GLOBAL JOURNAL OF COMMERCE & MANAGEMENT PERSPECTIVE
(Published By: Global Institute for Research & Education)
www.gifre.org

THE EFFECT OF CASSAVA AND CORN PRODUCTIONS AS SUBSTITUTE PRODUCTS ON THE VOLUME OF IMPORTED RICE FROM 1982–2011 IN INDONESIA

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Abstract

This study analyzes the effect of cassava and corn productions as substitute products on the volume of imported rice from 1982 –2011 in Indonesia. The researcher assumed that the growth of the production volume of cassava and corn as substitute products of rice in Indonesia had an effect on the amount of imported rice. The authors used this as the problem identification. Secondary data is used in doing this research such as: literature, searching on the web Journals, print journals, and e-books. Single and Multiple regressions are used as the statistic tools. Based on the findings, the independent variables do not have a simultaneous influence on the dependent variable. The result of T-test shows that cassava and corn production factors do not have a partial influence on the volume of imported rice.

Key Words: Substitute products, import, rice, corn and Indonesia.

1. Introduction

Indonesia, as one of the largest consumers of rice, corn and cassava, imports rice from other countries to meet its people's demand, despite its vast area of productive agricultural land. This importation surprises everyone because, as a country which has enough land to produce what its population needs in terms of agriculture, Indonesia is supposed to become an exporter of rice, not an importer. Government set a policy in 2011 to import rice, but they promised that amount of imported volume would not be as much as it was earlier for the country would already have enough stock by then.

The purpose of the import was to maintain price and stock availability in case there was an increase on the demand of rice until the next year.Apart from that,Indonesia is one of the world's largest cassava producers. However, it also imports the same commodity throughout the world. Based on the data from FAO Food Outlook November 2012, Indonesia was the largest importer of cassava in 2012.

Besides wheat and sago, corn and cassava actually have a huge potential to replace the need for rice because both are sources of carbohydrates, and can be used as raw materials for a variety of refined products. In some parts of Indonesia, such as in Madura and Nusa Tenggara, corn and cassava have been used as staple food. Now, the United States has also made corn as an alternative food source. Corn and cassava are expected to be one of the appropriate solutions to reduce rice consumption which has been increasing. It is thought that if the rice eating habits can be diverted, it will have a major impact on national food security.

Descriptive analysis using quantitative approach is used as the methodology in this research. To achieve the objective, the researcher used multiple regressions to find the impact of the independent variables on the dependent variable. X variable is corporate branding and Y factor is consumer's product evaluation.

1.1 Statement of Problem

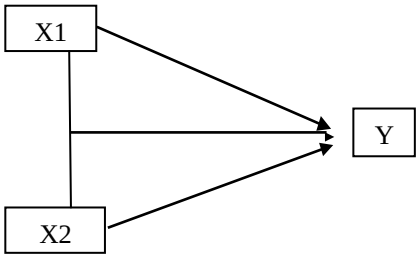
In this study, there are some questions that will be answered: Is there any a significant effect between cassava production and imported rice volume? Is there any effect between corn production and imported rice volume? Do cassava and corn production have an effect on imported rice volume? If yes, how strong is the effect?

1.2 Significance of Study

The author hopes the study will provide a positive impact by giving a better idea to help government to face the problem in food security.

1.3 Theoretical Framework

The illustration of the impact of corporate branding (X variable) to consumer's product evaluation (Y variable) is shown below:



Source: Self Constructed

2. Literature Review

2.1 International Trade

International trade is the exchange of goods and service across international boundaries or territories. (http://en.mimi.hu) Some theories related to international trade are mentioned below:

- **Hady** (**2003**) said that efficiency usage of inputs, such as labor, will largely determine a country's advantage in trade.
- **Salvatore** (**1997**) said that the difference in the relative prices of various commodities between the two countries is a reflection of the comparative advantage that becomes the basic for the relationship to be mutually beneficial trade.
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2.2 Food Security Concepts

Indonesian government and USAID (1992) provide different definitions. The fundamental difference of the two definition of the food security is the Undang- Undang No.7/1996 which emphasizes the availability of household and quality food, while the definition from the USAID emphasizes on consumption, individuals and quality of life.

2.3 Bulog

Bulog is state-owned public enterprises engaged in food logistics. The new agency is designed as a single buyer for the rice product (Kepres No.272/1967). As a company that has a public service of the government, Bulog purchases paddy to maintain market price, smooth distribution, and food stock.

3. Methods

Steps in this research are shown below:

3.1 Normality Assumption

A regression model will be considered well distributed if the distribution is normal or approaching normal (Santoso, 2010). The normality assumption could be analyzed by using the Normal P-P Plot of Regression Standardized Residual graphic.

3.2 Multicollinearity Assumption

This assumption is used to find out any correlation between the independent variables in this regression. If there is any correlation, then multicolinearity exists (Santoso, 2010). The hypothesis for multicollinearity assumption is as below;

Ho =Tolerance $\geq$ 0.10 and VIF $\leq$ 10, the regression does not have a multicollinearity problem.

H1 = Tolerance $\leq$ 0.10 and VIF $\geq$ 10, the regression have a multicollinearity problem.

3.3 Heteroscedasticity

A good regression model is when no heteroskedasticity exists (Santoso, 2010).According to Santoso (2010),the indicators of heterokedasticity assumption could be based on:

1. If there is any clear pattern consisting of points which create a specific well-ordered pattern, then heteroskedasticity exists.
2. If there is no well-ordered pattern, the points are spread between 0 in Y axis, then there is no heteroskedasticity exist.

3.4 Auto-correlation Assumption

A model regression is called a good model regression when there is no auto- correlation (Santoso, 2010). According to Santoso (2010), the indicators of auto-correlation assumption are listed as follows:

1.If the value from Durbin-Watson is below-2, there will be a positive auto- correlation.

2.If the value from Durbin-Watson is between -2 and +2, there will be no auto- correlation.

3.If the value from Durbin-Watson is above +2, there will be a negative auto- correlation.

3.5 Hypothesis Testing

Regression in general is a statistical tool that provides an explanation of the pattern of effects (model) between two or more variables.

3.5.1 Single Regression Analysis

Equations below are employed in single regression analysis

$$a = \frac{(\Sigma Y)(\Sigma X2) - (\Sigma X)(\Sigma XY)}{n\,\Sigma X2 - (\Sigma x)2\Sigma Y)}$$

$$b = \frac{n\,\Sigma XY - (\Sigma X)(\Sigma Y)}{n\,\Sigma X - (\Sigma X)2}$$

Where;
a = slope
b = Y-intercept,
n = total population/sample
X = independent variable
Y= dependent variable

3.5.2 Pearson Correlation Coefficient

Correlation is the degree of linear relationship between two or more variables from the data observation. The relationship between one variable and the other variables is expressed by the correlation coefficient that is symbolized by the "r". The magnitude of the correlation ranges from $-1 \leq r \leq 1$. This equation is shown below:

$$r = \frac{n\,(\Sigma XY) - (\Sigma X)(\Sigma Y)}{\sqrt{(n\Sigma X2 - (\Sigma X)2)\,(n\Sigma Y2 - (\Sigma Y)2)}}$$

3.5.3 Multiple Regression Analysis

Regression models are used to test whether a correlation between variables exists or not. The equation is shown below:

$$y = \beta + \beta 1\, x1 + \beta 2\, x2 + \cdots + \beta i x i + \epsilon$$

Where:
Y = Dependent Variable
β = Intercept (value of y when x=0)
$\beta 1$ = The slope (Beta coefficient) for X1
$x1$ = First independent variable that explains the variance in Y
$\beta 2$ = The slope (Beta coefficient) for X2
$x2$ = Second independent variable that explains the variance in Y
E = Random error

3.5.4 Multiple Coefficient of Determination (R2)

Coefficient determination is a summary measure that tells how well the sample regression line fits the data. It measures the volume the Y variable in percentages explained by the regressor jointly. It is nonnegative quantity and lines between 0 and 1.

3.5.5 Coefficient of Correlation (R)

The value of R shows whether the correlation between dependent variable and independent variables is strong or weak. The coefficient of correlation can be computed directly from the coefficient of determination as followed:

$$R = \pm\sqrt{R^2}$$

Table 3.1

Range	Description
0.00 - 0.199	Very Weak
0.20 - 0.399	Weak
0.40 - 0.599	Moderate
0.60 - 0.799	Strong
0.80 - 1.000	Very Strong

Source: Source: adapted from Sugiono, 2007

3.5.6 Hypothesis Testing

- **Simultaneous Coefficient Correlation Analysis (F-test)**

This analysis is used to find out the simultaneous influence between the independent variables and the dependent variable. The significance level (α) used is 0.05. If the value of significance level in ANOVA table is below 0.05,it means the independent variable is highly significant and it gives the simultaneous influence to the dependent variable. The hypothesis for F-test is:

H_0: Independent variables simultaneously influence the dependent variable.

H_1: Independent variables simultaneously do not influence the dependent variable.

H_0 is rejected if the α value is more than 0.05 and H_0 is accepted if the α value is less than 0.05.

- **Partial Coefficient Correlation Analysis (T-test)**

This analysis is used to find out the partial influence from the independent variables to the dependent variable. The significance number (α) used for t-test is 0.05. If the value of significance level in Coefficient table is below 0.05, it means the independent variable has a significant influence on the dependent variable.

The hypothesis for T-test is:

H_0: Independent variables have a significant influence on the dependent variable.

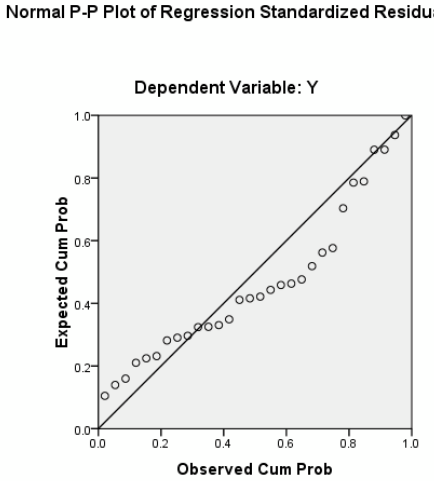
H_1: Independent variables don't have a significant influence on the dependent variable.

H_0 is rejected if the α value is more than 0.05and H_0 is accepted if the α value is less than 0.05.

4. Interpretation of Results

4.1 Normality Assumption

The spread of the data is around the diagonal line and keeping up with the diagonal line. Hence, the regression met the normality assumption.



Source: Data result of normality testing

4.2 Multicollinearity Assumption

Based on the data below, it shows the result of multicollinearity testing. The values of VIF for all of the independent variables are less than 10 and tolerance more than 0.1. It means the regression model does not have a multicollinearity problem. So, the H_0 is accepted. It also means that although there is an increasing or decreasing in the volume Corn& Cassava Production, it doesn't give an influence toward the volume of imported rice. For example if for each corn and cassava production for 2013 is 2000 kg, the imported rice volume in 2013 is 3000kg. After a year, in 2014, there is an increase in corn and cassava production becoming 3500 kg, but it will not give an impact on the volume of imported rice. The volume of imported rice can decrease or increase based on other factors that are not mentioned in this research.

Tabel 4.1 Results of Multicolinearity Test

Coefficient[a]

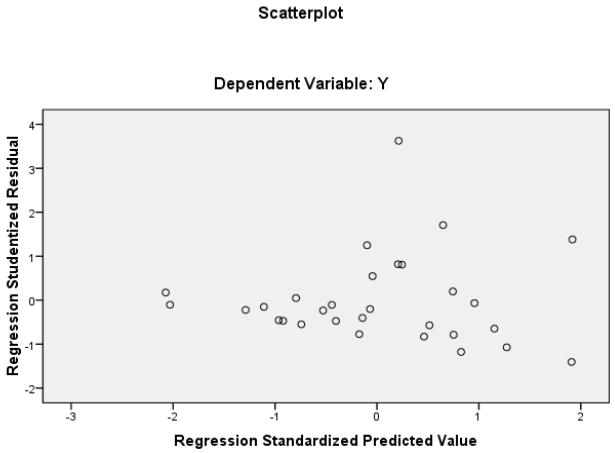
Model		CollinearityStatistics	
		Tolerance	VIF
1	(Constant)		
	X1	.145	880
	X2	.145	880

a. Dependent Variable Y

Source: Data result of multicollinearity testing

4.3 Heteroscedasticity Assumption

The figured 4.2 below shows that the spread of the data does not create any clear or specific pattern. Also, the points are spread between 0 in Y axis, so heteroskedasticity does not exist or in other words, the data is homoskedasticity.



Source: Data result of heteroskedasticity testing

4.4 Auto-Correlation Assumption

Table4.2 Result of Auto-correlation Test

Model Summary[b]

Model	R	RSquare	Adjusted R Square	Std. Errorofthe Estimate	Durbin-Watson
1	.341[a]	.116	.051	1.06609	1.298

Source: Data result of auto-correlation testing

a. Predictors: (Constant), X2, X1

b. Dependent Variable: Y

The table 4.2 above shows the value of the Durbin-Watson. The value of the Durbin-Watson is 1.298 which is between -2 and +2. It means there is no auto-correlation problem in this regression model.

4.5 Hypothesis Testing

4.5.1 Single Regression Analysis

Table 4.3 Single Regression Analysis Result between Cassava Production and Imported Rice

Year	Imported Rice (Million Tonne)	Cassava Production (Million Tonne)
1982	0,31	12,68
1983	1,117	11,26
1984	0,41	13,19
1985	0,03	12,3
1986	0,03	12,28
1987	0,05	14,36
1988	0,03	15,47
1989	0,27	17,12
1990	0,05	15,83
1991	0,17	15,95
1992	0,6	16,32
1993	0,02	17,22

1994	0,63	15,65
1995	1,81	15,37
1996	2,15	16,95
1997	0,35	15,09
1998	2,9	14,66
1999	4,75	16,46
2000	1,36	16,09
2001	0,64	17,05
2002	1,81	16,91
2003	1,43	18,52
2004	0,24	19,42
2005	0,19	19,32
2006	0,44	19,99
2007	0,48	19,99
2008	0,29	21,76
2009	0,25	22,04
2010	0,69	23,92
2011	2,75	24,04

Intercept = 0,36 Slope = 0,03

Source: Data result of simple regression form Ms. Excel 2010

Imported rice data is collected from Biro Pusat Statistik (Central Statistic Bureau) 1982-2011

4.5.2 Pearson Correlation Coefficient

Table4.4 Pearson Correlation Coefficient Result between Corn Production and Imported Rice

Year	Imported Rice (Million Tonne)	Corn Production (Million Tonne)	XY	X^2	Y^2
1982	0,31	3,21	1,00	10,30	0,10
1983	1,117	5,09	5,69	25,91	1,25
1984	0,41	5,29	2,17	27,98	0,17
1985	0,03	4,33	0,13	18,75	0,00
1986	0,03	2,92	0,09	8,53	0,00
1987	0,05	5,16	0,26	26,63	0,00
1988	0,03	6,65	0,20	44,22	0,00
1989	0,27	6,19	1,67	38,32	0,07
1990	0,05	6,73	0,34	45,29	0,00
1991	0,17	6,26	1,06	39,19	0,03
1992	0,6	8	4,80	64,00	0,36
1993	0,02	6,36	0,13	40,45	0,00
1994	0,63	6,75	4,25	45,56	0,40
1995	1,81	8,14	14,73	66,26	3,28

1996	2,15	9,2	19,78	84,64	4,62
1997	0,35	8,67	3,03	75,17	0,12
1998	2,9	10,11	29,32	102,21	8,41
1999	4,75	9,2	43,70	84,64	22,56
2000	1,36	9,68	13,16	93,70	1,85
2001	0,64	9,35	5,98	87,42	0,41
2002	1,81	9,65	17,47	93,12	3,28
2003	1,43	10,89	15,57	118,59	2,04
2004	0,24	11,23	2,70	126,11	0,06
2005	0,19	12,52	2,38	156,75	0,40
2006	0,44	11,61	5,11	134,79	0,19
2007	0,48	13,29	6,38	176,62	0,23
2008	0,29	16,32	4,73	266,34	0,08
2009	0,25	17,63	4,41	310,82	0,06
2010	0,69	18,33	12,65	335,99	0,48
2011	2,75	17,64	48,51	311,17	7,56

Source: Data result of Pearson Correlation Coefficient from Ms. Excel 2010
Imported rice and corn data is collected from Biro Pusat Statistc (Central Statistic Bureau) 1982-2011

4.5.3 Multiple Regression Analysis

Table4.5 Unstandardized coefficients result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	.715	1.648	
	X1	-.236	.158	-.711
	X2	.231	.127	.864

Source: Data result of unstandardized coefficients from SPSS 16.0

$$Y = 2.715 - 0.236\,X1 + 0.231\,X2 + e$$

Where:
Y = The volume of imported rice
X1 = The volume of cassava production
X2 = The volume of corn production
e =Random error

Table4.6 Descriptive analysis of variables

Descriptive Statistics

	Mean	Std. Deviation	N
Y	.8767	1.09419	30
X1	16.9070	3.29165	30
X2	9.3133	4.08471	30

Source: Data result of descriptive statistics result from SPSS 16.0

From the table 4.8 above, it shows the mean and standard deviation for each variable and the total of data that the writer use is 30 data.

4.5.4 Multiple Coefficient of Determination (R2)

The table4.7 below shows the value of R^2 is 0.116. It means the yearly Volume of Cassava Production(X1) and the yearly volume of Corn Production (X2) are explained by 11.6% of the volume of Imported Rice. The rest 88.4% are explained by other factors which are not mentioned in this research.

4.5.5 Coefficient of Correlation (R)

Table 4.7Model Summary Result

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.341[a]	.116	.051	1.06609	1.298

Source: Data result of model summary result from SPSS 16.0

Based on the table, R value is 0.341 which means there is a weak correlation or effect between the yearly Volume of Corn Production, the yearly volume of Cassava Production and the Volume of Imported Rice.

4.5.6 Hypothesis Testing

- **Coefficient Simultaneously Correlation Analysis (F-test)**

Table4.10 F-Test Result

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.034	2	2.017	1.775	.189[a]
	Residual	30.687	27	1.137		
	Total	34.720	29			

Source: Data result of model summary result from SPSS 16.0

The table 4.10 above shows that the significance value for this regression model is 0.189, and above shows the significance level which is 0.05. It means the independent variables which are Volume of Cassava and Corn Production do not give a simultaneous influence to the volume of Imported Rice. It means that Ho is rejected.

- **Coefficient Partial Correlation Analysis (T-test)**

Table 4.11 T-test Result

Coefficients[a]

Model		t	Sig.
1	(Constant)	1.648	.111
	X1	-1.497	.146
	X2	1.820	.080

Source: Data result of T-test result from SPSS 16.0

Based on the calculation, the significant value for the yearly volume of Cassava Production (X1) is 0.146. It shows the significance value for the yearly volume of Cassava Production (X1) is above the significance level (α) which is 0.05. It means Cassava Production has no significant influence in partial on the volume of Imported Rice. It means that Ho is rejected.

5. Conclusion

Based on this research, the researcher finds that "There is no significant effect between the cassava and corn production on imported rice partially or collectively."Another finding is cassava, corn and rice items are consumed when no other options are available. Consumers will not replace the consumption of goods for other goods under normal conditions. That is why the correlation between three items above is also weak.

5.1 Recommendation

The researcher recommends other researchers that include more variables to give a better result for further

research.

6. Reference

6.1 Books

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