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Analysis of Changes in Farmer's Exchange Rate and Their Effect on Farming in Indonesia

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ABSTRACT

The development of the Farmer's Exchange Rate (FER) index at the beginning of the COVID-19 pandemic in Indonesia. The effort to scrutinize the phenomenon of the decreasing FER is important and relevant for a deep study, especially related to its effects on farming activities. This study will observe FER changes and their effects on farming, especially rice farming. Methods of analysis include: (1) Descriptive Analysis (in the form of tables and graphs/diagrams only), (2) Quantitative Analysis (using multiple regression models). The results of the analysis of various factors affecting the FER show that the variable of the price of paddy at the farmer level has a positive and real effect on the FER. In this case, if the price of paddy increases by Rp 10, then the FER will increase by 0.157 units. Furthermore, the price of diesel fuel for agricultural equipment and machinery also has a positive and real effect on the FER. In this case, if there is an increase in the price of Rp 10, then there will be an increase in the FER of 0.052 FER units. It can be concluded that the influence of FER shows that the variable of unhusked-paddy price at the farm level has a positive and significant effect on FER. It can be made by farmers by achieving

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maximum possible economic efficiency through improvements in technical efficiency and optimization of resource reallocation (allocative efficiency), supported by output price incentive policies in order to obtain an adequate level of income.

Keywords: Sustainability; Decreasing; Fluctuation; Income; Price

1. Introduction

By definition, FER is an indicator of the ratio of the price index received by farmers to the price index paid by farmers in a percentage value [1, 2]. BPS et al. [3–5] states that the benefits and uses of FER include: (1) to see the fluctuation magnitude—as shown by price index received by farmers themselves resulting from the production of each farmer; and this becomes supporting data for the income sector in agriculture [6–8]; (2) to see the goods consumed by farmers mainly in rural areas as well as goods price fluctuations needed to produce agricultural products, as shown by price index paid by farmers [9, 10]; (3) as a measure for the ability to exchange products sold from farmers compare to various products needed in all production and household consumption, where the conditions for the fulfillment of food are reflected in the availability of sufficient food, both in quantity and quality, safe, evenly distributed and affordable [11–13]; and, (4) to show the level of competitiveness of agricultural products compared to other products [14, 15].

The interpretation of the FER value is as follows: if the FER is more than 100 (FER $>$ 100), it means that the farmers are more prosperous because they have a surplus. Production prices rose more than the increase in consumption prices. Farmers' incomes increased more than their expenditures. On the other hand, if the FER is less than 100 (FER $<$ 100), it means that farmers' welfare decreases because farmers experience a deficit that comes from an increase in production prices, which is relatively smaller than the increase in the price of consumption goods, so that farmers' income decreases and is smaller than their expenditure [16–18]. If the FER is equal to 100 (FER $=$ 100), it means that the level of welfare of the farmers at the time of measurement compared to the previous one has not changed or the farmers have broken even. This comes from the increase/decrease in production prices which is equal to the percentage increase/decrease in prices of consumer goods [19, 20]. The farmer's income is equal to his expenditure [21, 22]. Based on the Price Index Received by Farmers, it can be seen that the price fluctuations of the goods produced by farmers can be seen. This index is also used as supporting data in calculating agricultural sector income. Meanwhile, from the Price Paid Farmers Index, it can be seen that fluctuations in the prices of goods consumed by farmers who make up the largest part of the community in rural areas, as well as fluctuations in the prices of goods needed to produce agricultural products [23, 24]. The development of Ib can also describe the development of inflation in rural areas.

According to Tsikada and Pinilih et al. [25, 26], FER is the exchange rate (term of trade) between agricultural goods/products and consumer goods as well as production factors needed by farmers, stated in percent. If the price of agricultural products produced by farmers increases by a percentage greater than the percentage increase in goods and services paid by farmers, assuming the production volume does not decrease, then the FER increases and automatically the farmers' income increases relatively greater than the increase in expenditure or there is a surplus [27, 28]. Thus, conceptually, there is a strong correlation between FER and increased farmer income [29, 30]. As farmers' income is closely related to the welfare level, FER is a relevant indicator to show the development of farmers' welfare [31, 32].

At a time when the world, including Indonesia, was hit by the COVID-19 pandemic, the global economic sector experienced sluggishness and even a decline [33, 34]. In Indonesia, the agricultural sector continues to exist and is increasing in line with the Government's efforts to always guarantee food safety in the community. However, the COVID-19 pandemic has also had an impact on food marketing and distribution patterns in various countries, including Indonesia [35, 36]. Large-scale social

restrictions (PSBB) and the closure of transportation access as an effort to stop the spread of COVID-19 have resulted in a reduction in population mobility and activities, resulting in delays in the movement of goods and services, including various agricultural products [37, 38].

The development of the monthly FER value in the last two years, from January 2019 to December 2019 showed an increase of 0.15% per month. In 2019, the highest FER value occurred in December at 104.46 and the lowest occurred in April at 102.33. Furthermore, in 2020, January and February were still above 103, with 104.16 in January and 103.35 in February, respectively. Then when the COVID-19 pandemic began in Indonesia, starting in March 2020 the FER value began to fall to 102.09 and decreased again to 100.32 in April 2020 and to 99.47 in May 2020. The conditions for the decline in the FER mentioned above if it is not addressed properly, it is feared that it will affect the decline in the welfare of farmers [39, 40]. This will also be a separate problem for the sustainability of farming. Considering that due to the declining prices of agricultural commodities, it will be difficult for farmers to get their farming capital back, and of course it will be a disincentive for increasing farming [41, 42].

On the other hand, due to the COVID-19 pandemic, there has also been an increase in cases of layoffs in the industrial and service sectors [43, 44]. As a result, it causes people's income to decline, and with distribution and marketing constraints, the demand for agricultural commodities tends to decline [45, 46]. The decreasing demand for agricultural commodities will cause the selling price of agricultural products to decrease and of course will affect the welfare of farmers/commodity producers. Therefore, the effort to observe the phenomenon of the decreasing agricultural exchange rate (FER) becomes important and relevant to continue to be studied in depth, especially its effect on farming activities. In this context, this study will look at changes in FER and its effect on farming, especially rice farming.

The discussion above can be concluded that some of the main problems related to farmers' exchange rates: 1. Declining Agricultural Commodity Exchange Rates; 2. Price fluctuations; 3. High production costs; 4. Limited natural resources and technology; 5. Poor infrastructure; 6. Dominance of Small-Scale Farming; 7. Climate change; 8. Lack of Farmer Education and Skills; 9. Inefficient marketing. Thus, the impact of Farmer Exchange Rate Problems: 1. Declining Farmer Welfare; 2. Income disparity; 3. Declining agricultural production; 4. Shrinking number of farmers. So, the purpose of this study is to analyze the changes in FER and their effects on farming as well as the factors that affect FER [47, 48].

The theoretical framework of Farmer Exchange Rate (NTP) is based on the comparison between the price index received by farmers (It) and the price index received by farmers (Ib) expressed in percentage. Therefore, in the agricultural economic model, NTP is an important indicator in measuring the level of farmer welfare and providing an overview of rural economic conditions. Therefore, based on this idea, the concept of NTP refers to farmers purchasing power, namely the ability of income received by farmers to meet their consumption needs [49, 50]. According to Innocent and Trevor farmer income levels can be divided into three groups, namely: (a) income from farming (on-farm), (b) income from agricultural activities outside farming (off-farm) such as farm laborers, post-harvest workers, and (d) income from businesses outside agricultural activities such as civil servants, non-farm workers, trade activities, services and others [51, 52].

Therefore, it can be concluded that the challenges caused by the COVID-19 pandemic have resulted in an increase in layoffs in the industrial and service sectors. This has resulted in a decline in income, and the resulting distribution and marketing constraints have further impacted the declining demand for agricultural commodities. This further decline in demand for agricultural commodities will also lead to lower selling prices, which will undoubtedly impact the welfare of farmers and commodity producers. Therefore, examining the declining agricultural exchange rate (NTP) is crucial and relevant, requiring continued in-depth study, particularly regarding its impact on farming activities.

Referring to Liefert and Persaud [34], the influence of the price of grain, fuel oil and inflation can affect changes in the NTP. Then with limited resources and data availability, the research focused on these three variables to see how much influence they have on the

NTP. So there are still other gaps in this research, namely not including the variables of land area, rice production, GRDP, agricultural commodity prices which have been widely studied by previous research, but still rarely include the elements of the consumer price index and minimum wage variables, where these two variables are difficult to find, both at the regional and central levels. Therefore, the question posed is how the price of unhusked rice, the price of diesel fuel, and inflation affect the Farmer's Exchange Rate (NTP). Thus, the formulated hypothesis is that these three variables significantly influence NTP.

2. Materials and Methods

2.1. Sources and Types of Data

The type of data collected includes secondary data which is used for analysis. The data sources can be from: Statistics Indonesia (BPS), Ministry of Agriculture, National Development Planning Agency (Bappenas), and Indonesian Center for Agricultural Socio-Economics and Policy Studies (PSEKP). There is also secondary information collected regarding subsidized fertilizer policies from various institutions/agencies, scientific journals and other literature sources.

2.2. Data Collection

The scope of the study is national. Therefore, data collected from various sources and libraries for the national scope, and to enrich the analysis, can be presented as data/information on the scope of a particular case or area. The data collection technique was carried out by visiting agencies/institutions in the national scope and discussions on the development of the national FER.

2.3. Method of Analysis

The method of collecting data on the study of changes in FER and their effects on farming is carried out through Focus Group Discussions (FGD), literature review, analysis and attending seminars (public hearings) on FER. Methods of analysis include: (1) Descriptive Analysis (in the form of tables and graphs/diagrams only), (2) Quantitative Analysis (using simple multiple regression models, using the *Eviews 9*). To find out the various factors that influence FER, multiple regression analysis is carried out according to the availability of monthly data in the period of January 2014 to June 2020. The estimation model is that FER is presumed to be influenced by the price of dry threshed paddy (dry unhusked harvest paddy/GKP) at the farmer level, the price of diesel fuel for agricultural machinery, and inflation for the prices of staple goods. In the linear equation, the factors affecting FER are presented as follows.

$y = \alpha + \beta x$. The detailed formula is: FER $= \alpha 0 +$ β_1Price GKP $+ \beta_2$Price Diesel Fuel $+ \beta_3$inflation

$\beta_{1,2,3}$ = slope/coefficient

α = intercept/constant

y = coordinate y

$\chi_{1.2.3}$ = coordinate x

After the regression model is estimated, several statistical analyses are required to evaluate the model's quality and the significance of the variables. These include classical assumption tests and statistical tests.

1. Classical Assumption Tests: Basic regression assumptions need to be tested, such as linearity, residual normality, homoscedasticity, and the absence of multicollinearity.
2. Statistical Tests: Statistical tests are significance tests, consisting of the F-test, *t*-test, and R-squared test. The F-test tests the overall significance of the model, and the *t*-test tests the significance of each regression coefficient. The R-squared test describes the fit of the resulting model.

3. Results

3.1. Classical Assumption Test

3.1.1. Normality Test

Figure 1 shows that the Jarque-Bera value obtained is 3.201582 with the ρ (Prob) value of 0.201737, which is smaller than 0.05. This means that the data in this study is normally distributed.

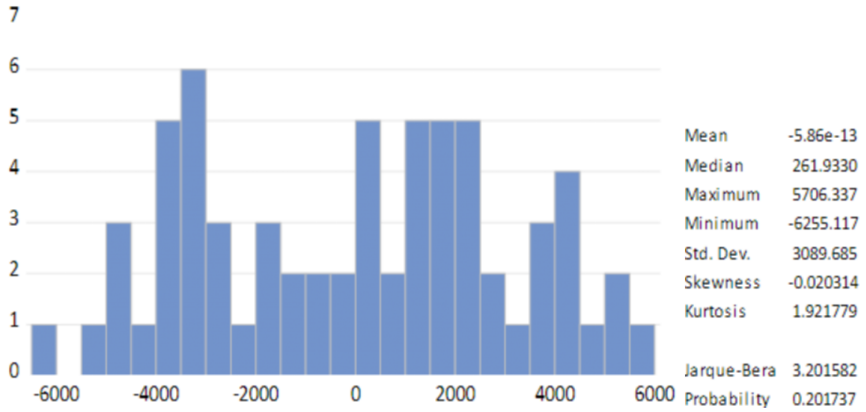

Figure 1. Residual Normality Test Results.

Sources: secondary database, processed, Eviews (2024).

3.1.2. Multicolinearity Test

Several linear relationships (Multicollinearity Detection) can be manifested statistically (VIF) or mathematically (Matrix). And in this test, only one of them is used, namely mathematically (matrix). Multicollinearity with the pair-wise correlation method, the correlation coefficient value is <0.80. If it is below 0.80, there is no multicollinearity problem.

The test results in **Table 1** show that none of the variables exceeds 0.85, so in this research model there is no multicollinearity between the independent variables.

The following are the results of the multicollinearity test.

3.1.3. Heterocedasticity

A regression model with heteroscedasticity has serious consequences for the OLS estimator, as it is no longer BLUE. Therefore, it is crucial to determine whether a model contains heteroscedasticity. The Gletsjer test is used in this testing stage, which simply compares the estimated absolute residual (RESABS) with the independent variable. **Table 2** shows the results of the heteroscedasticity test.

Table 1. Multicolinearity Test Results.

	GKP	PS	INF
GKP	1.000000	0.115187	0.075547
PS	0.115187	1.000000	0.031517
INF	0.075547	0.031517	1.000000

Sources: data secondary, processed, Eviews (2024).

Table 2. Heterocedastisity Test Results.

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
GKP	−4.02E−06	0.000927	−0.004338	0.9966
PS	−3.209996	1.082904	−2.964247	0.0043
INF	17,035.85	2,337.243	7.288866	0.0000

Sources: secondary database, processed, Eviews (2024).

The heteroscedasticity test shows that the independent variables in this study provide values greater than the alpha or confidence level used in this study, which is 0.05. This means that the estimation model in this study does not contain heteroscedasticity issues.

3.2. Statistic Test

Statistical tests or what can be said to be significance tests are the F-Test, *t*-Test and R-squared Test, which summarized in **Table 3** as follows:

Table 3. Results of Regression Analysis of Various Factors Affecting FER in Indonesia, 2020.

Description	Coefficient	t_{stat}
1. Price of GKP	12.912	0.0160***
2. Price of Solar	4.636	0.0050***
3. Inflation	−1.4054	−0.704
$f_{stat} = 15.38786$; $R^2 = 0.9811$		

Information: ***) significant at the level α=1%; ***) significant at the level α=1%.
Source: secondary database, processed, Eviews (2024).

The F-coefficient value is 15.38786, and the ρ-F statistic (0.00) exceeds the significance level. Therefore, it is concluded that the independent variables simultaneously influence the dependent variable. The results of the partial test (*t*-test) are explained in detail as follows:

1. Testing the Effect of GKP Prices on Farmers' Exchange Rates
   The analysis revealed that the *p*-value for the GKP variable is 0.016. Compared to the alpha value (0.05), the *p*-value is smaller. Therefore, Ho is rejected. Therefore, it is concluded that land area has a positive and significant effect on farmers' exchange rates in Indonesia.
2. Testing the Effect of Diesel Prices on Farmers' Exchange Rates
   The analysis revealed that the *p*-value for the diesel price variable was 0.005. Compared to the alpha value (0.05), the *p*-value was smaller, thus rejecting Ho. Therefore, it was concluded that diesel prices have a positive and significant effect on farmers' exchange rates in Indonesia.
3. Testing the Effect of Inflation on Farmers' Exchange Rates
   The analysis revealed that the *p*-value for the food crop inflation variable was 0.704. Compared to the alpha value (0.05), the *p*-value was greater, thus accepting Ho. Therefore, it was concluded that inflation had a negative and insignificant effect on farmers' exchange rates in Indonesia. The Adjusted R-squared value in **Table 3** was 0.9811, or 98.11 percent. Therefore, the conclusion was that 98.11 percent of the variables, including the price of dried fish, the price of diesel, and inflation, could explain the farmer's exchange rate.

3.3. Dynamics of Paddy Prices

In 2014, the average price of GKP paddy was IDR 4,301 /Kg, with a range of IDR 3,936 /Kg-IDR 4,911 /Kg. Furthermore, in 2015, the average price of GKP was IDR 4,697 /Kg, and decreased slightly to IDR 4,617/Kg in 2016 and to IDR 4,615 /Kg in 2017. In 2018, the average price of paddy began to increase to IDR 4,894/Kg, then fluctuated to IDR 4,723 /Kg in 2019 and to IDR 4,888 /Kg in 2020. The price of GKP at the farmer level in 2020 was far above the 2020 HPP of paddy of IDR 4,200 /Kg (**Table 4**).

Table 4. Development of Paddy Prices at the Farmer Level, 2014–2020 (IDR/Kg GKP).

Month	Price of GKP (IDR/Kg)							r (%/Year)
	2014	2015	2016	2017	2018	2019	2020	
January	4,412	5,028	5,206	4,754	5,415	5,353	5,273	2.43
February	4,423	4,923	5,211	4,639	5,207	5,114	5,176	1.90
March	4,135	4,500	4,703	4,373	4,757	4,603	4,936	2.08
April	3,936	4,107	4,262	4,308	4,556	4,357	4,600	2.31
May	4,130	4,428	4,440	4,485	4,554	4,356	4,623	1.17
June	4,214	4,442	4,501	4,528	4,650	4,552	4,720	1.49
July	4,098	4,444	4,376	4,483	4,633	4,618	-	2.11
August	4,170	4,595	4,480	4,509	4,774	4,759	-	2.21
September	4,283	4,765	4,537	4,655	4,889	4,905	-	2.20
October	4,365	4,905	4,555	4,791	4,937	5,012	-	2.14
November	4,535	5,070	4,514	4,864	5,116	5,098	-	1.94

Table 4. *Cont.*

Month	Price of GKP (IDR/Kg)							r (%/Year)
	2014	2015	2016	2017	2018	2019	2020	
December	4,911	5,118	4,623	4,995	5,237	5,215	-	1.28
Average	4,301	4,694	4,617	4,615	4,894	4,723	4,888	1.67
r (%/year)	0.80	0.67	−0.94	0.71	0.06	0.38	−2.78	xxx
CV (%)	32.12	32.86	32.69	32.35	32.96	33.06	24.91	xxx

Source: BPS (2020).

Furthermore, for the price of GKG, the CV value for the price of unhusked rice from the period 2014–2020 ranged from 1.71–29.20%. The tendency of the price of unhusked rice (GKG) in general is above the HPP of unhusked rice, where according to Presidential Instruction (Inpres) No. 5 of 2015 concerning the Policy on Procurement of Unhusked Rice/Rice and Distribution of Rice by the Government, where the purchase price from farmers for dry harvested unhusked rice (GKP) is set at IDR 3,700 /Kg, dry milled unhusked rice (GKG) IDR 4,600 /Kg, and rice is priced at IDR 7,300 /Kg. In 2014, the average price of unhusked rice (GKG) was IDR 4,748 /Kg, with a range of IDR 4,631/Kg-IDR 5,264 /Kg. Furthermore, in 2015, the average price of GKG was IDR 5,280 /Kg, and increased to IDR 5,459 /Kg in 2016 and to IDR 5,500 /Kg in 2017. In 2018, the average price of unhusked rice increased again to IDR 5,501 /Kg, then fluctuated to IDR 5,447 /Kg in 2019 and to IDR 5,746 /Kg in 2020 (**Table 5**).

Table 5. Development of Paddy Prices at the Farmer Level, 2014–2020 (IDR/Kg GKG).

Month	Price of GKP (IDR/Kg)							r (%/Year)
	2014	2015	2016	2017	2018	2019	2020	
January	4,776	5,447	5,689	5,542	6,002	5,780	5,780	2.56
February	4,792	5,357	5,753	5,525	5,961	5,828	5,826	2.72
March	4,791	5,264	5,501	5,452	5,442	5,530	5,766	2.25
April	4,529	4,843	5,474	5,220	5,242	5,127	5,671	2.60
May	4,572	4,886	5,510	5,531	5,267	5,172	5,588	2.31
June	4,664	5,234	5,430	5,564	5,361	5,246	5,845	2.34
July	4,598	5,238	5,380	5,457	5,206	5,277	-	1.86
August	4,631	5,248	5,405	5,471	5,308	5,309	-	1.99
September	4,643	5,330	5,285	5,502	5,399	5,392	-	2.27
October	4,783	5,356	5,312	5,532	5,467	5,508	-	2.24
November	4,936	5,524	5,325	5,593	5,646	5,619	-	2.13
December	5,264	5,632	5,438	5,606	5,714	5,775	-	1.52
Average	4,748	5,280	5,459	5,500	5,501	5,447	5,746	2.25
r (%/year)	0.54	0.51	−0.59	0.19	−0.32	−0.02	−0.24	xxx
CV (%)	29.08	29.10	28.90	28.84	29.20	29.13	1.71	xxx

Source: BPS (2020).

3.4. Dynamics of rice prices

For medium rice commodities, the price movement between years is quite stable. This can be seen from the average value of the coefficient of variation from 2017 to 2020 (until April) between 0.51 and 1.60 percent. When viewed from the dynamics, as seen in **Figure 2**, the price of rice tends to be high in December and January (2018 and 2019) (**Table 6**). This condition is actually an annual cycle that is understood that in the span of these months (December–January) is a lean period because it is the period after planting rice in Season I (MH) and approaching the MH harvest. Furthermore, the price of rice will decrease again. The thing to watch out for is that the price of rice in March and April 2020 tends to increase and is higher than the same months in 2018 and 2019 (**Figure 3**). Vigilance regarding this price movement should be observed, considering: (1) The main harvest season has not started, and will occur around the end of April to mid-May 2020,

(2) The existence of the COVID-19 pandemic, where everyone needs sufficient rice availability at home due to large-scale social restrictions, (3) Approaching the Fasting Season (April 24, 2020), and (4) There is HBKN Idul Fitri in May 2020. However, the dynamics of this price increase are optimistic that it will be contained along with the arrival of the harvest season in May 2020. For the current movement of rice prices, it seems not as extreme as in 2018, and in terms of size, the price of rice is lower compared to the conditions in the past 2 years.

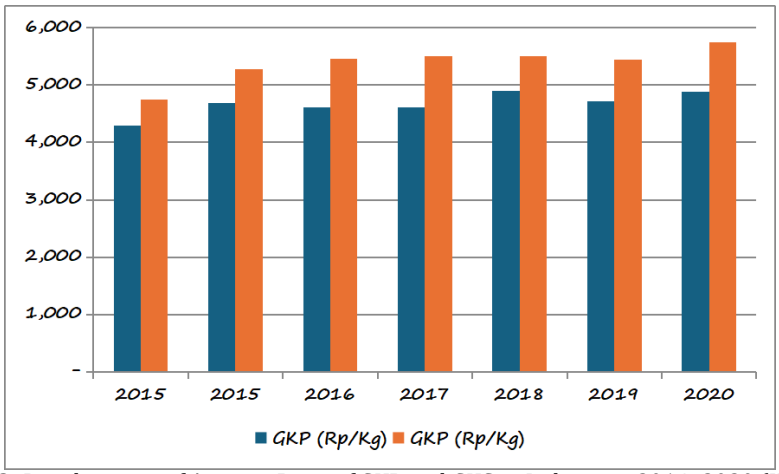

Figure 2. Development of Average Price of GKP and GKG in Indonesia, 2014–2020 (IDR/Kg).

Table 6. Monthly Consumer Price Dynamics for Rice Commodity in Indonesia, Jan 2017–April 2020 (IDR/Kg).

Month	2017	2018	2019	2020	r (%/Year)
January	11.211	11.625	11.434	11.258	−0.04
February	10.809	11.780	11.388	11.302	0.96
March	10.853	11.477	11.302	11.349	1.17
April	10.815	11.414	11.210	11.390	1.36
May	10.901	11.286	11.199	-	1.34
June	10.988	11.249	11.238	-	1.12
July	10.966	11.204	11.227	-	1.17
August	10.875	11.212	11.221	-	1.56
September	10.924	11.213	11.207	-	1.28
October	10.930	11.241	11.249	-	1.43
November	10.932	11.328	11.284	-	1.58
December	11.081	11.378	11.312	-	1.03
Average	10.940	11.367	11.273	11.325	xxx
CV	1.04	1.60	0.67	0.51	xxx

Source: BPS (2020).

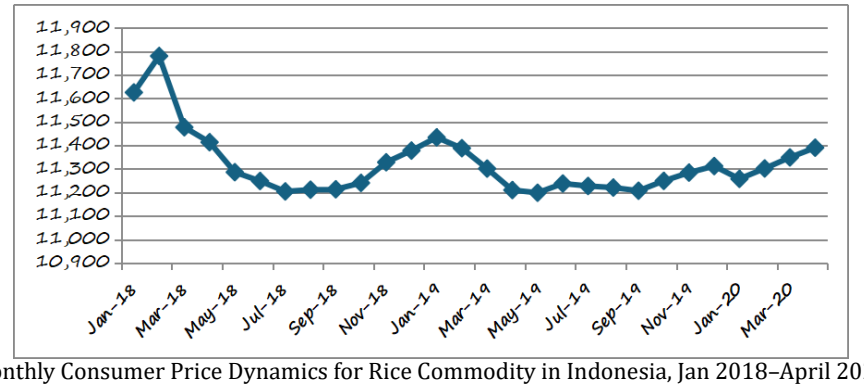

Figure 3. Monthly Consumer Price Dynamics for Rice Commodity in Indonesia, Jan 2018–April 2020 (IDR/Kg).

3.5. Rice Farming Business Analysis

When viewed from the aspect of national rice farming, the average rice productivity achieved is 5.11 tons/ha GKG. With an average selling price of Rp 5.464 /Kg, the average level of rice farming business income is Rp 27.93 million/ha/season. The total farming costs incurred reach Rp 14.54 million/ha/season, so that the level of farming profit achieved is Rp 13.39 million/ha/season with an R/C of 1.92. Thus, it can be concluded that rice farming is quite profitable and feasible to cultivate. The BEP price for rice commodities is Rp 2.845 /Kg. So with the real selling price at the farmer level of Rp 5.464 /Kg, the price is around 95.06% above the BEP price (**Table 7**).

3.6. Dynamics of FER Values

The dynamics of the average FER value from 2014 to 2019 (base year 2012 = 100) show fluctuations. In 2014, the FER value reached 105.71 then decreased drastically to 101.59 in 2015. Furthermore, in 2016, the FER value increased to 101.65 and slightly decreased to 101.27 in 2017. Then in 2018, the FER value fluctuated again, increasing to 102.46 and decreasing in 2019 to 101.12 (**Figure 4**).

Table 7. Analysis of Lowland Rice Farming Business in Indonesia, 2019 (IDR/Season/Ha).

	Value	Percentage (%)
A. Revenue		
1. Productivity (Kg GKG)	5.112	
2. Price (IDR/Kg)	5.464	
3. Value (IDR)	27.931.968	
B. Cost of farming (IDR)		
1. Seed	555.350	3.82
2. Fertilizer	1.385.312	9.52
3. Pesticide	600.385	4.13
4. Labor	7.094.548	48.78
5. Land rental	3.728.578	25.64
6. Other	1.180.608	8.12
Total Cost	14.544.781	100
C. Profit (Rp)	13.387.187	
D. R/C	1.92	
E. BEP(Break Even Point) of Price (IDR/Kg)	2.845	

Source: Data SOUT BPS, updated.

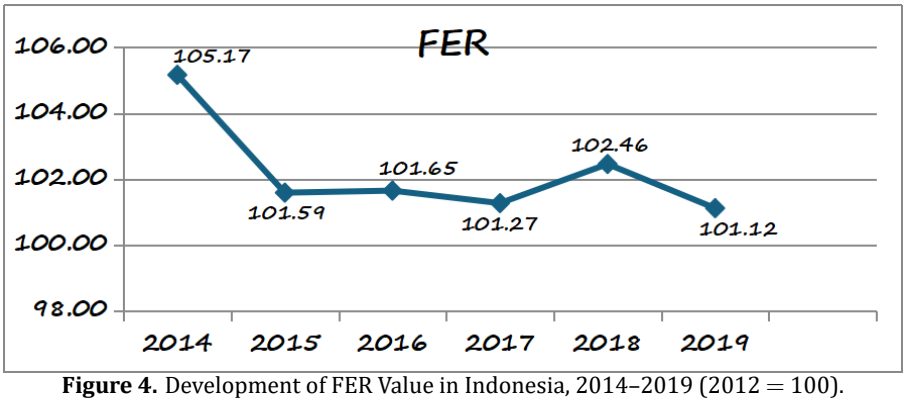

Figure 4. Development of FER Value in Indonesia, 2014–2019 (2012 = 100).

Changes in the FER value for the 2014–2016 period can be explained according to the facts and analysis of the Program run by the government (**Table 8**). According to the Public Relations Bureau of the Ministry of Agriculture, since 2015, there has been an important thing that cannot be ignored, namely that in that year the

Government launched a special upstream-downstream effort program to achieve food sovereignty and improve farmer welfare, which of course has a significant effect on the decline in the index that farmers must pay. This achievement is certainly a positive impact that is closely related to the Government's special efforts in agricultural development. On the upstream side, the Government's special efforts include improving infrastructure, especially irrigation networks, fertilizer subsidies and seed assistance through land optimization programs, as well as assistance for pre- and post-harvest agricultural tools and machinery, all of which must be taken into account to reduce the costs that farmers must pay. The facts show that various assistance has a direct effect on increasing productivity and production of agricultural businesses and of course this must also be calculated as additional income for farmers.

Meanwhile, if we look at the development of the FER value in the last 2 years, its development has also fluctuated quite a bit. From January 2018 to December 2019, the dynamics of the FER showed a decrease of −0.05% per month. In 2018, the highest FER value occurred in September at 103.17 and the lowest occurred in July at 101.66. Furthermore, in 2019, the highest FER value occurred in December at 103.36 and the lowest occurred in June at 99.45 (**Figure 5**).

Table 8. Development of monthly FER values, January 2014–December 2019 (2012 = 100).

Bulan	2014	2015	2016	2017	2018	2019
January	105.34	101.86	102.55	100.91	102.92	103.33
February	105.28	102.19	102.23	100.33	101.94	100.5
March	105.30	101.53	101.32	99.95	101.99	100.38
April	105.07	100.14	101.22	100.01	102.04	100.17
May	105.16	100.02	101.55	100.15	101.99	99.92
June	105.60	100.52	101.47	100.53	102.04	99.45
July	106.18	100.97	101.39	100.65	101.66	99.85
August	106.24	101.28	101.56	101.6	102.56	100.51
September	106.71	102.33	102.02	102.22	103.17	101.53
October	107.42	102.46	101.71	102.78	103.02	101.99
November	102.37	102.95	101.31	103.07	103.02	102.43
December	101.32	102.83	101.49	103.06	103.16	103.36
Average/year	105.17	101.59	101.65	101.27	102.46	101.12
r (%/year)	−0.145	0.135	−0.046	0.289	0.091	0.131

Information: basic year 2012 = 100.
Source: BPS (2014–2020).

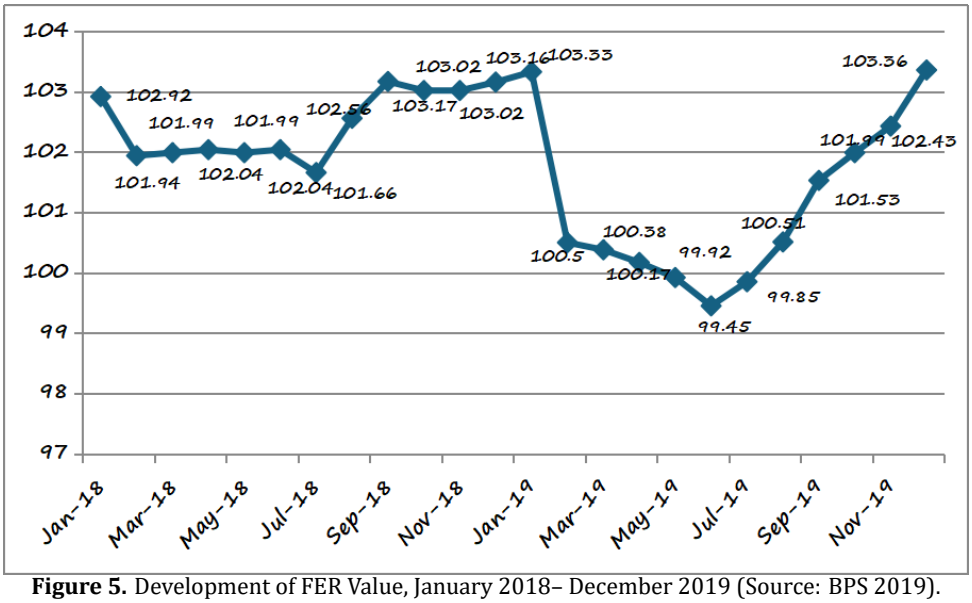

Figure 5. Development of FER Value, January 2018– December 2019 (Source: BPS 2019).

Furthermore, in 2020 (base year 2018 = 100), in the period from January to June 2020, the FER value tended to decrease by −0.61% per year. In January and February, it was still above 103, which was 104.16 in January and 103.35 in February respectively. Then when the COVID-19 pandemic started in Indonesia, starting in March 2020, the FER value began to fall to 102.09 and decreased again to 100.32 in April 2020 and to 99.47 in May 2020, and began to increase to 99.60 in June 2020. Furthermore, in July and August 2020 it continued to increase to 100.09 and 100.26 respectively (**Figure 6**).

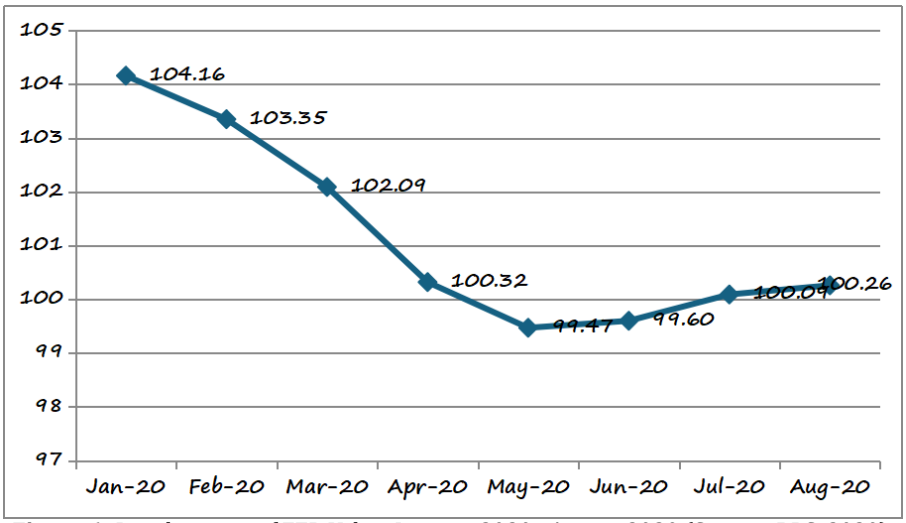

Figure 6. Development of FER Value, January 2020– August 2020 (Source: BPS, 2020).

The condition of the declining FER above, if not addressed properly, is feared to affect the decline in farmer welfare. This will also be a separate problem for the sustainability of farming. Given the declining price of agricultural commodities, it will be difficult for farmers to get back their farming capital, and of course it will be a disincentive for increasing farming.

4. Discussion

4.1. Results of Regression Analysis of Various Factors Affecting FER

The results of the analysis of various factors affecting FER are presented in **Tables 4** and **6**. The variable of paddy price at the farmer level has a positive and significant effect on FER. In this case, if the price of paddy increases by Rp 10, then FER will increase by 0.160 units. Furthermore, the price of diesel fuel for agricultural equipment and machinery also has a positive and significant effect on FER. In this case, if there is an increase in price of Rp 10, then there will be an increase in FER of 0.050 FER units. Meanwhile, for general inflation, it has no significant effect and its effect is negative on FER. For many countries, inflation is considered an economic disease. High inflation will trigger low purchasing power of the community. Low purchasing power will trigger low consumption of commodities in the goods market, commodity prices will decrease, and so on. Both production and consumption sides will experience contraction. Monetary sector shocks will affect the real sector, or vice versa. This contraction has an impact on slowing economic growth, as has happened recently (Kompasiana.com, 2015).

4.2. Paddy/Grain Price Policy

The existence of a basic price policy (HD) for paddy and rice that has been implemented since 1980, has a positive role in providing production incentives and contributing to efforts to stabilize paddy and rice prices. In 2001, one of the key factors that eliminated the effectiveness of this price policy was the liberalization of the rice economy by opening up opportunities for rice imports to the private sector. At that time, international rice prices were relatively low compared to domestic prices so that

even though a tariff of 30% or Rp430 /Kg was later applied, this tariff policy could not stem the influx of imported rice. Another important supporting factor that was lost was related to Bulog's operational capabilities. Rice outlets purchased by Bulog from farmers were eliminated by eliminating the policy of distributing rice to civil servants and cheap credit from Bank Indonesia was eliminated so that Bulog had to operate with commercial credit. In the period 1997–2000, 1998 was a year of turbulence for the Indonesian rice economy. In fact, the international rice price in 1998 was relatively stable, averaging USD 250 /ton, with monthly prices ranging between USD 243–275 /ton, but the rupiah exchange rate was very volatile. In January to April 1998, the rupiah exchange rate strengthened to IDR 8,000 per USD, but after President Soeharto resigned in mid-May 1998, the rupiah exchange rate against the USD weakened sharply in a short time, to more than IDR 15,000 per USD, although starting in July it strengthened again, and finally returned to a reasonable level in the fourth quarter of 1998 and the following two years, namely in the range of IDR 7,500–8,500 per USD.

Rice policy was developed by adopting a managed market mechanism approach, in an effort to protect the interests of producers and consumers. This means that as long as the market can function well and efficiently, the development of the rice agribusiness system and business refers to the market mechanism. However, if there is market distortion (deviation), the government will intervene in the policy[53]. The rice policy using the rice agribusiness approach lasted for nine years until 2010. During this period, nine Presidential Instructions were issued with the same title, with changes in the HPP level, expansion of policy targets, and additions to regulated aspects, although still within the corridor of paddy and rice agribusiness. In 2001, the Presidential Instruction was issued in order to increase farmers' income and develop the rural economy. This means that this Presidential Instruction is primarily a government tool to provide protection to farmers and create conditions for increasing farmers' income through guaranteed paddy and rice prices and rural economic development[54–58].

Broadly speaking, there are three output price policy formats that have been implemented since 1973 until now. First, the period 1973–1980 price policy was in the form of determining the purchase price of rice (then unhusked rice) from within the country. Second, during the period 1980–2000 the price policy implemented was HD and the upper or highest price to provide sufficient farming incentives to rice farmers and maintain rice prices at the consumer level through the regulation of rice imports monopolized by the government. Third, the period from 2000 to the present the HPP policy has been implemented. At the beginning of the implementation of the HPP policy, this instrument was more directed at the rice production subsystem with the aim of increasing farmer income and developing the rural economy. This approach has been running for 10 years (2000–2010) with the expansion of the scope of the policy and its targets, which include increasing food security and national economic stability. Starting in 2011 the main objective of the unhusked rice and rice price policy is to maintain national economic stability.

The development of monthly grain prices at the farmer level during the 2014–2020 period tended to fluctuate each month and increased (except in 2016) with a range of 0.06–0.80%/month. According to the result, the CV value of grain/rice price development above 10% can be said to fluctuate. The CV value for grain prices from the 2014–2020 period ranged from 24.91% to 33.06%. The tendency of grain prices (GKP) in general is above the HPP of grain of IDR 3,700 /Kg (before 2020). Furthermore, the amount of HPP in 2020 has been stipulated in Permendag 24 of 2020, namely for dry harvested grain (GKP) at the farmer level of IDR 4,200 /Kg and at the milling level of IDR 4,250 /Kg, dry milled grain (GKG) at the milling level of IDR 5,250 /Kg and in the Bulog warehouse of IDR 5,300 /Kg, and rice in the Perum Bulog warehouse of IDR 8,300 /Kg.

4.3. Factors Contributing to Changes in FER and Rice Farming

In the context of increasing FER, efforts that can be made by farmers are to achieve maximum economic efficiency through improving technical efficiency and optimizing resource reallocation (allocative efficiency) supported by output price incentive policies so that adequate income levels are obtained. The level of efficiency

achievement for several agricultural commodities varies relatively, namely 0.50–0.85 (technical efficiency), 0.45–0.70 (allocative efficiency) and 0.35–0.60 for economic efficiency. By considering an efficiency value greater than 0.70 as a high efficiency level category, it can be stated that the efficiency value is in the low to medium category. So, there is still room to increase the level of productivity and income (and ultimately FER) of national agriculture through improving the efficiency of farming businesses.

There are a number of policy instruments that can be considered in reducing technical inefficiencies in farming [59–61], namely: (a) increasing the area of cultivated land; (b) increasing sources of income both agricultural and non-agricultural; (c) increasing formal education and farming experience of heads of farming families; (d) increasing technical knowledge of cultivation; (e) increasing farmer access to agricultural input and output markets; (f) increasing farmer participation in farmer group activities; and (g) improving the handling of harvest and post-harvest aspects of agricultural commodities. At a broader level [62–64], several policy instruments that can be considered to increase the efficiency of farming businesses in the perspective of increasing the exchange rate and welfare of farmers are (a) increasing agricultural production capacity through technology development, revitalization, optimization, and development of land resources; (b) development of agricultural infrastructure in a broad sense that includes irrigation, farm and rural roads, electricity, and telecommunications, and others; (c) strengthening the implementation of production facility subsidies and developing price incentives for farmers in the perspective of price stabilization so that it is possible to optimize the allocation of resources in farming businesses; (d) revitalization of extension programs and implementation in improving farmers' management skills so that their ability to improve the efficiency of farming businesses increases; and (e) improvement of the structure and efficiency of marketing of national agricultural inputs and products so as to be able to reduce costs and increase sales value which will ultimately increase farmers' income.

The main production facility policies implemented by the government so far are for seeds and fertilizers. Seeds and fertilizers play an important role in the cost structure of production and are the main factors determining the increase in agricultural commodity production. The availability and access of farmers to seeds and fertilizers at the right level of need and affordable prices will determine the level of success in increasing production and farmer welfare. This discussion presents the performance and perspective of the implementation of policies for these two main inputs in order to successfully increase agricultural production and farmer welfare. The availability and access to quality seeds play an important role in increasing the productivity and quality of agricultural commodity production, so they still need to be under the control of government policy [65, 66].

The seed subsidy policy is considered ineffective as indicated by the price of seeds that remains high, the quality of seeds that is not appropriate, and the level of participation in the use of labeled seeds that still needs to be improved. Policy reorientation needs to consider the mode of providing seed subsidies according to commodities and their distribution patterns so that the goal of using quality seeds can be achieved optimally. Alternative mechanisms for distributing subsidized seeds offered are (a) selling prices set by the government; and (b) selling prices based on market mechanisms. In both alternatives, seed distribution can remain open, so that there is no market dualism due to price differences, as occurs in the fertilizer market.

Fertilizer subsidy policy is related to price protection policy (HPP policy). Even certain fertilizer policies (urea) can affect the use of balanced fertilization between inorganic fertilizers and/or increase the use of organic fertilizers [67]. Research shows that reducing urea fertilizer subsidies (increasing HET urea) on a macro scale has a positive impact on the efficiency of fertilizer use and the economic performance of rice. In relation to the policy and stabilization of agricultural output prices, several aspects that should be considered are (a) the performance and perspective of government purchase prices for grain and rice; (b) anticipatory policies for the implementation of government purchase price policies for multi-quality grain and rice; (c) anticipation of the implementation and learning of rice export subsidy policies in responding to future export opportunities; and

(d) anticipation of the impact of grain and rice price policies in supporting national food security.

Implementation of the target of the HPP policy was to increase farmers' income and develop the rural economy. In its ten years of development (2000–2010), the target of the HPP policy was expanded to include increasing food security and national economic stability. Since 2011, the focus of this HPP policy has been to maintain national economic stability, with justification and targets to anticipate the impact of climate change and the global food crisis. In line with efforts to encourage increased rice production with special efforts made by the current government, it is worth considering the opportunities and anticipatory policies for rice exports. The success of increasing rice production can have a positive impact on national food security, but it also has the potential to be negative for producer farmers. Excess production will strengthen food security by eliminating the risk of imports with a relatively high level of instability. Excess production can also suppress domestic rice prices and reduce farmer incentives, which will have a negative impact on the sustainability of increasing rice production.

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The government purchase price policy (HPP) for grain and rice has been implemented since 2000, with the dynamics of justification and targets adjusted to the development of the rice economy from the perspective of supporting the agricultural, rural, and national economies. At the beginning of its implementation, the target of the HPP policy was to increase farmers' income and develop the rural economy. In its ten years of development (2000–2010), the target of the HPP policy was expanded to include increasing food security and national economic stability. Since 2011, the focus of this HPP policy has been to maintain national economic stability, with justification and targets to anticipate the impact of climate change and the global food crisis.

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The solution is to export rice, with a choice of medium or premium quality rice. According to Erna et al.[65, 66], this choice of quality is very important with the following considerations: (a) Preventing a decrease in the price of unhusked rice through the export of medium quality rice will require an export subsidy of US$200 /ton, so that with an export target of only half a million tons, the total export subsidy needed will reach US$100 million (Rp1,200 billion); (b) the decision to export and subsidize medium rice seems difficult for the DPR and the wider community to accept, so it is more realistic to provide subsidies to the domestic population; and (c) The government may consider exporting aromatic rice and/or other premium quality rice by referring to the price disparity of the rice in the domestic and foreign markets.

The export policy of aromatic and premium rice is in line with efforts to implement multi-quality HPP to encourage a gradual increase in the production of quality rice, in line with increasing domestic demand and export opportunities. The HPP policy for unhusked rice and rice is considered to remain relevant and is considered effective as an incentive instrument for farmers, a price reference, and stabilization of the supply and price of unhusked rice and rice. The implementation of the HPP policy for unhusked rice and rice, complemented by its supporting policies, has a positive impact on the stability of the supply and price of rice at the consumer level.

In the period 2002–2014, the price of rice was relatively very stable, with an average CV/monthly price variation of 4.48, which is considered much lower than the CV of other food commodities such as granulated sugar, beef, and red chilies that do not receive comprehensive price policy protection.

The success of the implementation of the HPP policy for unhusked rice and rice cannot be separated from the effectiveness of the implementation of its supporting policies, which include (a) purchasing unhusked rice and rice from farmers according to the purchase price set by the government; (b) management of stocks of paddy and rice purchased from farmers, including storage, processing, and distribution; (c) isolating the domestic rice market from international price fluctuations through the implementation of appropriate and conducive import policies; (d) regulation of domestic rice distribution, including for social security and emergency purposes; and (e) support for appropriate and transparent financing and budget policies. Policy for Increasing Production and Farmer Welfare: Increasing production at a level that benefits farmers cannot be separated from efforts to explore opportunities for increasing productivity and optimizing the allocation of production facilities effectively and efficiently. Opportunities for increasing productivity will be possible at a certain level of technical efficiency and technological potential. Optimizing the use of inputs will be possible at a certain level of allocative efficiency with the support of conducive input and output price stability.

4.4. Factors Affecting FER

The reason for the decline in FER is quite relevant, considering. FER also shows the exchange rate (terms of trade) of agricultural products with goods and services consumed or for production costs. The higher the FER, the relatively stronger the level of ability/purchasing power of farmers. The higher the FER, the relatively stronger the level of ability or purchasing power of farmers. The increase in the FER value is also influenced by the increase in FER in four agricultural subsectors, namely the FER of the food crop subsector, horticultural crops, people's plantation crops, and the livestock subsector.

According to Jimoh et al.[68–70], the factors that influence FER can be traced through analysis of its constituent components, in the form of measuring the influence of changes in the prices that make up FER on FER in the form of marginal values and price elasticity. From these marginal values and elasticity, it can then be used to evaluate the impact of related policies on FER. The Farmer Exchange Rate (FER) is the ratio between the price received by farmers (HT) and the price paid by farmers (HB). The price received by farmers (HT) is the producer price (farm gate) of the farmer's production. The farmers in question are those who cultivate food crops (rice and secondary crops), horticultural crops (vegetables and fruits), people's plantation crops, livestock (large livestock, small livestock, poultry, and livestock products), and fisheries (capture and cultivation). Meanwhile, the price paid by farmers (HB) is the retail price of goods/services consumed/purchased by farmers either to meet their own household needs or for production costs and additional agricultural capital goods. Household needs include foodstuffs, processed foods, housing, clothing, health, education, recreation, and sports, as well as transportation and telecommunications. Meanwhile, the need for production costs and additional capital goods includes seeds, medicines and fertilizers, land rent and taxes, transportation, additional capital goods, and farm labor wages. The effects of changes in these prices can be grouped into the effects of changes in prices received by farmers (HT) and the effects of changes in prices paid by farmers (HB). In summary, several factors that affect the FER are:

1) Variable prices received by farmers.
2) Changes in the price of food commodities such as rice.
3) Changes in the cost of production facilities/increases in the price of production facilities.
4) Changes in prices/capital costs.
5) Inflation in rural areas
6) Increase in fuel prices.

The results of the analysis show that the value of the price elasticity of food crop sub-sector commodities to the FER shows the largest value (0.50), followed by the horticulture sub-sector (0.19), plantations (0.18), livestock (0.16) and fisheries (0.13). The magnitude of this

elasticity value is also in line with the marginal value of the impact of price increases on the FER. The price elasticity value received by food crops of 0.50 means that a 1 percent increase in the price of the food crop group increases the FER by 0.5 percent, and so on for other subsector commodities.

The marginal impact of the influence of price changes on the FER is in the form of direct impacts and indirect impacts of changes in each price on the FER. The direct impact in question is the follow-on effect of changes in the price of the commodity in question on the prices of other commodities produced by farmers (which has a positive effect on the FER) and its effect on the increase in the price/cost of production facilities and capital goods (which has a negative effect on the FER). The results of the analysis show that the direct effect of changes in commodity prices is relatively more dominant than the indirect effect.

Furthermore, the results of research on the food crop sub-sector, the elasticity and marginal value of changes in rice prices to the FER are relatively greater compared to secondary crops. A one percent increase in the rice and secondary crop price index has an impact on increasing the FER by 0.28 percent and 0.25 percent respectively; or in marginal form, an increase of one unit in the price index will increase the FER index by 0.0023 and 0.0019 respectively. In the horticulture sub-sector, the elasticity of vegetable and fruit prices to the FER shows the same value, which is 0.18 each, which means that a one percent increase in the vegetable and fruit price index will have an impact on increasing the FER by 0.18 percent each, but there is a difference in its marginal effect, which is 0.0013 and 0.0014 respectively. In the plantation sub-sector, the FER has not been detailed according to the main commodities that make it up. In this sub-sector, the plantation in question is smallholder plantations.

The price elasticity value to the FER of 0.18 indicates that a one percent increase in the plantation price index will increase the FER by 0.18 percent, or a one unit increase in the plantation price index will increase the FER by 0.0014 units. In the livestock sub-sector, the largest elasticity and marginal value values occur in large livestock commodities (with an elasticity value of 0.10 and a marginal value of 0.0008), followed by small livestock (elasticity value of 0.08 and a marginal value of 0.0006), livestock products (elasticity value of 0.07 and a marginal value of 0.0005), and poultry (elasticity value of 0.06 and a marginal value of 0.0005). In the fisheries sub-sector, the elasticity and marginal value of changes in the price of fishing activities are 0.08 and a marginal value of 0.0007; while in fisheries cultivation activities the elasticity value is 0.06 and the marginal value is 0.0005.

In the group of prices paid for production costs and additional capital goods, the largest elasticity and marginal value are for wages (i.e. elasticity of -0.08 and marginal value of -0.0007), followed by medicine and fertilizer (elasticity of -0.05 and marginal value of -0.0004), transportation (elasticity of -0.05 and marginal value of -0.0005), and the smallest is seeds (elasticity of -0.02 and marginal value of -0.0001). In the structure of FER formation, the price index paid in the household consumption group (KRT) is the rural inflation index. The results of the analysis show that the elasticity of KRT (or rural inflation) to FER is 0.80, which means that a 1 (one) percent increase in rural inflation will reduce FER by 0.80 percent. In the form of marginal value, the results of the analysis show that an increase in rural inflation of 1 (one) unit will reduce FER by -0.0064 units.

The largest component contributing to consumption prices (rural inflation) is the price of food with an elasticity of -0.50, followed by processed food (elasticity -0.25), transportation and communication (elasticity -0.05) and the smallest is clothing products. The results of the analysis also show a close relationship between the price of household consumption (KRT), especially food (BM) from the side of costs paid by farmers (HB), with the price received by farmers (HT), especially the price of food crops (HTTP). The elasticity values of HT to KRT and BM are 0.869 and 0.988 respectively, while the elasticity of HTTP to KRT and BM is 0.721 and 0.821 respectively. This means that a 1 percent increase in the price received by farmers (HT) will increase the price/cost of household consumption (KRT) by 0.869 percent and the cost of food consumed by 0.988 percent; while the increase in the price of food crop commodities received by farmers (HTTP) by 1 percent will

increase the price/cost of household consumption (KRT) by 0.721 percent and the cost of food consumed by 0.821 percent. Thus, the policy of increasing HT, especially the price of the food crop sub-sector (HTTP) will have an impact on the price of food and KRT (rural inflation) or it also means that the food price policy (HTTP) in order to increase FER also results in increasing KRT (rural inflation). Thus, the policy of increasing HT, especially the price of the food crop sub-sector (HTTP) will have an impact on the price of food and KRT (rural inflation). The food price policy (HTTP) in order to increase farmer's income/receipts has played a role in increasing FER while also causing an increase in inflation in rural areas.

In relation to controlling rural inflation, it can be done through controlling the prices received by farmers (HT), and this also means that it will have an impact on the stability of the FER. A stable FER also means that there is a proportional increase in prices between HT and HB. In relation to the impact of the increase in fuel prices on the FER, the increase in fuel prices can be seen from the increasing transportation cost index indicator. The transportation cost index is a component of the cost index paid by farmers (HB) in two ways, namely part of the household consumption cost (KRT) and the production cost component (BPPBM). As part of the expenditure component (prices paid by farmers HB), the increase in transportation costs will reduce the FER.

4.5. Factors Affecting Rice Farming

In general, the characteristics of farming in Indonesia are narrow land, relatively small capital, limited farmer knowledge, less dynamic resulting in low farm income [71–75]. In farming, production is obtained through a fairly long and risky process. Apart from time, type of commodity, the adequacy of production factors also play a role in determining the achievement of production. The production process can only run if these requirements are met. These requirements are better known as production factors.

According to Ahodo et al. [76–79] agricultural production is influenced by various factors including:

1) Types/kinds of commodities,
2) Land area,
3) Labor,
4) Management capital,
5) Climate,
6) Socio-economic factors of producers.

The factors that influence production are divided into two groups, namely: 1). Biological factors, such as: agricultural land with various levels of fertility, seeds, varieties, fertilizers, medicines and others; and 2) Socio-economic factors such as production costs, prices, labor, education levels, income and others. Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

The rice and paddy price policy implemented since 1973 has had a positive impact on efforts to increase rice production and the stability of rice supply and prices. However, the effectiveness of this policy is also determined by the existence and seriousness of implementing supporting policies, namely as mentioned by Tomek et al. [13–15]: (1) buying farmers' paddy and rice according to the purchase price set by the government, (2) managing the stock of paddy and rice purchased from farmers, (3) isolating the domestic rice market from international price fluctuations by regulating monopolies or import policies, (4) regulating the distribution of rice in the domestic market and for social security and emergency purposes, and (5) providing sufficient financing through a clear and transparent budget. The rice and paddy price policy is still relevant to provide incentives for farmers to produce, provide signals to the market in the form of price references, and stabilize the supply and price of rice. However, this instrument will be effective if accompanied by other policies and implemented synergistically.

The development of monthly grain prices at the farmer level during the 2014–2020 period tended to fluctuate each month and increased (except in 2016) with a range of 0.06–0.80%/month. The CV value for grain prices from the 2014–2020 period ranged from 24.91% to 33.06%. The tendency of dry harvested grain prices

in general is above the government's purchase price of grain of IDR 3,700 /Kg (before 2020). Furthermore, the amount of the government's purchase price in 2020 has been stipulated in Permendag 24 of 2020, namely for dry harvested grain at the farmer level of IDR 4,200 /Kg and at the milling level of IDR 4,250 /Kg, dry milled grain at the milling level of IDR 5,250 /Kg and in the Bulog warehouse of IDR 5,300 /Kg, and rice in the Perum Bulog warehouse of IDR 8,300 /Kg. The price of dry harvested grain at the farmer level in 2020 was far above the government's purchase price for grain in 2020 of IDR 4,200 /Kg.

When viewed from the aspect of national rice farming, on average rice farming is quite profitable and feasible. The BEP price for rice commodities is IDR 2,845 /Kg. So with the real selling price at the farmer level of IDR 5,464 /Kg, the price is around 95.06% above the BEP price. The dynamics of the average FER value from 2014 to 2019 show fluctuations. In 2014, the FER value reached 105.71 then decreased drastically to 101.59 in 2015. Furthermore, in 2016, the FER value increased to 101.65 and slightly decreased to 101.27 in 2017. Then in 2018, the FER value fluctuated again, increasing to 102.46 and decreasing in 2019 to 101.12.

Changes in the FER value for the 2014–2016 period can be explained according to the facts and analysis of the Program run by the government. Since 2015, the Government has launched a special upstream-downstream effort program to achieve food sovereignty and improve farmer welfare, which of course has a significant impact on the decline in the index that farmers must pay. This achievement is certainly a positive impact that is closely related to the Government's special efforts in agricultural development. On the upstream side, the Government's special efforts include improving infrastructure, especially irrigation networks, fertilizer subsidies and seed assistance through land optimization programs, as well as assistance for pre- and post-harvest agricultural tools and machinery, all of which must be taken into account to reduce the costs that farmers must pay. The facts show that various assistance has a direct impact on increasing productivity and production of agricultural businesses and of course this must also be calculated as additional income for farmers.

The development of the FER value in the last 2 years has been quite fluctuating. From January 2018 to December 2019, the dynamics of the FER showed a decrease of -0.05% per month. In 2018, the highest FER value occurred in September at 103.17 and the lowest occurred in July at 101.66. Furthermore, in 2019, the highest FER value occurred in December at 103.36 and the lowest occurred in June at 99.45. Furthermore, in 2020 (base year $2018 = 100$), in the period from January to June 2020 the FER value tended to decrease by -0.61% per year. In January and February it was still above 103, which was 104.16 in January and 103.35 in February respectively. Then when the COVID-19 pandemic started in Indonesia, starting in March 2020 the FER value started to fall to 102.09 and decreased again to 100.32 in April 2020 and to 99.47 in May 2020, and started to increase to 99.60 in June 2020. Furthermore, in July and August 2020 it continued to increase to 100.09 and 100.26 respectively.

The results of the study can be concluded that increasing FER can be done through maximum economic efficiency through improving technical efficiency and optimizing resource reallocation (allocative efficiency) supported by output price incentive policies so that adequate income levels are obtained. There are a number of policy instruments to reduce technical inefficiency in farming businesses, namely as mentioned by Indah et al.[22, 33, 34]: (a) increasing the area of cultivated land; (b) increasing sources of income both agricultural and non-agricultural; (c) increasing formal education and farming experience of heads of farming families; (d) increasing technical knowledge of cultivation; (e) increasing farmer access to agricultural input and output markets; (f) increasing farmer participation in farmer group activities; and (g) improving handling of harvest and post-harvest aspects.

The results of the analysis of various factors affecting the FER show that the variable of the price of paddy at the farmer level has a positive and real effect on the FER. In this case, if the price of paddy increases by Rp 10, then the FER will increase by 0.157 units. Furthermore, the price of diesel fuel for agricultural equipment and machinery also has a positive and real effect on the FER. In this case, if there is an increase in the price of Rp 10, then there will be an increase in the FER of 0.052

FER units. Meanwhile, inflation has no real and negative effect on the FER. For many countries, inflation is considered an economic disease. High inflation will trigger low purchasing power of the community. Low purchasing power will trigger low consumption of commodities in the goods market, commodity prices will decrease. Therefore, rice stocks must be controlled so that they do not have the potential to increase inflation. Uncontrolled inflation often has an impact on other aspects outside the economy, such as social instability and the political situation in this country.

The results of the study also show that generally the characteristics of farming in Indonesia are narrow land, relatively small capital, limited farmer knowledge, less dynamic resulting in low farm income. In farming, production is obtained through a fairly long and risky process. The length of time required is not the same depending on the type of commodity being cultivated. Not only time, but the adequacy of production factors also plays a role in determining production achievement. The production process can only run if these requirements are met. So it can be concluded that the factors that ultimately influence changes in FER and their impact on farming in Indonesia are biological factors (agricultural land with various levels of land fertility, land area, seeds, varieties, fertilizers, pesticides and insecticides) and socio-economic factors (production costs, prices, labor, education levels and income).

The research results, can be concluded that increasing the FER can be done through maximum economic efficiency through improving technical efficiency and optimizing resource reallocation (allocative efficiency) supported by output price incentive policies so that an adequate level of income is obtained. The factors that ultimately influence changes in FER and its impact on farming in Indonesia are biological factors (land, seeds, varieties, fertilizers, pesticides and insecticides) and socio-economic factors (production, prices, labor, education levels and income).

Author Contributions

Conceptualization, R.A. and E.S.Y.; methodology, R.A., A.T.S. and D.O.D.; software, R.A., R. and Y.H.S.; validation, R.A., D.L. and I.A.; formal analysis, R.A., A.Y. and I.; investigation, R.A., E.S.Y. and Y.H.S.; resources, R.A., R., A.T.S.; data curation, R.A., D.O.D. and I.; writing—original draft preparation, All Author; writing—review and editing, All Author; visualization, R.A., I.A. and D.L.; supervision, R.A., E.S.Y., R., Y.H.S.; project administration, R.A., I.A., I., D.L.; funding acquisition, R.A., D.O.D., A.T.S., I. All authors have read and agreed to the published version of the manuscript.

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There is no specific storage location for data for privacy or ethical reasons.

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Conflicts of Interest

The authors declare no conflict of interest.

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