Competitiveness effect of the UPSUS Program on rice production in West Java Province, Indonesia

A Setiyanto*, I M Pabuayon², C B Quicoy², J V Camacho Jr³ and D P T Depositario⁴

1 Indonesian Center for Agricultural Socio Economics and Policy Studies, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture. Kawasan Penelitian Pertanian Cimanggu, Jalan Tentara Pelajar No 3B, Bogor, Indonesia 16114.
2 Department of Agricultural and Applied Economics, College of Economic and Management, University of the Philippines Los Banos, F.A. Tiongson Avenue University of the Philippines Los Banos, College Batong Malake, Los Banos, Laguna, Philippines 4031.
3 Department of Economics, College of Economics and Management, University of the Philippines Los Banos. Banos, F.A. Tiongson Avenue University of the Philippines Los Banos, College Batong Malake, Los Banos, Laguna, Philippines 4031.
4 Department of Agribusiness Management and Entrepreneurships, College of Economics and Management, University of the Philippines Los Banos. Banos, F.A. Tiongson Avenue University of the Philippines Los Banos, College Batong Malake, Los Banos, Laguna, Philippines 4031.

Corresponding author: setiyantoadi1969@gmail.com

Abstract. The sustainability of rice self-sufficiency and export are expected from the implementation of the UPSUS Program on rice and the attention to the issues affecting the rice competitiveness become very important. Using rice farm household survey data, the study employed the Policy Analysis Matrix (PAM) and Kernel Density Estimation method of analysis. The study aimed to analyse the effects of the UPSUS Program on the global competitiveness of rice production and estimate the proportion of rice farms that produce competitively and the proportion of the total production that is produced competitively from the implementation of the UPSUS Program in West Java. Rice farming in the study sites was both financially and economically profitable before and after the implementation of the UPSUS Program and showed a slight decline in competitive and comparative advantages after the program. In 2020-2025, to increase rice competitiveness and achieving the target, the government should: (1) Maintain the area of rice planting and give more focus on higher productivity target; (2) Improve the adequacy and effectiveness of the various components of the program; and (3) Improve the provision of other services outside the program components that affect competitiveness of rice production.

1. Introduction
Rice is the most important staple crop and contributes significantly to the Indonesian economy. The Ministry of Agriculture (MOA) initiated the UPSUS Program or “Special Program” for increasing


rice, corn and soybean in 2015–2019. In this program, rice got the largest portion of the government spending and rice self-sufficiency is expected in 2017, then aim for sustainability. Indonesia targeted to be able to achieve surplus for export after 2017. It means that attention to the rice competitiveness become very important. West Java is a province which will remain as a major contributor to rice production and potentially become a source of rice export in the future, especially because the UPSUS Program on rice was implemented in this province. This study aimed to: (1) analyse the effects of the UPSUS Program on the global competitiveness of rice production in West Java; and (2) estimate the proportion of rice farms that produce competitively and the proportion of the total production that is produced competitively from the implementation of the UPSUS Program in West Java.

2. Methodology

2.1. Data collections

This study is a comparative analysis before and after the implementation of the UPSUS Program. The Panel Petani Nasional (PATANAS) 2015 data collected by the Indonesian Center for Agricultural Socio Economics and Policy Studies (ICASEPS) were used to analyze the conditions before the UPSUS Program. For the post-implementation, a survey was carried out in the same location covering the same household respondents in September to October 2019. The total samples were 288, consisting of 144 samples in 2015 (before the UPSUS Program) and 144 samples in 2019 (after the UPSUS Program). Secondary data were also collected from various sources. Three districts in West Java Province were covered, namely, Subang, Karawang and Indramayu.

2.2. Data analysis

2.2.1. Measurement of competitiveness using Policy Analysis Matrix (PAM) analysis. The PAM tool was employed to assess the impact of the UPSUS Program on the private and social profitability using Private Cost Ratio (PCR) and Domestic Resource Cost Ratio (DRC) of rice production as competitiveness indicators (Table 1). The analysis considered the farm households’ performance before and after the UPSUS Program.

Table 1. Policy Analysis Matrix (PAM)

|                      | Price | Revenue | Tradable inputs | Domestic factors (Non-tradable inputs) | Profit |
|----------------------|-------|---------|-----------------|----------------------------------------|--------|
| Private Prices       | A     | B       | C               | D                                      |        |
| Social Prices        | E     | F       | G               | H                                      |        |
| Divergences          | I     | J       | K               | L                                      |        |

Source: [1,2]

The private profitability or competitive advantage (PCR) calculations show the competitiveness of the rice production, given current technologies, output values, input costs, and policy transfer equal to \( C/(A-B) \). PCR < 1 indicates that the commodity has competitive advantage when produced domestically. Meanwhile, PCR > 1 indicates that the commodity has competitive disadvantage when produced domestically, and neutral condition exist if it is equal to 1. The term private refers to observed revenues and costs reflecting actual market prices received or paid by farmers, merchants, or processors in the rice production system. The actual market prices, thus, incorporate the underlying economic costs and valuations plus the effects of all policies and market failures. DRC as an indicator is used to measure whether a commodity is more profitable when produced domestically or imported and it reflects social profitability or comparative advantage and equal to \( G/(E-F) \). DRC < 1 indicates that the commodity is more profitable when produced domestically. Meanwhile, DRC > 1 indicates that it is less profitable to produce domestically, and a neutral condition exists if it is equal to 1.
2.2.2. Probability distribution of proportion of rice competitiveness analysis. The study used probability distribution analysis of proportion of rice farms that produce competitively and the proportion of the total rice production that was produced competitively. The impact of the UPSUS Program was captured from measurement results of before and after program comparison. This study used the adaptive kernel density estimate given by [5]:

\[
\hat{f}(x) = \frac{1}{\sum_{i=1}^{n} w_i} \sum_{i=1}^{n} w_i \frac{K\left(\frac{x-x_i}{h_i}\right)}{h_i}
\]

(1)

where the \(x_i\)'s are the data points (associated with weights \(w_i\)), \(K\) is a kernel function, and \(h_i = h \times \lambda_i\). Equation (1) shows that the local bandwidth factors are proportional to the square root of the underlying density functions at the sample points [5]:

\[
\lambda_i = \lambda (x_i) = \left(\frac{G}{\hat{f}(x_i)}\right)^{0.5}
\]

(2)

\(G\) is the geometric mean value of all \(i\) over the estimate of pilot density \(f^*(x)\). The estimate of pilot density is a standard fixed bandwidth kernel density estimate obtained with \(h\) as bandwidth. The variability bands are based on the following expression for the variance of \(\hat{f}(x)\) given in [6]:

\[
V\left(\hat{f}(x)\right) = \left(\sum_{i=1}^{n} \frac{w_i^2}{n}\right) \int_{-\infty}^{\infty} \frac{f(x)}{h_k(x)} K^2(s) ds
\]

(3)

Where \(s\) is standard error. The \(h\) parameter that controls the number of standard errors to add around \(\hat{f}(x)\) to constructs the variability bands and specified by the user.

2.2.3. Simulation analysis. In this section, three analyses were conducted. The first was the effect of output per farm (kg/farm) or yield per ha (kg/ha) and price changes on comparative and competitive advantages; the second was the expected effect of the UPSUS Program implementation on comparative and competitive advantages, and the third was the expected effect of the UPSUS Program implementation on West Java rice sustainable self-sufficiency and export objectives. In the first analysis, to capture the impact of price and yield fluctuations on comparative advantage and competitiveness of rice production, simulation analysis of the Break Event Yield (BEY) and the Break Event Price (BEP) was done. The second and third analyses began from the consideration that the aim of the UPSUS Program is not only to increase rice production by increasing both the harvested area and productivity, but also sustainable rice self-sufficiency and rice expected to be an export commodity in the medium term. To achieve these targets, improvement of the competitive and comparative advantages levels of rice production is very important.

The study evaluated the effect estimation of the UPSUS Program on the ability to compete and maintain sustainable rice self-sufficiency and the potential for West Java rice exports in the medium term 2020–2025. Evaluation of the estimated impact was carried out using three scenarios. Scenario 1 was based on the assumption under a condition when the UPSUS Program continues to run as it is today. The government has not made improvements in the implementation of the UPSUS Program. Scenario 2 was based on the assumption where the UPSUS Program continues to run and the government realizes that the West Java Province has an average Cropping Intensity (CI) of more than 2 and has difficulty in increasing it, so the implementation of the UPSUS Program is more focused on maintaining the area of planting and increasing productivity. Efforts to achieve increased productivity are carried out using technology that has been mastered by farmers, namely, Integrated Crop Management (ICM) with the level of use of inputs as has been done by farmers today, so there is no change in input use. In this regard, the government seeks to increase the effectiveness of program
guidance and extension by increasing the number of agricultural extension workers who are skilled and continue to maintain or repair irrigation networks. Scenario 3 was based on the assumption of Scenario 2 coupled with withdrawing agricultural machinery and equipment that are not suitable for location and replacing them with more suitable ones and conducting guidance and extension that is more focused on efforts to reduce the level of yield loss during harvest and post-harvest handling.

3. Results and discussion

3.1. Financial and economic profitability of rice farms before and after the UPSUS Program
The result of PAM analysis on the rice production after the UPSUS Program in Table 2 shows that rice farming was financially and economically profitable. West Java Province, Indonesia has competitive and comparative advantages to produce rice. After the UPSUS Program implementation, West Java, Indonesia had a competitive advantage to produce rice, as shown by the value of PCR of 0.718, but slightly declined compared to the value before the program (0.645). The value of DRC after the UPSUS Program was 0.948 also slightly declined compared to the value before (0.938). The results of other studies conducted before the UPSUS Program implementation showed that rice farming in West Java had a comparative advantage with DRC values of 0.647 [7] and 0.620 [8]. Those were lower than the DRC value of 0.938 obtained from the present study. One possible reason is the difference in the samples used in these studies. The other reasons are related to the changes in other factors, e.g., prices and technology. In this study, the price of output was lower and the prices of inputs were higher compared to the output and input price levels used in the studies of [7,8]

Table 2. Financial and economic profitability of rice per farm and per hectare before and after the UPSUS Program (IDR million), 144 farmer respondents, West Java, Indonesia, 2019

| Item            | Before UPSUS Program | After UPSUS Program |
|-----------------|----------------------|---------------------|
|                 | Private price | Social price | Divergence | Private price | Social price | Divergence |
| Revenue (Per Farm (0.95 ha)) | 40.15 | 31.87 | 8.28 | 34.18 | 29.94 | 4.24 |
| Tradeable Cost  | 4.96 | 6.95 | -1.99 | 3.94 | 6.33 | -2.40 |
| Non-Tradeable Cost | 22.71 | 23.38 | -0.67 | 21.70 | 22.37 | -0.67 |
| Profit (Per Farm (0.85 ha)) | 12.48 | 1.54 | 10.94 | 8.54 | 1.23 | 7.31 |
| PCR             | 0.645 | 0.718 |
| DRC             | 0.938 | 0.948 |

| Item            | Before UPSUS Program | After UPSUS Program |
|-----------------|----------------------|---------------------|
|                 | Private price | Social price | Divergence | Private price | Social price | Divergence |
| Revenue (Per ha) | 42.26 | 33.54 | 8.72 | 40.21 | 35.22 | 4.99 |
| Tradeable Cost  | 5.22 | 7.31 | -2.09 | 4.63 | 7.45 | -2.82 |
| Non-Tradeable Cost | 23.91 | 24.61 | -0.71 | 25.53 | 26.32 | -0.79 |
| Profit (Per ha) | 13.14 | 1.62 | 11.51 | 10.05 | 1.45 | 8.60 |
| PCR             | 0.645 | 0.718 |
| DRC             | 0.938 | 0.948 |

3.2. Probability distribution of competitive rice farms and competitively produced rice volume
Using kernel density estimation, the distribution of competitiveness scores of sample farms before and after the UPSUS Program were summarized in Table 3. Overall, the results confirm that many rice farmers in West Java can produce rice competitively. However, the share of individual farms in the sample which have a competitive advantage of about 81.94% after the UPSUS Program was less than before the UPSUS Program with a share of about 89.58%. The share of total production volume after the UPSUS Program was about 86.56%; while before the UPSUS Program, it was 87.71%. That means 86.56% and 87.71% of total production volume after and before the UPSUS Program in the individual sample of farms were produced competitively.
The kernel density estimation result of comparative advantage shows that after the UPSUS Program, 61.81% of individual farms in the sample were competitive with the share of the total production volume of 59.75%. Before the UPSUS Program implementation, the share of the individual farms in the sample that have DRC < 1 was 79.17% with the share of the total production volume in the sample of 73.74%. More individual farms in the samples operated their farms competitively; moreover, higher production volume was produced competitively before the UPSUS Program compared to after the program.

The percentage of the number of the farms in the sample that had a comparative advantage decreased by 7.64%; while the total production volume produced in the sample decreased by 1.15%. Meanwhile, the percentage of the number of farms in the sample that had a comparative advantage decreased by 17.36%; while the total production volume produced in the sample decreased by 13.99%. It shows that subsidies and government assistance provided to the farmers in the implementation of the UPSUS Program mean to increase the protection of rice farmers, even though they have resulted in decreasing comparative advantage.

**Table 3.** Summary of competitive and comparative advantages results by share of individual farms and total rice production before (2015) and after (2019) the UPSUS Program implementation, 144 farmer respondents, West Java, Indonesia

| Item                                                      | Competitive Before | Competitive After | Uncompetitive Before | Uncompetitive After |
|-----------------------------------------------------------|--------------------|-------------------|----------------------|---------------------|
| Share of individual farms in the sample (%)               | 89.58              | 81.94             | 10.42                | 18.06               |
| Share of total production of farms in the sample (%)      | 87.71              | 86.56             | 12.29                | 13.44               |
| Share of individual farms in the sample (%)               | 79.17              | 61.81             | 20.83                | 38.19               |
| Share of total production of farms in the sample (%)      | 73.74              | 59.75             | 26.26                | 40.25               |

3.3. Effects of yield and prices changes on comparative and competitive advantages

The results of BEY and BEP analyses in rice production after the UPSUS Program show that West Java Province of Indonesia still has the comparative advantage to produce rice as import substitute if yield of rice in the UPSUS Program farms is not less than 6,449.65 kg/farm or 6,766.03 kg/ha. In other words, at the given price, West Java, Indonesia will still maintain its comparative advantage provided by the yield of rice if not less than 84.56% of the existing output per farm or 75.45% of existing yield per ha in the UPSUS Program. Similarly, West Java, Indonesia still has a competitive advantage even though the yield reached only 62.88% of the existing output per farm or 56.92% of existing yield per hectare in the UPSUS Program. Considering the price fluctuation at a given yield, West Java Province of Indonesia will maintain its comparative advantage of rice production in the UPSUS Program farms as the import price (border price) is going to decline by 17.81% or around IDR 3,124.09 per kg under the UPSUS Program. Producing rice through the implementation of the UPSUS Program has a competitive advantage even if the market price go down up to 62.51% (IDR 2,802.97 per kg).

From the analysis, it can be concluded that West Java Province still has comparative and competitive advantages when the output (per farm) does not go down to more than 15% and 37%, and the yield (per ha) does not go down to more than 43% and 24%. In the same manner, the effect of the price fluctuation is the same as West Java will still have comparative and competitive advantages if the border price does not decrease to more than 17% and the domestic price does not lessen to more than 38% after the UPSUS Program.

3.4. Expected effects of UPSUS Program implementation on comparative and competitive advantages

Scenario 1 in A.1 shows that the competitive advantage (PCR) will increase even though there was no improvement in the implementation of the UPSUS program. The share of farmers’ number who are operating competitively will increase, while the volume of production that would be produced
competitively will increase. In contrast, the comparative advantage, the share of farmers operating competitively, and the total volume of production that is produced competitively will decreases. The government's target to increase production, preserve rice self-sufficiency, and increase surpluses and exports in the future through the implementation of the UPSUS program will not be achieved.

Comparative advantage will not change if the improvements in the effectiveness of the implementation of the UPSUS program are minimal. Based on the analysis of scenario 2, competitive advantage shows an increase in line with the increase in assistance and protection provided in the implementation of this program. However, comparative advantage will not decline. The targets to maintain sustainable self-sufficiency and increase rice surpluses and exports in the future are unlikely to be achieved.

Based on the analysis of scenario 3, what the government does will affect the increase in competitive and comparative advantages. The comparative advantage, the proportion of farmers who can operate competitively, and the production volume produced competitively will increase. The results of the analysis show that the target of increasing production, preservation of self-sufficiency, and exports of rice in the future are likely to be achieved. Based on the results of this analysis, it can be deduced that if the government wants to achieve the target to increase production, preserve rice self-sufficiency, and increase rice surpluses and exports in the future, it has to improve and increase the adoption, adequacy, and effectiveness of implementing the UPSUS Program.

3.5. Expected effects of the UPSUS Program implementation on West Java rice sustainable self-sufficiency and export

The results of the analysis in A.2 show that under scenario 1, if the growth rate of harvested area and the growth rate of productivity can be maintained at an average of 0.58% and 0.85% per year, respectively, with no improvement in the implementation of the UPSUS program, rice production in West Java will increase by an average of 1.43% per year. But, with an increase in the rice consumption volume by average of 1.89% per year, West Java will experience a decline in the rice surplus by an average of 3.43% per year in 2020–2025. The sustainability of West Java rice self-sufficiency is in a vulnerable position, and the possibility to export is very small. Scenario 2 shows the analysis results in which West Java rice production exhibits an increase by an average of 1.68% per year, with a rate of consumption increase of 1.89% per year. Under this scenario, the rice surplus only increases by an average of 0.02% per year. West Java can maintain the sustainability of rice self-sufficiency, but the potential for exports is relatively small. Scenario 3 shows the results of the analysis wherein West Java rice production posts an increase by an average of 1.75% per year, with an increasing rate of consumption of 1.89% per year. Under this scenario, the rice surplus increases by an average of 0.71% per year. West Java can maintain the sustainability of rice self-sufficiency and has the potential to export rice. The results of this analysis are consistent with the results of analysis from A.1, which shows that to maintain rice self-sufficiency in West Java, and then increase surpluses and export in the future, improvements in the implementation and improvement in the effectiveness of the UPSUS Program must be carried out thoroughly.

4. Conclusion and policy recommendations

4.1. Conclusion

Rice farming in the study sites was both financially and economically profitable before and after the implementation of the UPSUS Program. The value of PCR was 0.718 and 0.948 for DRC which means that rice farmers were able to generate financial profit for their farms and as import substitute government, the government was able to save foreign exchange. These estimates, however, were slightly less favorable than “before” estimates of 0.645 for PCR and 0.938 for DRC implying the slight decline in competitive and comparative advantages after the program.

Based on kernel density estimation, rice farms which have competitive advantage comprised 81.94% after the UPSUS Program and 89.58% before the program. Production share of competitive
farms was 86.56% and 87.71% before and after the program, respectively. A similar pattern was revealed in terms of comparative advantage. There were relatively more farms which have comparative advantage and bigger share in the rice output produced competitively before rather than after the program. Rice farms which had comparative advantage comprised 61.81% after and 79.17% before the program, and production share of competitive farms was 59.75% after and 73.74% before the program, respectively.

West Java Province will still have comparative and competitive advantages if the output (per farm) does not go down by more than 15% and 37% of the existing output, respectively, the border price will not decrease by more than 17% of existing border price, and the domestic price will not be lower to more than 38% of the existing farm gate price during the program implementation. If there is no improvement in the implementation of the UPSUS Program (scenario 1), in 2020–2025, the competitive advantage will continue to increase, but comparative advantage will decline. If the improvement in the UPSUS Program will be small (scenario 2), the competitive advantage will continue to increase, but comparative advantage will not change. Under the scenario 3, the improvement of the implementation of the UPSUS Program will cover measures that would increase the adoption and adequacy and effectiveness of the various components, both the competitive and comparative advantages will increase. Projections under scenario 3 showed that West Java rice production will post an increase by an average of 1.75% per year, with an increasing rate of consumption of 1.89% per year, and the rice surplus increasing by an average of 0.71% per year. Thus, West Java can maintain the sustainability of rice self-sufficiency and has the potential to export rice. Under this scenario, the government has to improve the management of implementation of the UPSUS Program and increase the adoption and adequacy and effectiveness of the program components in order to achieve the target of increasing the rice production, maintaining rice self-sufficiency, and increasing surpluses and export of rice.

4.2. Policy recommendations

The following are three policy recommendations to further help and improve the next implementation strategies of the UPSUS Rice Program in West Java: (1) Maintain the area of rice planting and give more focus on higher productivity target. (2) Improve the adequacy and effectiveness of the various components of the program. (3) Improve the provision of other services outside the program components that affect competitiveness.

Appendices

A.1. Expected competitive and comparative advantages effects of the UPSUS Program implementation on rice production under scenario 1, 2 and 3, 144 farmer respondents, West Java, Indonesia, 2020–2025

| Year | PCR Average Share of farms in the sample (%) | PCR Competitive | Uncompetitive | DRC Average Share of farms in the sample (%) | DRC Competitive | Uncompetitive |
|------|--------------------------------------------|-----------------|---------------|--------------------------------------------|-----------------|---------------|
|      |                                            |                 |               |                                            |                 |               |
| 2020 | 0.68                                       | 95.14           | 4.86          | 0.96                                       | 61.11           | 38.89         |
| 2021 | 0.66                                       | 95.83           | 4.17          | 0.96                                       | 59.72           | 40.28         |
| 2022 | 0.64                                       | 96.53           | 3.47          | 0.97                                       | 57.64           | 42.36         |
| 2023 | 0.62                                       | 97.22           | 2.78          | 0.97                                       | 56.94           | 43.06         |
| 2024 | 0.60                                       | 97.92           | 2.08          | 0.98                                       | 56.25           | 43.75         |
| 2025 | 0.58                                       | 97.92           | 2.08          | 0.98                                       | 54.86           | 45.14         |

| Year | Share of total production of farms in the sample (%) | Share of total production of farms in the sample (%) |
|------|-----------------------------------------------------|-----------------------------------------------------|
|      |                                                     |                                                     |
| 2020 | 0.68                                                 | 92.66                                               | 7.34                                               | 0.96                                     | 58.55                                               | 41.45                                               |
| 2021 | 0.66                                                 | 93.75                                               | 6.25                                               | 0.96                                     | 56.29                                               | 43.71                                               |
| 2022 | 0.64                                                 | 94.16                                               | 5.84                                               | 0.97                                     | 55.68                                               | 44.32                                               |
| 2023 | 0.62                                                 | 96.43                                               | 3.57                                               | 0.97                                     | 54.42                                               | 45.58                                               |
| 2024 | 0.60                                                 | 97.82                                               | 2.18                                               | 0.98                                     | 53.67                                               | 46.33                                               |
| Year | Harvested Area (1,000 ha) | Productivity (tons/ha) | Paddy Production (1,000 tons) | Rice Production (1,000 tons) | Rice Consumption (1,000 tons) | Surplus/Deficit (1,000 tons) |
|------|--------------------------|------------------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|
| 2020 | 2,145.34                 | 5.99                   | 12,845.24                     | 8,059.10                    | 7,321.99                      | 737.11                      |
| 2021 | 2,137.62                 | 6.04                   | 12,907.80                     | 8,098.35                    | 7,459.20                      | 639.16                      |
| 2022 | 2,170.01                 | 6.09                   | 13,214.78                     | 8,290.95                    | 7,599.53                      | 691.42                      |
| 2023 | 2,162.20                 | 6.14                   | 13,279.14                     | 8,331.33                    | 7,743.08                      | 588.25                      |
| 2024 | 2,194.97                 | 6.19                   | 13,594.95                     | 8,529.47                    | 7,889.93                      | 639.54                      |
| 2025 | 2,187.07                 | 6.25                   | 13,661.16                     | 8,571.01                    | 8,040.17                      | 530.85                      |

Growth rate (%/year)

| Year | Harvested Area (1,000 ha) | Productivity (tons/ha) | Paddy Production (1,000 tons) | Rice Production (1,000 tons) | Rice Consumption (1,000 tons) | Surplus/Deficit (1,000 tons) |
|------|--------------------------|------------------------|-------------------------------|-----------------------------|-------------------------------|-----------------------------|
| 2020 | 2,145.34                 | 6.02                   | 12,909.00                     | 8,099.11                    | 7,321.99                      | 777.12                      |
| 2021 | 2,137.62                 | 6.08                   | 13,004.03                     | 8,158.73                    | 7,459.20                      | 699.53                      |
| 2022 | 2,170.01                 | 6.15                   | 13,346.30                     | 8,373.47                    | 7,599.53                      | 773.93                      |
| 2023 | 2,162.20                 | 6.23                   | 13,444.55                     | 8,435.11                    | 7,743.08                      | 692.03                      |
| 2024 | 2,194.97                 | 6.29                   | 13,798.41                     | 8,657.12                    | 7,889.93                      | 767.20                      |
| 2025 | 2,187.07                 | 6.36                   | 13,899.99                     | 8,720.85                    | 8,040.17                      | 680.69                      |

Growth rate (%/year)
| Year | Income | growth_rate |
|------|--------|-------------|
| 2023 | 2,162.20 | 0.58 |
| 2024 | 2,194.97 | 1.18 |
| 2025 | 2,187.07 | 1.75 |

Growth rate (%/year)

| Year | Income | growth_rate |
|------|--------|-------------|
| 2023 | 6.31 | 7,743.08 |
| 2024 | 6.37 | 8,840.39 |
| 2025 | 6.46 | 9,006.78 |

References

[1] Monke E A and S K Pearson 1989 The Policy Analysis Matrix for Agricultural Development (New York: Cornell University Press)

[2] Pearson S K, Gotsch C and Bahri S 2005 Aplikasi Policy Analysis Matrix Pada Pertanian Indonesia (Jakarta: Penerbit Yayasan Obor Indonesia)

[3] Rosenblatt M 1956 Annals of Mathematical Statistics 27 832–37

[4] von Cramon-Taubadel S and Nivyevskiy O 2008 Agricultural Competitiveness World Bank Report No. 44843-UA

[5] van Kerm 2003 Adaptive Kernel Density Estimation 9th UK Stata Users meeting paper (London: Royal Statistical Society) pp 19–20

[6] Burkhauser R V, Crews A D, Daly M C and Jenkins S P 1999 J. Appl. Econom. 14 253–72

[7] Antriyandarti E 2015 J. Rural Probl. 51 74–85

[8] Agustian A, Hermanto, S Friyatno, A M Ar-Rozi and A Suryana 2014 Competitiveness of Some Foods Strategic Commodity Policy Analysis Research Report (Bogor: Ministry of Agriculture, Center for Agricultural Socio Economic and Policy Studies)