ANALYSIS FOR SELF-SUFFICIENCY OF RICE IN INDONESIA: FORECAST OF ITS PRODUCTION AND CONSUMPTION

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ABSTRACT

While there are different opinions whether or not Indonesia should be self-sufficient in rice, the data for analyzing its production and consumption are not reliable according to some experts. This paper, therefore, attempts to forecast the possibility of self-sufficiency in rice for Indonesia. The empirical models of the production and the consumption are econometric models. By using the FAO's data in the period 1961-2014, the result revealed that Indonesia will be self-sufficient in 2028 and after.

Keywords: Rice, Production, Consumption, Self-sufficiency

INTRODUCTION

Indonesia has been a rice importer since 1900 (Rosnerand McCulloch, 2008, for the data in the period 1900-2000; FAO, 2016, for the period 1961-2013; and BPS-Statistic Indonesia, 2016, for the period 2014-2015).Indeed, in the period 1985-1990 after Indonesia was a self-sufficient in 1984, the quantity of rice imported had been very low, i.e. 0.03-0.05 million tons for certain purposes.Since 1991, Indonesia has been back as a big rice importer country.

The Indonesia Government has been trying to get back as a self-sufficient in rice. However, according to Simatupang and Timmer (2008), based on the experience of reaching self- sufficiency in 1984, itwas very costly. In this regard, McCulloch and Timmer (2008) suggested that Indonesia should engage more fully in the world rice market to fulfill the Indonesian demand of rice.

Whether Indonesia will be self-sufficient in rice is a big question.To answer this question, we need to forecast the production and the consumption of rice and then compare them. However, it is almost impossible to get a sound forecast result since the data of

production are overestimated and the data of consumption are underestimated (Rosnerand McCulloch, 2008; and Arifin, 2015). In this circumstances, this paper attempts to analyze the possibility of Indonesia be self-sufficient in rice.

METHOD

The empirical models can be seen in Equation (1) for the rice production and Equation (2) for the rice consumption.

$$Prod_t = b_o + b_1 AH_t + b_2 Seed_t + b_3 Year_t + e_{1t} \quad (1)$$

$$Cons_t = c_o + c_1 GDP_{t,} + c_2 Pop_t + e_{2t} \quad (2)$$

Where:

t	:	For production, t: 1961. 1962, …, 2014; For consumption t: 1970, 1971, …, 2013
Prod	:	Rice production (million tons of paddy)
AH	:	Rice Area Harvested (million hectares)
Seed	:	Seed planted for rice (million tons)
Year	:	1961=1, 1962=2, …, 2014=54
Cons	:	Rice consumption (million tons, paddy equivalent)
GDP	:	Indonesia Gross Domestic Product ($US billion, 2005 price)
Pop	:	Population (million people)
b and *c*	:	Parameter estimates
e	:	Error term

The source of all data is the FAO's website: http://faostat3.fao.org/home/E. Those two empirical models are firstly analyzed by using Ordinary Least Square (OLS). Since the data are time series, the OLS results should be evaluated for the existence of autocorrelation (Greene, 2000). If there is autocorrelation, then we use Feasible Generalized Least Square (FGLS) in order to get the efficient standard error.

RESULTS AND DISCUSSION

For analyzing the rice production, the data are from 1961 to 2014. The rice production and the area harvested data are depicted in Figure 1. It reveals that the rice production has been increasing affected more by the increasing of yield than by the additional harvested area. Moreover, there were two periods when the yields of rice drastically increased, i.e. the 1981-1989 due to the green revolution and the 2008-2014 due to the agricultural revitalization.

The average yield of rice in 2014 is 5.13 ton/ha. It may be too high because of the average value. However, if we compare with the potential yield, it is still low. According to

Indonesian Agency for Agricultural Research and Development (IAARD), 2016, the potential median yield of the rice is 8.85 ton/ha.

The result of the estimation for the rice production model can be seen in Table 1. It shows that the production forecast model resulted by FGLS is the best model since it is not only the best linear unbiased estimator (BLUE) of the coefficients, but also it has the efficient standard error. Therefore, it is used for forecasting the rice production (Table 2). In this table, there are three values for each forecast year, i.e. average, lower limit and upper limit of the 95% confidence interval. We used the lower limit for the rice production projection.

For analyzing the rice consumption, we use the data from 1970 to 2013. The rice consumption data and its calculated coput (consumption per capita) are depicted in Figure 2. It shows that the rice coput almost has the same trend with the rice consumption in the period 1970-2013. Only in the period 2002-2005, the coput had been declining, while the rice consumption had been increasing.

The calculated coput in 2013 is 134 kg/capita/year. Based on the National Economic Survey, it is 85 kg/capita/year, while according to OECD/FAO (2015), the average of Indonesian rice coput in the 2010-2014 is 163 kg/capita/year.

The result of the estimation for the rice consumption forecast model can be seen in Table 3. The model resulted by FGLS is BLUE and has efficient standard error. Based on this estimated consumption model, the forecast for the rice consumption is calculated and revealed in Table 4. We used the upper limit of the 95% confidence interval for the projection of the rice consumption.

The domestic production of rice is used for consumption, feed, seed, processing and others. Some rice is waste before reach the end user, such as consumers. The domestic supply for rice consumption (DS) is the rice production minus others (seed, feed, processing, other uses, and waste). If the DS equals to the consumption of rice, Indonesia is self-sufficient in rice. The DS data in the period 1961-2013 are revealed in Figure 3. It shows that there were 13 years when Indonesia self-sufficient in rice, i.e. 1962, 1968, 1981, 1983, 1984, 1985, 1986, 1989, 1992, 2007, 2009, 2010, and 2013. Since the self-sufficient happened for several years in the period 1983-1986, we say the 1984 is the year when Indonesia achieving self-sufficiency in rice.

After forecasting the rice production and consumption, then we use them for predicting whether Indonesia will be self-sufficient in rice. For production, we choose the lower limit of

the 95% confidence interval. Conversely, we use the upper limit for the rice consumption forecast. This means our prediction will be in the 5% level of significant. The forecast of the rice self-sufficiency in Indonesia can be seen in Table 8. This table reveals that Indonesia will be rice self-sufficient in 2028 and after.

REFERENCES

Arifin, Bustanul. 2015. The Problem of The 1.5 Million Ton Rice Import (Soal Impor Beras 1,5Juta Ton). Kompas, 3 October, 2015.

BPS-Statistics Indonesia.2016. Foreign Trade Statistics 2015, Import, Volume II. Jakarta.

FAO.2016. http://faostat3.fao.org/home/E.

Greene, W.H. 2000.Econometric Analysis.Fourth Edition.Prentice Hall, Upper Saddle River, New Jersey.

Indonesian Agency for Agricultural Research and Development (IAARD).2016. http://en.litbang.pertanian.go.id/research/400/Food-Crops.

McCulloch, Neil andTimmer, C. Peter.2008. Rice Policy in Indonesia: A Special Issue. Bulletin of Indonesian Economic Studies, Vol. 44, No. 1: 33-44, 2008.

OECD/FAO.2015. OECD-FAO Agricultural Outlook, OECD Agriculture statistics (database). doi: dx.doi.org/10.1787/agr-outl-data-en.

Rosner, L. Peter and McCulloch, Neil.2008. A Note on Rice Production, Consumption and Import Data in Indonesia. Bulletin of Indonesian Economic Studies, Vol. 44, No. 1: 81–91, 2008.

Simatupang, PantjarandTimmer, C. Peter. 2008. Indonesian Rice Production: Policies and Realities. Bulletin of Indonesian Economic Studies, Vol. 44, No. 1: 65-79, 2008.

Table 1. The Estimated Forecast Model for Rice Production

Independent Variables	OLS		FGLS	
	Coefficients	t-value	Coefficients	t-value
Intercept	-24.00*	-4.38	-27.31*	-4.72
Area Harvested	4.03*	4.55	4.30*	4.62
Seed	30.01*	4.02	37.90*	4.98
Year	0.40*	3.98	0.31*	2.94
F value	1,891*		2,241*	
R Square (R^2)	0.9913		0.9928	
Adj. R^2	0.9907		0.9923	
Standard Error	1.7174		1.4910	
Observations	54		53	
Durbin Watson	0.644		2.326	

*: Statistically significant at the 1% level
Note:
Dependent variable: Rice Production (million tons)
Independent variables: Area Harvested (million hectares); Seed (million tons); and Year (1961=1, 1962=2, …, 2014=54)

Table 2. The Forecast of Rice Production in Indonesia (million tons)

Year	Average	Confidence Interval 95%	
		Lower Limit	Upper Limit
2016	75.75	72.76	78.75
2017	77.37	74.38	80.37
2018	79.02	76.02	82.01
2019	80.68	77.68	83.68
2020	82.36	79.37	85.36
2021	84.07	81.08	87.07
2022	85.80	82.81	88.80
2023	87.56	84.56	90.56
2024	89.34	86.34	92.33
2025	91.14	88.15	94.14
2026	92.97	89.97	95.97
2027	94.82	91.83	97.82
2028	96.70	93.71	99.70
2029	98.61	95.61	101.60
2030	100.54	97.54	103.53

Table 3. The Estimated Forecast Model for Rice Consumption

Independent Variables	OLS		FGLS	
	Coefficients	t-value	Coefficients	t-value
Intercept	-11.74*	-3.75	-12.27*	-3.90
GDP	-0.02**	-2.42	-0.02*	-2.68
Population	0.28*	-10.85	0.28*	10.98
F value	588*		615*	
R Square (R^2)	0.9663		0.9685	
Adj. R^2	0.9647		0.9669	
Standard Error	1.6944		1.5515	
Observations	44		43	
Durbin Watson	0.414		2.142	

*: Statistically significant at the 1% level, and ** at the 5% level
Note:
Dependent variable: Rice Consumption (million tons of paddy equivalent)
Independent variables: GDP (billion US$, 2005 price); and Population (million people)

Table 4. Forecast of Rice Consumption in Indonesia (million tons, paddy)

Year	Average	Confidence Interval 95%	
		Lower	Upper
2016	52.33	49.19	55.46
2017	52.96	49.82	56.09
2018	53.54	50.40	56.67
2019	54.07	50.94	57.21
2020	54.84	51.71	57.98
2021	55.29	52.15	58.42
2022	55.94	52.81	59.08
2023	56.27	53.13	59.41
2024	56.81	53.68	59.95
2025	57.14	54.01	60.28
2026	57.51	54.38	60.65
2027	57.84	54.70	60.98
2028	58.12	54.98	61.26
2029	58.35	55.22	61.49
2030	58.53	55.39	61.66

Table 5. Forecast of Rice Self Sufficiency in Indonesia

Year	Consumption [C]	Others	Production	Domestic Supply for Cons. [DS]	[DS-C]	[DS-C]/DS (%)
	<== = = = = = = = = = = = (million tons of paddy) = = = = = = = = = = = == =>					
2016	55.46	22.07	72.76	50.69	-4.77	-9
2017	56.09	22.78	74.38	51.59	-4.50	-9
2018	56.67	23.53	76.02	52.49	-4.18	-8
2019	57.21	24.29	77.68	53.39	-3.82	-7
2020	57.98	25.08	79.37	54.28	-3.70	-7
2021	58.42	25.90	81.08	55.18	-3.25	-6
2022	59.08	26.74	82.81	56.06	-3.02	-5
2023	59.41	27.62	84.56	56.95	-2.46	-4
2024	59.95	28.52	86.34	57.83	-2.12	-4
2025	60.28	29.44	88.15	58.70	-1.58	-3
2026	60.65	30.40	89.97	59.57	-1.08	-2
2027	60.98	31.39	91.83	60.43	-0.54	-1
2028	61.26	32.42	93.71	61.29	0.03	0
2029	61.49	33.47	95.61	62.14	0.65	1
2030	61.66	34.56	97.54	62.98	1.32	2

Figure 1. The Production and Area Harvested of Rice in Indonesia

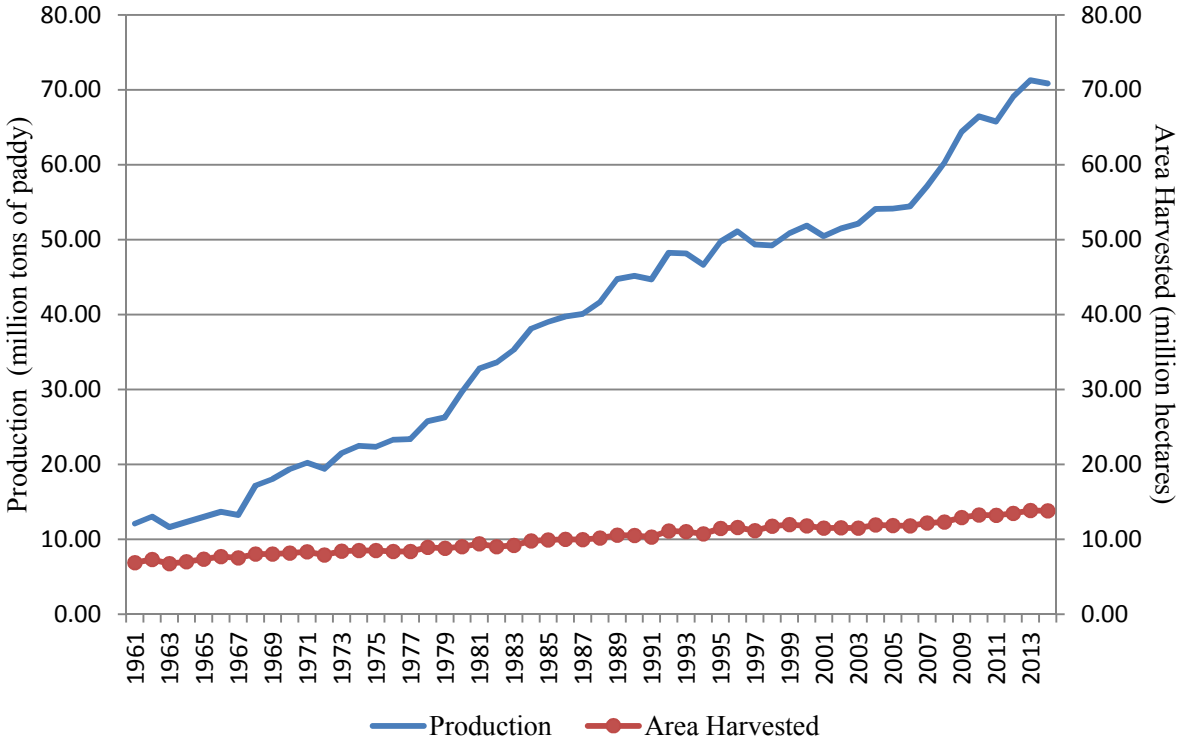

Figure 2. The Rice Consumption and Coput in Indonesia

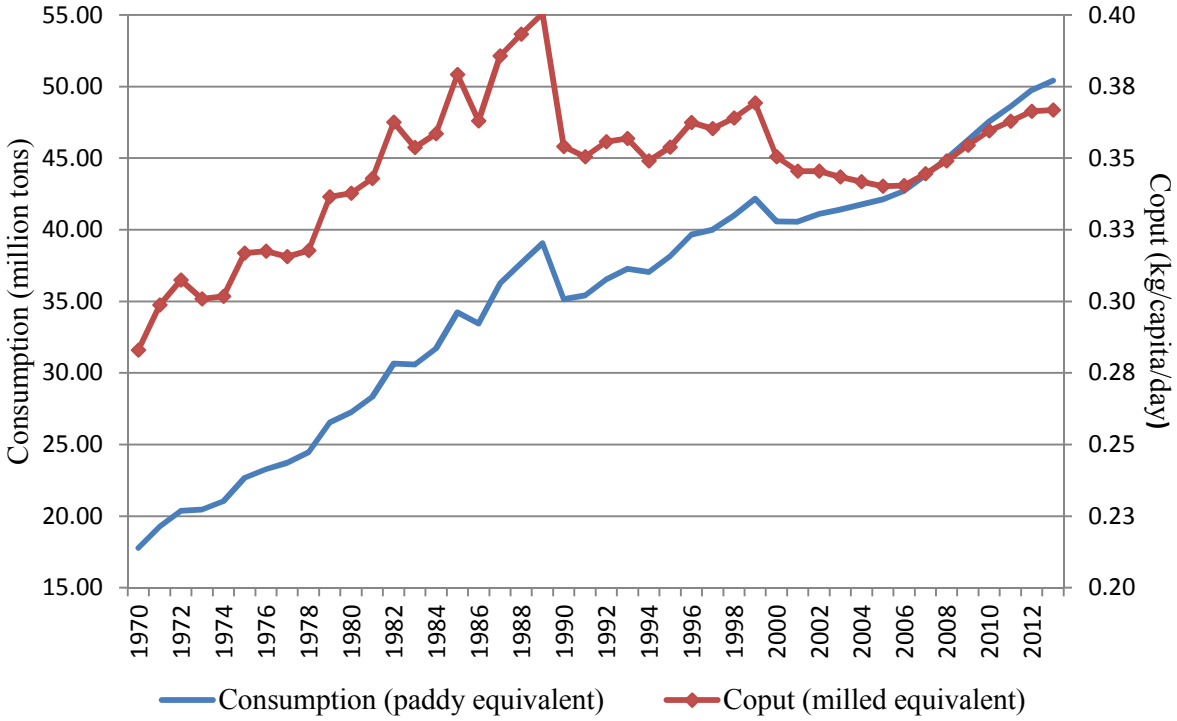

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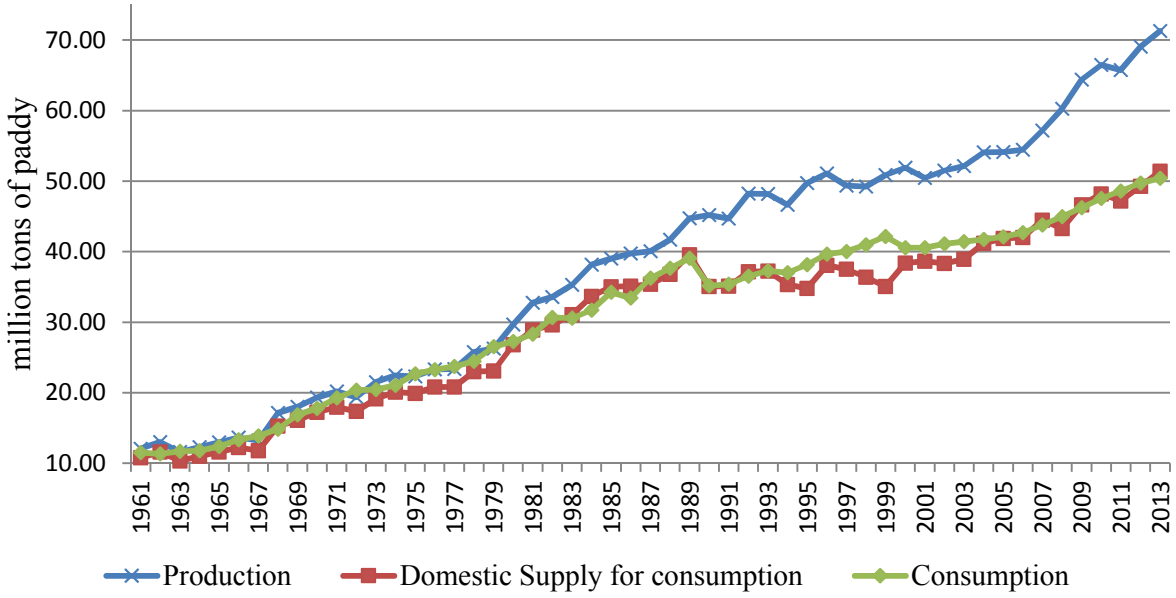
Figure 3. The Rice Consumption, Production and Domestic Supply in Indonesia (paddy equivalent)



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