneity problem between total expenditures and error terms. The QUAIDS model with the ILLS estimator proposed by (Lecocq & Robin, 2015) so that the estimation results are consistent.

This study uses the QUAIDS (Quadratic Almost Ideal Demand System) method with an Iterated Linear Least Square estimator to overcome the non-linear relationship between income and total expenditure on the Engels curve and overcome the problem of endogeneity. The data used is the 2019 National Socio-Economic Survey (SUSENAS) data in 28 regencies/cities in Papua Province in 13,151 households collected by the Central Statistics Agency. This survey is conducted twice a year, in March and August. This study uses data from March because it includes a larger sample of data.

In collecting SUSENAS data, there are two questionnaires. First, The KOR questionnaire to get household social demographic information such as age, relationship with the head of the household, gender, marital status, and education information. Second, Questionnaire VSEN KP or consumption expenditures to obtain information on the quantity, the value of consumption, and household food expenditure, both from purchases and gifts a week ago. The research used 12 food groups rice, local foods, fish, meat, eggs, milk, vegetables, nuts, fruits, spices-coconut oil, drinks, and other foods. The food groups in this study can be seen in Table 1 below:

The steps to estimate the demand for QUAIDS-ILLS are the first step to form the dependent variable (w_i), namely the comparison of expenditure from each food group in a month with total food expenditure. In this study, we must create the food groups based on several commodity codes according to table 1 because there are 12 food groups. After that, we calculate the expenditure value per food group from column 10 SUSENAS KP questionnaire. Then, we compute the total expenditure value for all food groups. The dependent variable (w_i) is formed by dividing the expenditure value of each food group by the total expenditure of the food group to find a share of consumption expenditure for each food group.

Table 1. Name of Food Group

Name of Food Group	Code of the commodities by National Social and Economic Survey in 2019
Rice	(Code 2-7)
Local Foods	(Code 9-15)
Fish	(Code 17-51)
Meat	(Code 53-61)
Eggs	(Code 63-66)
Milk	(Code 67 - 71)
Vegetables	(Code 73 - 97)
Nuts	(Code 99 - 105)
Fruits	(Code 107 - 119)
Spices-Coconut Oil	(Code 121 - 124 and Code 134 - 145)
Drinks	(Code 126 - 132)
Other Foods	(Code 147 - 150 and Code 152 - 188)

Source: Susenas, 2019

The second step is to create the price variable as the independent variable. The weakness in the SUSENAS data is not having price data. So, we use unit value by dividing the total expenditure by the number of commodities consumed. Using unit value instead of price has an endogeneity problem in the demand system equation because of the quality effect. Price heterogeneity can control with price differential as a corrected unit value modified by (Majumder et al., 2012). The corrected unit value (pi median) creates from the totaling of the median unit value (vi median) with the median of the residual estimator (ei median) [see equation 2]. The residual estimator from the regression between the difference in the median unit value of each district/city with socio-demographic factors (number of household members, education of the head household, location of residence, age of the head households, the gender of the head households, the job of the head household, and the income group).

With this model, households in the same district/city deal with the same commodity prices. The model must handle the problem of heteroscedasticity and multicollinearity. Testing for heteroscedasticity is conducted using a robust regression, while multicollinearity testing is done using VIF (Variance Inflation Factors). Mathematically, it can be written as follows:

$$V_i\text{-}V_{median}=\propto_i+\propto_1 \quad educ+\propto_2 \quad dloc+\propto_3 \quad dhsize_{i1}+\propto_4 \quad dhsize_{i2}+\propto_5 \quad dgen+\propto_6 \quad djob_{i2}+\propto_7 \quad djob_{i3}+\propto_8 \quad dage_{i2}+\propto_9 \quad dage_{i3}+\propto_{10} \quad income_{q2}+\propto_{11} income_{q3}+\propto_{12} income_{q4}+\propto_{13} income_{q5}+\varepsilon_i \quad (1)$$

The correction price is formed from the addition of the median value per unit of the commodity group and the residuals:

$$(p_i)median=(v_i)median+(e_i)median \quad (2)$$

The third step is to form an instrument variable using income as a proxy for total expenditure. The income logarithm will be random and correlated with total food expenditure (Lecocq et al., 2015). In the fourth step, control variables or taste variables (education, age of the head household, location, number of household members, gender of the head household, job of the head household, and household income group) are created. They have variations in household preferences because there are differences in household characteristics.

The specification of the model used in this study is w_i = f(the price of own goods, prices of other goods, household food consumption expenditure, number of family members, education of the head household, location of residence, age of the head household, gender of the head household, job of the head household, income group, and variable instrument).

Mathematically it can be written as follows:

$$w_i^h =\propto_i+\gamma_{ij}^{'}p^h+\beta_i\,[m^h-(a(p^h)]+\lambda_i\frac{[m^h-a(p^h)]^2}{b(p^h,\theta)}+\propto_1 educ+\propto_2 dloc+\propto_3 dhsize_{i1}+\propto_4 dhsize_{i2}+\propto_5 dgen+\propto_6 djob_{i2}\ \propto_7 djob_{i3}+\propto_8 dage_{i2}+\propto_9 dage_{i3}+\propto_{10} income_{q2}+\propto_{11} income_{q3}+\propto_{12} income_{q4}+\propto_{13} income_{q5}+iv+\varepsilon_i^h \quad (3)$$

Where:

h = households

i = food group (i=1,2,3,…,12)

w_i^h = share of food expenditure from food group i

$\propto_i$ = constant

$\gamma_{ij}^{'},\beta_i,\lambda_i,\alpha_1,\alpha_2,\alpha_3,\alpha_4,\alpha_5,\alpha_6,\alpha_7,\alpha_8,\alpha_9,\alpha_{10},\alpha_{11},\alpha_{12},\alpha_{13}$= Coefficient;

p^h = commodity price;

m^h = household food consumption expenditure;

iv = instrument variable;

dloc = dummy location of residence (1=urban dan 0=rural);

dhsize = dummy number of family members (1=small ;2=medium;3=large)

dgen = dummy of head household gender (1=male and 0=female);

educ = dummy of head household education (0:<Junior High School;1:>=Junior High School)

djob = dummy of head household job (1=no-work ;0=other sectors;3= agriculture sector)

dage = dummy of head household age (1:<25 years old ;2:25-49 years old ;3:≥50 years old

dincome = dummy group income of household (1=<20;Q2=20-40;Q3=40-60;Q4:60-80;Q5=80+); ε_i^h = error term

The fifth step is the QUAIDS-ILLS demand estimation model satisfied the assumption for homogeneity test assumptions (if prices and income change in the same portion, then the amount of demand for a commodity remains). Second, symmetry test assumptions (if real income is constant, the substitution effect due to changes in commodity *j* on price changes *i* are equal to the substitution effect due to changes in commodity *i* on price changes *j*). Then add up the assumption (the assumption that consumers will spend all existing budgets). The test equation in the demand system can define as below:

a. Adding-up

$$\sum_{i=1}^{n} \propto_i = 1 \; ; \sum_{i=1}^{n} \beta_i = 0 \; ; \sum_{i=1}^{n} \gamma_{ij} = 0 \quad (4)$$

b. Homogeneity

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \quad (5)$$

c. Symmetry

$$\gamma_{ij} = \gamma_{ji} \quad (6)$$

Table 2. Variables in Model Research

Variable	Code	Operational Definition	Category/Value
Budget share	w_x	Budget share from each group	Percent (%)
Price (Unit value)	*p*	Price Correction (Ratio of food expenditure to quantity of food consumption)	Rupiah
Number of household member	*hsize*	Dummy number of household member	Person (1=small [1-2 person]; 2=medium [3-4 person]; 3=large [>=5 person])
Education of head household	*educ*	Dummy of education base of last diploma	1: >=Junior high school 0: <Junior high school
Location of residence	*dloc*	Dummy location of head household	Rural=0 Urban=1
Age	*dumur*	Dummy of head household age	(1: <25 years old; 2: 25-49 years old; 3: >=50 years old)
Gender	*dgen*	Dummy of head household gender	Male=1 Female=0
Type of head household job	*djob*	Dummy of head household job	3= agriculture sector 2= other sectors 1= no-work
Group income	*dincome*	Group income of household	Group income of household Q1 = <20; Q2=20-40; Q3=40-60; Q4=60-80; Q5=80+
Instrument Variable	*iv*	Total income as instrument variable to overcome endogeneity problem	Generate lnpndptn = ln (100+(runiform () *1000) +10*expend) (Lecocq et al., 2015)

3. Result and Discussion

3.1 Result

3.1.1 Descriptive Statistics

Public expenditure in Papua Province is separated into two categories food and non-food needs. Figure 1 shows that the food consumption group is more dominant in Papua Province, namely 67.54 percent, and non-food at 32.45 percent. Then the food groups were divided into 12 food groups that became the focus of the research, and the share of the carbohydrate food group was more dominant than the share of other food groups, which was around 12.38 percent. Carbohydrate food needs are still a necessity in food consumption in Papua Province.

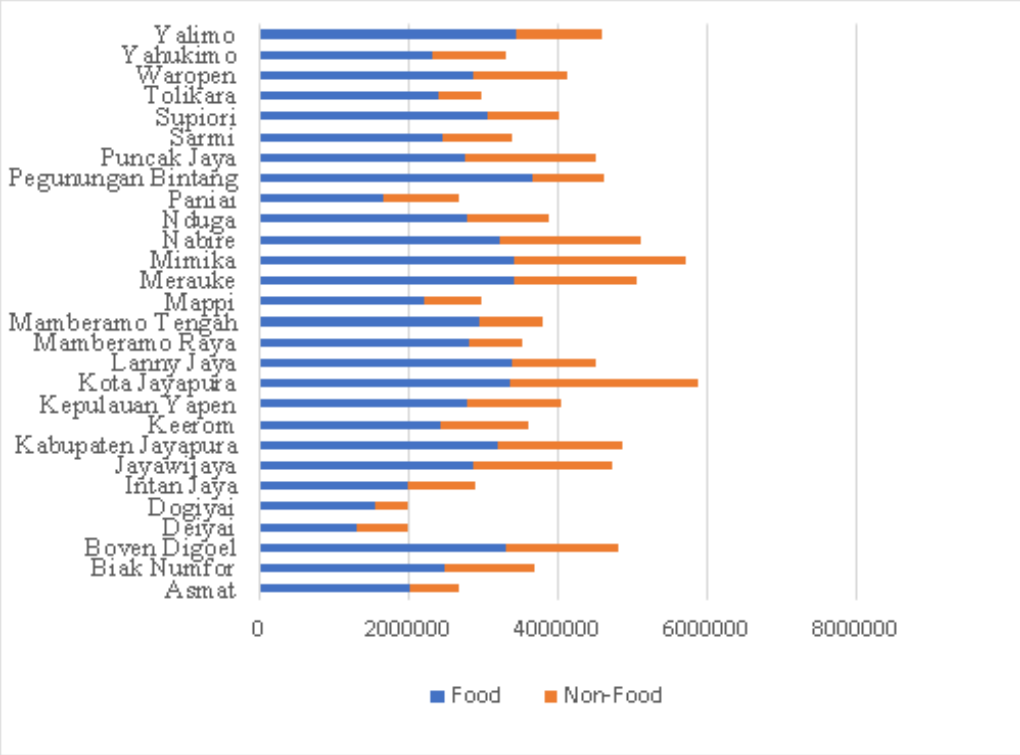

Figure 1. Monthly expenditure for food and non-food consumption by district/city in Papua Province in 2019

Socio-economic and demographic characteristic

In Table 3, male heads of households in Papua Province are dominantly dominated (89.35 percent) compared to female household heads. The predominant household head education is less than nine years (<SMP). The location of the head household lives is dominant in rural areas. The dominant age of the head of the household is 25-49 years. The number of household members in Papua Province is of medium size, consisting of 3-4 people. The dominance of domestic work in Papua Province in the agricultural sector. If we see by location of residence (Table 4), people with higher education are more dominant in living in urban areas than in villages. In addition, based on the income group (Table 5), the high-income group is more in urban areas, and low-income groups are more dominant in rural areas.

Table 3. Dummy Variable Statistics Summary

Variable	Category	Frequent	Percent
Gender of Head Household	Female	1400	10.65
	Male	11751	89.35
Education of Head Household	<Junior High School	7298	55.49
	>=Junior High School	5853	44.51
Location of Head Household Residence	Rural	10714	81.47
	Urban	2437	18.53
Age of Head Household	<25	532	4.05
	25-49	9104	69.23
	>=50	3515	26.73
Job of Head Household	No-work	570	4.33
	Non-agriculture sector	6173	46.94
	Agriculture sector	6408	48.73
Number of Household Members	Small	3152	23.97
	Medium	5627	42.79
	Large	4372	33.24

Source: Author's Calculation

Table 4. Education of Head Household by Location of Residence

Location of Residence	Education of Head Household					
	<Junior High School		>= Junior High School		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Rural	6782	63.3	3932	36.7	10714	100
Urban	516	21.17	1921	78.83	2437	100

Source: Author's Calculation

Table 5. Income Group of Household by Location of Residence

Location of Residence	Income Group				
	Quantile 1	Quantile 2	Quantile 3	Quantile 4	Quantile 5
Rural	24.85	21.91	18.96	17.39	16.9
Urban	1.23	10.05	24.83	30.08	33.81

Source: Author's Calculation

Table 6 shows the average food expenditure in Papua Province is Rp 2.5 million per month. The average household member in one household is about four people, so food consumption expenditure per capita in Papua Province is Rp 648.682. Meanwhile, there is a variation in food consumption expenditure in Papua Province, from Rp. 162.857 to Rp. 2.740.000 for a month. Table 4 also shows the corrected variation in food prices calculated where the highest prices are meat (Rp

284.442), milk (Rp 162.160), and fish (Rp 158.665). For carbohydrate consumption, the price of rice is Rp. 61.272, which is higher per month compared to local food, which is Rp. 37.060. The drinks group price is the cheapest, which is Rp.10.230. When viewed from the income group, the lowest income group is in the Province at Rp.455.469, and the highest is in the range of Rp. 5.326.155.

Table 6. Summary Statistics of Food Price and Consumption Variable in Papua Province

Variable	Obs	Mean	Std. Dev	Min	Max
Total Consumption (Rp/Month)	13151	2594730	1957870	162857.1	2740000
Rice Group Price (Rp/Month)	13151	61272.06	31648.41	34699.87	144807.5
Local Group Price (Rp/Month)	13151	37006.72	11636.64	16706.64	667200.96
Fishs Group Price (Rp/Month)	13151	158664.7	87830.38	49910.89	441171.8
Meat Group Price (Rp/Month)	13151	284442.5	110385.1	155366.4	522904.1
Milk Group Price (Rp/Month)	13151	162159.7	94450.25	50761.35	536651
Vegetables Group Price (Rp/ Month)	13151	67859.8	21307.69	29921.36	123566
Nuts Group Price (Rp/Month)	13151	81282.11	42160.73	36621.68	211824.6
Fruits Group Price (Rp/Month)	13151	66494.87	24273.7	37115.63	127549.4
Spice Coconut-Oil Group Price (Rp/ Month)	13151	52396.17	21107.32	28489.47	104864.5
Drinks Group Price (Rp/Month)	13151	10230.43	5360.808	3876.149	22650.83
Other Foods Group Price (Rp/ Month)	13151	12744.5	4340.974	6436.108	21599.09
Number of Household Members	13151	4	1.983756	1	27
quantile 1	13151	455469	0	455469	455469
quantile 2	13151	771732	0	771732	771732
quantile 3	13151	1228892	0	1228892	1228892
quantile 4	13151	1910194	0	1910194	1910194
quantile 5	13151	5326155	0	5326155	5326155

Source: Author's Calculation

3.1.2 Estimation Statistics

The Quadratic model with ILLS estimators is the best because the coefficient value of lamdha_lnx2 is significant in all shares of food consumption (Widarjono, 2012). The model has overcome the endogeneity problem because it uses instrumental variables. The model satisfied the assumption for adding up, homogeneity, and symmetry in the demand system equation. So, the demand system is consistent. Based on the parameter estimation of the demand system from equation (3), we can see the taste factors in food consumption in Papua Province.

Socio-demographic factors influencing food demand in Papua Province

Table A1 is a summary of the estimated coefficients of the QUAIDS-ILLS model. The results of the QUAIDS-ILLS estimation in equation 3 can answer the first research objective about the socio-demographic factors that affect food consumption patterns in Papua Province, especially carbohydrate food consumption. The effect of taste factors variables on food consumption in Papua Province based on the results of the QUAIDS-ILLS model can see below:

The education variable use dummy 0 for education below junior high school and 1 for junior high school and above. The estimation results show that the education of the head of household affects the proportion of consumption of rice and local foods. Education has a positive effect on rice consumption but has a negative correlation with local food consumption. Demand for rice consumption will decrease when education increase, but the local foods decrease when education increase. There is an urbanization effect on food consumption patterns in Papua Province. This result supports the research of (Pusposari et al., 2012) that higher education will affect the quality of food. The quality is from local food to national food. Education head household affects the quality of the carbohydrate food menu. The findings from (Najmudinrohman, 2015; Wijayati et al., 2019) have different results that are a negative correlation between education and rice consumption. Their opinion says if education increases, food patterns will be more diverse because of a good understanding of nutrition in terms of carbohydrates and other proteins food. In addition, (Wijayati et al., 2019) research shows education has a positive effect on local food tubers because the nutritional content of tubers is higher than rice. In addition, the educational level of the head of household affects the composition of other foods such as meat, eggs, milk, nuts, oil, and coconut. The higher the education, the more people want to consume more eggs and milk than meat. Positive and negative influences affect the information obtained. The higher the level of education, the better in accessing information related to nutrition compared to low-educated household heads who also play a role in decision-making in controlling consumption. The negative effect is possible because of the information on cholesterol contained in meat, and the positive is because of the information about animal protein that is important for the body (Nugroho et al., 2015). Education does not affect the consumption of fish, vegetables, fruits, beverages, and ready-to-eat foods.

The location in Papua Province does not affect the proportion of rice consumption. The rural area mostly consumes local food more than urban areas. The results show that urbanization will affect the consumption of local food but not rice consumption. Sago used to be a dominant carbohydrate source in urban areas such as in Jayapura city area, but the study shows the change towards rice and other food now. Urban communities depend on rice as the main food because it is easier to obtain (Rauf et al., 2009).

The other reason is reduced land to grow local food because lifestyles has change the land use, what previously mainly for agriculture has shifted to build housing and infrastructure (Gerbens-Leenes et al., 2005). In addition, the propensity to consume rice is due to the influence of interactions from outside region that mainly consume rice as staple food (Amanto et al., 2019). Rural people in Papua Province are dominant in consuming local food due to the possibility of access to where they live or close to agricultural areas (Sayaka et al., 2005). The remote areas have limited transportation to obtain rice, so they focus on local food for their household sources of easy-to-obtain carbohydrates (Rauf et al., 2009).

Urbanization affects the consumption of food groups of eggs, meats, vegetables, nuts, oil, and coconut, as well as processed foods which are more dominantly consumed in urban areas than in rural areas. There is no effect on location with the fish, milk, fruit, and beverage food groups.

The variable number of household members is a dummy where code 1 is for small household size (1-2 people), code 2 is for medium size (3-4 people), and code 3 is for large size (above five people) as a reference. The proportion of rice and local food consumption increase when the number of household members increases. This result is in line with research of Pangaribowo et al., (2011); Wijayati et al., (2019) that the more household member, the more carbohydrate they consume.

It is different for other foods such as fish, meat, eggs, milk, nuts, fruits, oil and coconut, beverages, and other foods where the more members of the household, the less the consumption. When the number of household member increase, it is possible for people to reduce the amount of consumption of meat, eggs, milk, nuts, fruits, oil, and coconut is less consumed because it is expensive (Pangaribowo et al., 2011). For drinks

and other foods are consumed less because the people prefer to cook for themselves.

The gender of the head of the household affects rice consumption but does not affect local food consumption. Male household heads have a smaller proportion of rice consumption than female household heads. Moreover, consumption of fish, eggs, milk, nuts, fruits, oil, and coconut from households headed by women is more than in households headed by men. But consumption of other foods is dominantly consumed by male household heads because they prefer simple and ready-to-eat foods. Meanwhile, consumption of meat and vegetable with the gender of the head of household has not significant. Based on these results, almost all food groups have negative values, indicating that women have a role in food consumption in Papua.

The job variable of the head of the household consists of three dummies where code 1 is not working as a reference, code 2 for who has a job in other sectors, and code 3 is for who works in the agriculture sector. The proportion of rice consumption is more consumed by the head of household who is not working and in other sectors. The household heads who work in the agriculture's sector consume more local food because they are closer to agricultural areas, so it is easy to obtain any local food. Household heads who are not working consume more rice because of the assistance for poor rice, and they do not have any other choices than others. Even though the "Raskin" (rice for the poor) program takes time to get to some areas in Papua, it takes time and distance to obtain the desired food.

In addition, for household heads who work in the agricultural sector, the proportion of food consumption is more on eggs, milk, and nuts and less on fish and other foods. But there is no effect on meat, vegetables, fruits, drinks, oil, and coconut. In other sectors, the consumption of oil, coconut, and other foods is more, while less consumption of meat, nuts, drinks, vegetables, and fruit has no effect. So, household heads who work in the non-agricultural sector tend to consume processed food or other food.

The age variable use dummy where dummy 1 is less than 25 years old as a reference, dummy 2 is for the age category of 25 to 49 years, and dummy 3 is for the age category of more than 50 years. The age of the head of the household does not affect rice consumption. The proportion of local food consumption is more consumed by age groups 2 and 3. However, local food consumption is consumed more in the 25-49 years age group than age over 50 years. These show that the age of the head of household tends not to change their food patterns, and this result same with the research of (Pusposari et al., 2012). The older head of household also consumed more vegetable group and more fish group than meat, eggs, milk, drinks, and other foods than the younger age of head of household. These show that the older household heads tend to maintain their diet and health and eat healthier foods. The nuts, fruits, oil, and coconut group did not have a sign with the age of the head of household.

For carbohydrate food consumption, the proportion of rice food consumption is lower in the second percentile than in the 1st percentile. For the third percentile, the share of rice consumption continues to decline, the 2nd percentile is higher than the 3rd percentile, and for the 4th and 5th percentiles, the values tend to be equal but smaller than the 2nd percentile. These show that income increases followed by a decrease in the share of rice consumption in the third percentile and increases again in the 4th percentile then stabilizes at the 5th percentile.

In local food, if the income increase, the local food consumption mind to increase, but in the 4th to 5th percentile, the consumption of local food decreases. These show that when people's incomes are still low, the proportion of local food is small. But, when their incomes increase, they can buy rice and reduce their consumption of local food. These indicate that local food is an inferior good, but when the household income increase, they prefer rice to local food.

According to Engel's law a high level of welfare shows the proportion of food consumption will be lower than non-food consumption. The welfare condition of Papua Province is poor because the share of total expenditure is more dominated by food consumption. Then, including taste variables in-demand system equation is

crucial because the influence of tastes varies in each household and between food groups. The role of education significantly affects local food patterns in Papua Province. If education increases, it shows the local food consumption decreasing and changes the food patterns to rice. The effect of education in Papua Province affects the quality of food but also pays attention to the diversity of food and knows the better nutrition of carbohydrate foods in Papua Province (Najmudinrohman, 2015; Wijayati et al., 2019). In addition, urbanization plays a crucial role in influencing local food consumption. The effect of urbanization shifts local food consumption to rice due to the interaction effect from outside that has food patterns rice. Furthermore, rice is easy to obtain for urban areas, and agricultural land for growing local food is decreasing due to land transfer to housing (Amanto et al., 2019; Gerbens-Leenes et al., 2005; Rauf et al., 2009)it calculates the amount of land needed to produce singular foods, and second, it assesses land requirements of food consumption patterns. The paper observes large differences among requirements for specific foods. Especially livestock products, fats, and coffee have large land requirements. The consumption of specific foods can change rapidly over time, causing shifts in land requirements. A rise or fall of requirements, however, depends on the initial consumption pattern. Patterns based on animal foods shifting towards market foods containing more staples require less land. This dietary change direction was shown for Dene/Métis communities in Canada. Patterns based on staples shifting toward diets containing more livestock foods and beverages require more land. This change direction was observed in the Netherlands. Per capita land requirements differ among countries. In Europe, Portugal showed the smallest requirement (1814 m 2. Then, if the number of household members increases, its significant increasing local food consumption in Papua Province. So, the population affects local food consumption in Papua. In addition, the role of income is necessary. Consumption of local food reduces when the income group of the community increases. These indicate that local food is inferior. When the household income increase, they reduce local food consumption and prefer rice.

4. Conclusions

The role of education, number of household members, location of residence, age, and the job of the head of household affect local food consumption. The result shows that local food is consumed more by people with low education who live in rural areas and work in the agricultural sector. In addition, the role of income is also necessary. Consumption of local food reduces when the income group of the community increases. These indicate that local food is inferior goods. When the household income increase, they reduce local food consumption and prefer to consume rice. Therefore, when urbanization, education, and income level increase, they tend to shift food choices from local food because it is difficult to obtain. Meanwhile, based on the taste factor for rice and other carbohydrate sources in Papua Province tend to be consumed by highly educated people who live in urban areas and work in the non-agricultural sector. It shows that the socio-demographic condition has different taste between households and regions.

Local food has a higher nutritional value compared to rice or other foods. The government needs to increase understanding through education about food diversity and good nutrition. In addition, it is necessary to increase the horizontal diversification of local food so that sago, once a popular source of food in urban areas of Papua province, can be planted and easily accessible to the people. Another important thing is the need for government to increase the average income of Papuan, because the low level of economic condition makes them vulnerable to food insecurity.

The limitations of this study are that it has not study how food consumption patterns change when prices and incomes change. The exclusion of migration in the variable analyzed. For these limitations, suggestions in further research are the need to look at the effect of changes in prices and income elasticity, to include the migration factor where the influence of migration can be

significant because urbanization change the social and economic structure of consumption patterns. Future research is suggested to narrow the scope of research subject from the level of family to individual in the family, since everyone in the household has preferences in food consumption.

5. Acknowledgement

The authors thank the participants of the Postgraduate Program in Economics, Faculty of Economics and Business Universitas Indonesia's internal reviewer for their valuable inputs and the Central Bureau of Statistics, where the author obtained the data.

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7. APPENDIX

Appendix 1

Table A1. Parameter Estimation Results of the QUAIDS-ILLS Model for Food Demand System in Papua Province in 2019

Dependent Variable	Independent Variable			
	w_rice	w_local food	w_fishs	w_meats
beta_lnx	.1185436***	-.246154***	.1034435***	.1498262***
lambda_lnx2	-.0216624***	.0309442***	-.0136651***	-.0219231***
rho_vtotal_kons	-.0488576***	.0161435**	-.041547***	-.0130826**
alpha_edu	.007447***	-.0119688***	.0016324	-.0043322*
alpha_dloc	.003138*	-.0481373***	-.0036626	-.0104179***
alpha_dhsize_i1	-.0085278**	-.0728094***	.0080472*	.0106201*
alpha_dhsize_i2	-.0020418	-.0342539***	.0025904	.0065634**
alpha_dgen	-.0057968**	-.0026645	-.0142254***	-.0046635
alpha_djob_i2	-.0054877*	.0006443	-.0037157	-.0162438***
alpha_djob_i3	-.0136799***	.0768004***	-.0454035***	.0065374
alpha_dage_i2	.0001824	.0224188***	-.004696	.0017615
alpha_dage_i3	.0025356	.0198493**	.0110671*	-.0142825**
alpha_income_q2	-.0380549***	.0176101***	-.0021394	-.0208293***
alpha_income_q3	-.0438616***	.0644058***	-.0143285***	-.0236205***
alpha_income_q4	-.0369469***	.0611385***	-.0180398***	-.0188597***
alpha_income_q5	-.037115***	.030419***	-.0289553***	-.0096317
alpha_cons	-.0671468***	.5418321***	-.0240165	-.1204828***
F-statistik	167.40***	801.99***	273.85***	68.90***
R2	0.2562	0.6226	0.3604	0.1242

Dependent Variable	Independent Variable			
	w_eggs	w_vegetables	w_milks	w_nuts
beta_lnx	.0446466***	-.147645***	.0318771***	.0346519***
lambda_lnx2	-.0071381***	.0175427***	-.0038135***	-.0053333***
rho_vtotal_kons	-.0200222***	-.0506382***	-.0234684***	-.0141118***
alpha_edu	.001752**	.0009748	.0047301***	.0022786***
alpha_dloc	.0058852***	.0050308**	.0003568	.0054364***
alpha_dhsize_i1	.0058627***	-.0022799	.000165	.0052448***
alpha_dhsize_i2	.0039619***	-.0041605*	.0028955**	.0026923***
alpha_dgen	-.0038974***	.0000496	-.0032118**	-.0027161***
alpha_djob_i2	.0005803	-7.08e-06	-.0006345	-.0035095**
alpha_djob_i3	.0031648*	.0031947	.0041319*	.0033369**
alpha_dage_i2	-.0014178	.0071459*	-.006176***	.0019395*
alpha_dage_i3	-.0030473*	.0141603***	-.0120492***	.0005693
alpha_income_q2	-.0029553***	.0341562***	-.0034199**	.0002006

Dependent Variable	Independent Variable			
	w_eggs	w_vegetables	w_milks	w_nuts
alpha_income_q3	-.0045494***	.0319685***	-.0067989***	-.0010563
alpha_income_q4	-.0028192*	.0344973***	-.0038111*	-.0015111
alpha_income_q5	-.0022355	.0395135***	-.0047276*	-.0008682
alpha_cons	-.0298058***	.34077***	-.0023178	-.0339947***
F-statistik	127.56***	254.31***	50.36***	88.02***
R2	0.2079	0.3435	0.0939	0.1533

Dependent Variable	Independent Variable			
	w_fruits	w_oil and coconut	w_drinks	w_other foods
beta_lnx	-.0026983	-.0305292***	.0185181***	-.074480***
lambda_lnx2	.0011728*	.0031411***	-.0038567***	.024591***
rho_vtotal_kons	-.0158695***	-.0369664***	-.0127502***	.261170***
alpha_edu	.0011089	.001394*	-.0009351	-.0040816
alpha_dloc	-.0000957	.0074083***	.0014054	.0336526***
alpha_dhsize_i1	.0045787*	.0053165***	.0039774**	.0398048***
alpha_dhsize_i2	.0023615*	.0037499***	.0024751**	.0131663**
alpha_dgen	-.006438***	-.0036023***	.0022375*	.0449288***
alpha_djob_i2	-.0026043	.0022903*	-.0025219*	.0312095***
alpha_djob_i3	-.0011386	.0017881	.0022186	-.040951***
alpha_dage_i2	-.0011581	.0004569	-.0053812***	-.0150757*
alpha_dage_i3	.0009285	.0006463	-.007672***	-.0127053*
alpha_income_q2	.0024855*	.0087141***	-.0030624**	.0072947
alpha_income_q3	-.0007954	.0058741***	-.0021521*	-.0050859
alpha_income_q4	-.0024091	.0015358	-.0012534	-.0115213
alpha_income_q5	.0014069	.0032856*	.0011511	.0077571
alpha_cons	.1190767***	.1033069***	-.0731922***	.2459709***
F-statistik	88.05***	188.45***	81.42***	452.10***
R2	0.1534	0.2794	0.1435	0.4819

Note: * p<0.05 dan p<0.1; ** p<0.01; *** p<0.001

Source: QUAIDS-ILLS Estimation