Determinants of Indonesian Sugar Import

Winni Putri Inayaturrohmah[1], Istiqomah[2*], Ratna Setyawati Gunawan[3]

[1,2,3]Department of Economics and Development Studies, Jenderal Soedirman University, Indonesia
E-mail: [1]winniputriii@gmail.com, [2]istiqomah@unsoed.ac.id, [3]ratna.gunawan@unsoed.ac.id
*Corresponding author

Abstract

Indonesian sugar imports have increased due to a steady increase in sugar consumption, while domestic sugar output has increased but has not kept pace with consumption. This study aims to examine the impact of sugar consumption, income per capita, sugarcane harvested area, and sugarcane productivity on sugar imports in Indonesia. The data in this study include time series data from 1995 to 2021 that were analyzed using multiple regression. Sugar consumption and income per capita have a statistically significant positive effect on sugar import, whereas sugarcane harvested area and sugarcane productivity significantly negatively affect sugar import. Several policy options for reducing sugar imports are recommended, including reducing sugar consumption through education and healthy lifestyle programs, extending sugarcane-harvested areas, and rejuvenating and building new sugar mills.

Keywords:
sugar import; sugar consumption; income per capita; sugarcane harvested area; sugarcane productivity

INTRODUCTION

The agricultural sector has a significant contribution to national income. Based on data from the Central Statistics Agency (BPS), in 2022, the agricultural, forestry, and fishery sectors contributed 12.40 percent to the Gross Domestic Product (GDP). The agricultural sector's contribution to GDP at current prices was Rp 2,429 trillion, the third largest after the manufacturing sector and wholesale and retail trade, car and motorcycle repairs. Plantation crops are the most significant contributor to the added value of the agricultural sector. However, this is not the case for sugarcane, although sugar plays a very strategic role with various product variants, including consumption of sugar, bioethanol, bioelectricity, chemicals, and bio manure (Solomon, 2016). The productivity of sugarcane plantations in Indonesia continues to decline, resulting in lower domestic sugar production and the need for imports to meet national sugar consumption. This condition can put a strain on the balance of payments.

Furthermore, sugar import has a significant negative impact on local farmers. Based on the simulation of Fudhlaa et al. (2021), an increase in sugar imports will significantly decrease the income of sugarcane farmers. Indonesia is the third-largest consumer of sugar in the world and a significant sugar importer (Solomon et al., 2016). This is because Indonesia's sugar consumption continues to rise, while domestic sugar production increase cannot keep up. Import is thus required to ensure food security (Popescu, 2022). Sugar imports into Indonesia increased from 2009 to 2021. The highest import volume in the last ten years was 5.54 million tons in 2020. In 1930, Indonesia experienced a sugar heyday, propelling it to the world's second-largest sugar-exporting country after Cuba (Marpaung et al., 2011). However, sugar production in Indonesia has been volatile over the last few years, with production falling short of consumption.

Import is determined mainly by income; when there is an increase in income, import will also increase. Domestic demand, which is affected by population size, significantly impacts imports. Foreign exchange rates also affect imports. An increase in the value of foreign currencies relative to the rupiah causes an increase in the price of imported goods, as many domestic products contain a significant number of imported components. Consequently, domestically produced items containing imported components will also become more costly. Sugar imports based on Rahayu (2017), Hairani et al. (2014), Rumánková & Smutka (2013), and Nurjanah (2015) are influenced by sugar consumption and income per capita. As the population increases, so does the demand for sugar, while domestic industries such as food and beverage manufacturing and pharmaceuticals also continue to expand.

Hermawan & Rasbin (2012) argue that the decline in sugar production is due to the limited development of new sugarcane plantations, the conversion of agricultural land for non-agricultural needs, and competition with other commodities. A reduction in agricultural land area will affect output. When the quantity of production exceeds the quantity of demand, a shortage exists, encouraging imports. In Indonesia, sugarcane plantations are divided into two categories, community plantations and commercial

plantations, based on their cultivation method. The large plantations are then separated into large private plantations and large state plantations. Until 2021, the total sugarcane area in Indonesia was 449 thousand hectares.

Aside from rebuilding old sugar mills, it is also essential to focus on the productivity of sugarcane plantations to improve sugar production on farms. The low use of technology in farming and the inefficiency of sugar mills led to a drop in sugarcane productivity (Yunitasari et al., 2015). Sugarcane in Indonesia has a low level of productivity and ranks 55th in the world, indicating that agricultural technology innovation is required to increase sugarcane productivity (Ministry of Agriculture, 2019).

Previous research analyzed various factors that affect sugar imports, including income (Hairani et al., 2014; Rahayu, 2017; Najafi et al., 2020), the exchange rate (Najafi et al., 2020; Saputra & Swara, 2014), sugar consumption (Hairani et al., 2014; Muhaimin & Sari, 2019; Rahayu, 2017; Saputra & Swara, 2014), domestic sugar production/stock (Fuller et al., 2019; Mudzofar & Bowo, 2020; Muhaimin & Sari, 2019; Rahayu, 2017; Saputra & Swara, 2014). Despite the importance of sugarcane productivity and harvested area, to the best of the authors' knowledge, the previous studies did not investigate these variables as determinants of sugar import.

This study examines whether sugar consumption, income per capita, sugarcane harvested area, and sugarcane productivity affect the volume of imports in Indonesia during 1995-2021. Therefore, this study contributes theoretically to the existing literature by introducing new independent variables, which is extremely useful for formulating policies to reduce sugar import dependency.

METHODS

This study employs a quantitative methodology and secondary data sources. The secondary data includes sugar consumption, income per capita, sugarcane harvested areas, and productivity. The data were collected through the official website of the Central Statistics Agency, the Ministry of Agriculture, and the USDA Foreign Agricultural Service.

Indonesia's sugar imports are measured in tons from 1995 through 2021. Sugar consumption includes the direct sugar consumption by households and the indirect sugar consumption. Income per capita is Gross Domestic Product (GDP) per capita based on constant prices calculated from the total GDP for a given year divided by the total population. *Land* is the area farmers use to cultivate sugarcane and is measured in hectares (Ha). Productivity is the production of sugar from large state sugarcane plantations, large private plantations, and smallholder plantations in Indonesia, measured in tons per ha.

This study applied Multiple linear regression analysis to time series data to examine the effect of sugar consumption, income per capita, sugarcane harvested area, and sugarcane productivity on sugar imports in Indonesia. Because multicollinearity and autocorrelation were detected after analyzing absolute data, the data were then converted to the natural logarithm (ln) with the following model:

$$lnM_t = \alpha + \beta_1 lnCON_t + \beta_2 lnINC_t + \beta_3 lnLAND_t + \beta_4 lnPROD_t + \varepsilon_t$$

Where:

M   = sugar import
CON = sugar consumption (ton)
INC   = income per capita (Rupiah)
LAND = sugarcane harvested area (Ha)
PROD = sugarcane productivity (ton/Ha)

The ordinary least squares (OLS) is used to estimate the multiple regression model. This method aims to find the smallest possible residual value through the sum of the residual squares. This OLS model is ideal with the Gauss-Markov theorem which will produce an estimator that is unbiased, linear and has a minimum variance or best linear unbiased estimators (BLUE). The Jarque-Bera (J-B) test was used in this study to determine normality. The VIF method was used to detect multicollinearity, which indicates the degree to which an independent variable is explained by other independent variables. The Glejser method was used to detect the presence of heteroscedasticity in the model. The Durbin Watson (DW) test is used to determine whether there is a correlation between the residuals in period t and period t-1 in a regression model. The coefficient of determination, F test, and t test were then performed.

RESULT AND DISCUSSION

Indonesia is listed as one of the world's major importers of sugar. The sugar industry in Indonesia, which was thriving then, is in a drastically different state now. In 1930, the success of the sugar trading industry made Indonesia the second-largest sugar exporter in the world after Cuba (Marpaung et al., 2011). Indonesia began to import sugar in 1967 and continues to do so today (Muhaimin & Sari, 2019). Every year, Indonesia imports sugar because domestic production is insufficient to meet domestic demand. Indonesia imports raw, refined, and white crystal sugar (Arifin, 2008). The government permits sugar import through the Ministry of Trade by adhering to the Minister of Trade's Regulation (Ministry of Trade, 2015) No.117/M-DAG/PER/12/2015. Since the domestic supply of sugar is insufficient to meet demand, importing sugar is possible. However, after imports were made, Indonesia's sugar balance was in surplus due to the discrepancy between supply and demand. According to the 2016 Food Consumption Bulletin, there was a surplus in the sugar balance of around 1.43 million tons in 2014 and approximately 1.04 million tons in 2015.

As shown in Figure 1 2008, imports decreased significantly by 9.8 thousand tons compared to the previous year of 2.91 million tons. From 1995 to 2021, the year 2020 saw the highest sugar imports. In 2019, Indonesia's sugar imports decreased considerably from 5.02 million tons in 2018 to 4.09 million tons. In 2020, however, it increased significantly. Despite fluctuations, sugar imports into Indonesia tend to increase. Prabowo (2014) stated that according to the criteria in Law No. 18 of 2012 concerning Food,

sugar is a staple food ingredient for people in Indonesia after rice, chicken eggs, tofu and tempeh, broiler chicken, fresh mackerel, and fresh milkfish. Sugar is also required by several industries, including the food and beverage and pharmaceutical industries. The sugar industry, which has existed since the Dutch colonial period, uses sugarcane as a raw material for its production, and it is now expanding into refined sugar production alongside the development of the manufacturing industry.

Figure 1. Indonesia's Sugar Import 1995-2021 (in tons)
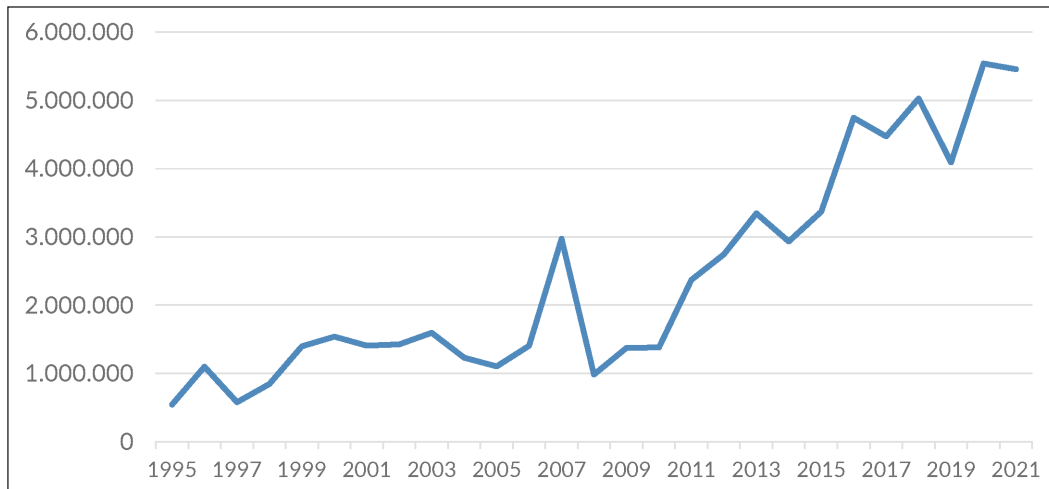
Source: Statistic of Indonesia 2011-2022

Domestic sugar consumption continues to rise, particularly among households. However, overall national sugar consumption, including household and industrial sugar consumption, is increasing. According to Ingesti & Handojo (2019), the increase in income was one of the factors that contributed to the increase in domestic sugar consumption. Figure 2 depicts Indonesia's sugar consumption from 1995 to 2021.

Figure 2. Indonesia's Sugar Consumption 1995-2021 (in tons)
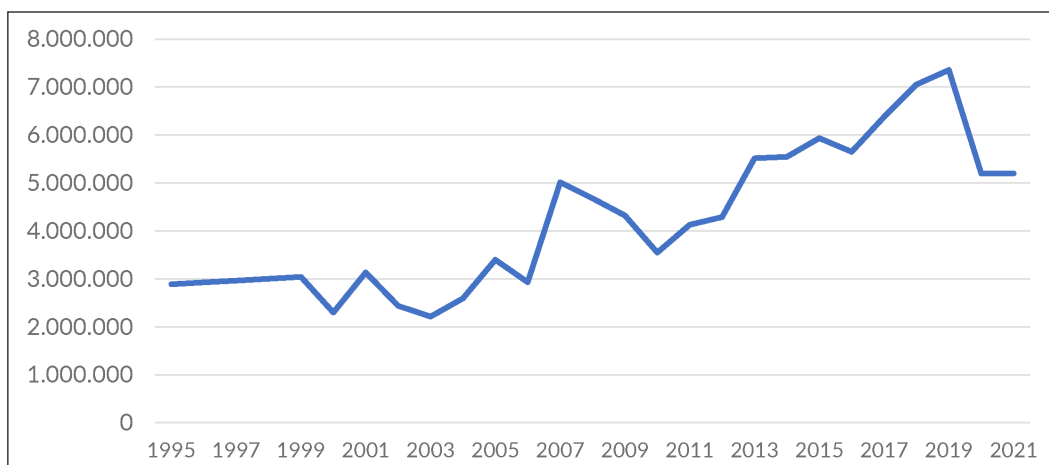
Source: USDA (2010-2021) & Central Bureau of Statistics (2011)

Figure 2 indicates that from 1995 to 2019, sugar consumption in Indonesia tends to increase. Nevertheless, in 2020, the figure decreased significantly. The level of income per capita describes the people's prosperity. In other words, rising income per capita means people can consume goods and services in larger quantities and/or higher quality. As shown in Table 1, Indonesia's income per capita increases yearly. Indonesia's GDP per capita at constant prices in 2021 represents its most significant achievement. In 2020, Indonesia's sugar imports reached a record high of 5.54 million tons.

**Table 1. Income per capita and Sugar Import in Indonesia 2010-2021**

Year	Income per capita (Rupiah)	Sugar Import (Ton)
2010	28,778,200	1,382,525
2011	30,115,400	2,371,250
2012	31,484,500	2,743,778
2013	32,781,000	3,343,803
2014	33,965,400	2,933,823
2015	35,161,900	3,369,941
2016	36,468,600	4,746,047
2017	37,851,400	4,472,179
2018	39,340,600	5,028,854
2019	40,844,000	4,090,053
2020	57,566,813	5,539,679
2021	61,428,152	5,455,144

Source: Statistics of Indonesia 2011-2022

Java has numerous sugarcane centers based on sugarcane production, harvested area, and the number of sugarcane producers (Ingesti & Handojo, 2019). Sugarcane planting can take place on either paddy fields or dry areas. Sugarcane productivity potential is generally higher in paddy fields than in dry fields. The primary water source for dry fields is rainfall, which is only available during the rainy season. Therefore, the distribution and frequency of water cannot be controlled, and the planting technique requires specific care. Sugarcane acreage can be expanded on dry fields since irrigation land for sugarcane is becoming increasingly scarce owing to competition from other agricultural commodities (Tando, 2017).

Due to the lack of expansion of sugarcane plantations, the emergence of new sugar mills has not increased production. From 2009 to 2019, eleven new sugar mills were constructed on Java, although sugar production has declined from 2.59 million tons in 2012 to 2.22 million tons in 2019 (Association, 2020). The development of sugarcane harvested area in Indonesia can be seen in Figure 3.

Figure 3. Sugarcane harvested Area in Indonesia 1995-2021 (in 000 Ha)
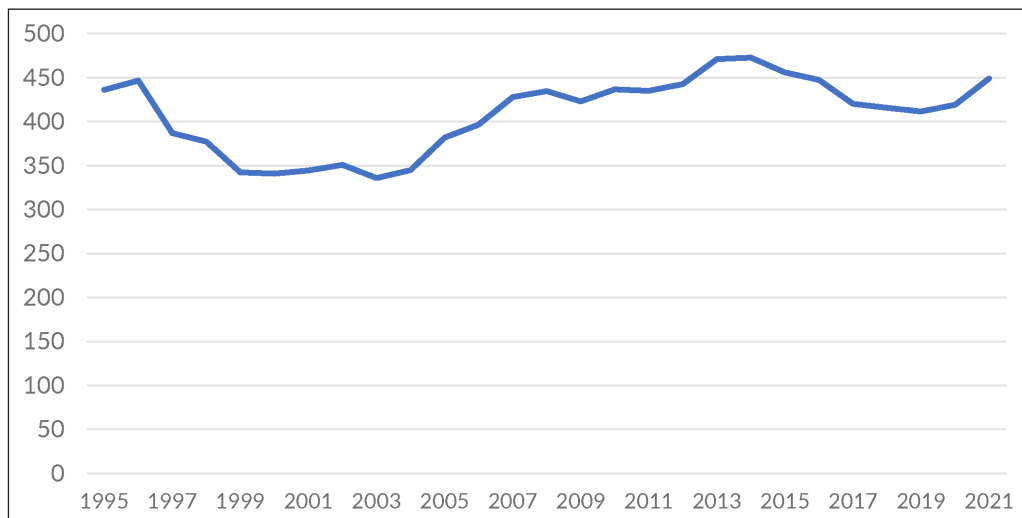
Source: Statistics of Indonesian Sugarcane (2012-2022)

As shown in Figure 3, the area of sugarcane plantations in Indonesia decreased from 472,68 thousand hectares in 2014 to 411,44 thousand hectares in 2019 but increased in 2020 and 2021. In 2018, private plantations covered 110,98 thousand hectares, whereas large state plantations covered only 68,93 thousand hectares, and smallholder plantations dominated the total sugarcane area of 235,76 thousand hectares.

The productivity of sugarcane is one of the issues associated with sugar production. One reason Indonesia's sugar production has not grown significantly is low sugarcane productivity. Low sugarcane production will reduce the availability of raw materials for the sugar industry, resulting in suboptimal output in quantity and quality. Low sugarcane productivity can result in a decline in the domestic sugar industry's performance (Zainuddin & Wibowo, 2018; Ingesti & Handoyo, 2019).

Indonesia's sugarcane productivity is relatively small compared to other countries. Based on Ministry of Agriculture (2019), sugarcane productivity in Indonesia ranks 55th in the world. After implementing the sugarcane Community Intensification (TRI) program in 1975, sugarcane productivity continued to decline due to producers' tendency to prioritize sugarcane production volume over sugar content. In Indonesia, the highest sugarcane yield recorded was 12 tons/ha in 1970. However, achieving 7 tons/ha of sugarcane productivity in recent years has become increasingly challenging. Figure 4 depicts the evolution of Indonesian sugarcane productivity from 1995 to 2021.

From 1995 to 2021, as depicted in Figure 4, sugarcane yields in Indonesia fluctuated between 4 and 6 tons per hectare. Sugarcane yields have always been 6 tons per hectare. Figure 4 also demonstrates that the trend of sugarcane yield has increased but tends to plateau. This result indicates that sugarcane productivity in Indonesia has changed little over the past quarter-century. According to the Indonesian People's Sugarcane Farmers Association, this condition results from the crisis of superior seedlings, demanding access to financing, a need for plant-cutting personnel, and ever-shrinking land resources.

Figure 4. Indonesia's Sugarcane Productivity 1995-2021 (ton/ha)
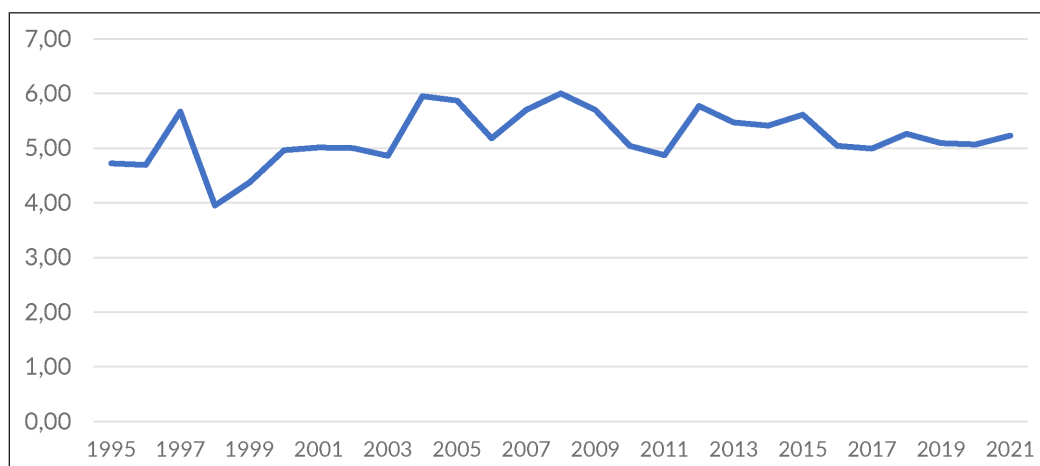
Source: Ministry of Agriculture (2020)

This study uses the Ordinary Least Squares (OLS) model to analyze the factors that influence sugar imports in Indonesia. Because absolute data analysis revealed multicollinearity and autocorrelation, the data were converted to the natural logarithm (ln). After converting the data to natural logarithms, the analysis reveals that the OLS model passes all classical assumption tests and has a high adjusted R squared value of 80.6103%. Table 2 displays the estimation result of the regression model.

Table 2. Estimation of Multiple Linear Regression Model

Variable	Coefficient	t-Statistic	p-value
C	18.43471**	2.21863	0.0371
ln(CON)	0.854496**	2.687477	0.0135
ln(INC)	0.405403***	4.817910	0.0001
ln(LAND)	-1.662032**	-2.109358	0.0465
ln(PROD)	-1.256813*	-1.883758	0.0729

Table 2 shows that all independent variables (sugar consumption, income per capita, sugarcane harvested area, and sugarcane productivity) significantly impact sugar import. The t-test indicates that sugar consumption and income per capita positively affect sugar import, while sugarcane harvested area and productivity have a negative effect.

The result indicates that sugar consumption has a positive impact on sugar import. This result implies that sugar imports will increase as sugar consumption rises. This finding supports the first hypothesis. The result of this study also supports Hairani et al. (2014) and Saputra & Swara (2014) that sugar consumption positively affects sugar imports. This condition is because sugar consumption reflects sugar demand. If an adequate supply does not meet the high demand for sugar, imports will increase. Sugar demand may rise due to lifestyle changes (Sugiyanto, 2007). The agricultural sector is vital as an upstream industry that provides raw materials for various industries, such as food and beverage.

In addition to necessities, sugar is an essential raw material for the food and beverage processing and pharmaceutical industries. The presence of sugar is almost always inherent in every need and human lifestyle today, both on a large scale in industry and on a small scale in households. In addition, sugar mills in Indonesia import all of their raw materials for raw crystal sugar ((Kurniasari et al., 2015). If sugar consumption continues to rise without sufficient production, sugar import will persist.

This study finds that income per capita positively influences Indonesia's sugar import from 1995 to 2021. This result indicates that rising income per capita will increase sugar imports. This result is consistent with the second hypothesis. It confirms the economic theory, which states that income per capita has a direct relationship with consumption, such as a higher income can result in higher consumption expenditures and vice versa. Household income is closely related to consumption. If there is an increase in income, it will increase spending on consumption. Suriani & Putra (2012) and Saputra & Swara (2014) find that income per capita positively affects domestic sugar demand. When demand for sugar rises but production remains insufficient to meet demand, sugar import will increase.

The result shows that the sugarcane harvested area significantly and negatively impacts sugar imports. This result indicates that the reduction of sugarcane plantations will increase sugar imports. This result corroborates the third hypothesis. The land is one of the critical resources that support the agricultural production. Given that production will become increasingly inefficient as the land narrows, the size of farmland is crucial.

Apriawan et al. (2016) find that increased harvested area increases sugarcane production. However, as population density increases, the harvested area decreases as it is shifted to non-agricultural usage (Pipitpukdee et al., 2020). Furthermore, the area under sugarcane cultivation has been dramatically reduced due to the pressure of cereals and other short-duration crops, resulting in lower sugarcane production (Rahman et al., 2016). The sugar industry requires large quantities of sugarcane of the desired quality to maximize sugar production in quantity and quality. Sugarcane plantations must be expanded to produce more significant quantities of sugar to satisfy this demand. For example, Russia has moved from a sugar importer to an exporter due to increased harvested area and output per hectare (Maitah & Smutka, 2016).

The result indicates that sugarcane productivity has a significant negative influence on sugar import, supporting the fourth hypothesis. This hypothesis was based on the premise that Indonesia's lower sugarcane productivity relative to other nations demonstrates how low sugarcane production is relative to sugar-producing nations such as Brazil and India (USDA, 2018). Increased productivity leads to increased production, which reduces reliance on imported goods (Siringo & Daulay, 2014). However, stagnant sugarcane productivity has been a significant agricultural challenge (Solomon, 2016). Sustainable agro-techniques, climate-robust cultivars, biointensive modules, and need-based equipment must be created for increased sugarcane yield. Reduced production costs, increased sugar content, higher product pricing, and close collaboration between sugar mills and farmers

will contribute to the desired increase in productivity (Arun & Premkumar, 2022). To encourage the growth of the sugar industry, Keerthipala (2016) emphasizes the significance of eco-friendly agricultural practices

CONCLUSION

This study investigates whether sugar consumption, income per capita, sugarcane harvested area, and sugarcane productivity affect the volume of imports in Indonesia during 1995-2021. This study contributes theoretically to the existing literature by introducing new independent variables helpful in formulating policies to reduce sugar import dependency. During 1995-2021, sugar consumption and income per capita had a statistically significant positive effect on sugar import, while sugarcane harvested area and sugarcane productivity had a statistically significant negative effect on sugar import. Since domestic sugar production is insufficient to satisfy Indonesia's growing demand for sugar, import is the optimal solution to this problem. However, it is necessary to make long-term efforts to prevent the continued reliance on sugar imports.

The policy implications of the findings are, among others, the need to control sugar consumption through education and healthy lifestyle campaigns. In addition to import, it is necessary to strengthen the domestic sugar industry by, among other things, establishing or expanding sugarcane plantations based on a comprehensive land suitability analysis and adding and revitalizing sugar mills. Most factories are old and have low productivity rates due to underinvestment. Sugarcane productivity can be increased by applying good agricultural practices and entrepreneurial attitudes. As for limitation, this study utilizes only data on total sugar imports, with no description of the types of sugar imported into Indonesia. If further research can characterize sugar imports, it will be easier to determine which types of sugar imports are the most prevalent each year.

REFERENCES

Apriawan, D. C., Irham, I., & Mulyo, J. H. (2016). Analisis Produksi Tebu dan Gula di PT. Perkebunan Nusantara VII (Persero). *Agro Ekonomi*, *26*(2), 159-170. https://doi.org/10.22146/agroekonomi.17268.

Arifin, B. (2008). Ekonomi Swasembada Gula. *Economic Review*, *211*, 1-12.

Arun, J., & Premkumar, A. (2022). Sugarcane growth in India: Problems and Prospects. *SAARC Journal of Agriculture*, *20*(2), 133–144. https://doi.org/10.3329/sja.v20i2.63575.

Association of Indonesian Sugar. (2020). Reinventing New Sugar Policy Towards National Food Resilience in Commemoration of Historical Milestone. *Proceeding at the National Sugar Summit 2020,* 1-57. AGI IKAGI.

Fudhlaa, A. F., Rachmawati, W., & Retnowati, D. (2021). Analysis of Sugar Import Policy Effects on Sugar Cane Farmer's Income in East Java: A System Dynamic Approach. *IOP Conference Seres: Material Science Engineering, 1072*, 012023. https://doi.org/10.1088/1757-899X/1072/1/012023.

Fuller, K., Kennedy, P. L., Hall, M. D. W., & Rouge, B. (2019). A Determination of Factors Influencing Sugar Trade. *International Journal of Food and Agricultural Economics, 7*(1), 19–29.

Hairani, R. I., Aji, J. M. M., & Januar, J. (2014). Analisis Trend Produksi dan Impor Gula Serta Faktor-Faktor yang Mempengaruhi impor Gula Indonesia. *Berkala Ilmiah Pertanian*, *1*(4), 77–85. https://doi.org/10.2307/1937742.

Hermawan, I., & Rasbin. (2012). Analisis Penggunaan Luas Lahan Tebu dan Padi Terkait dengan Pencapaian Swasembada Gula di Indonesia. *Jurnal Ekonomi & Kebijakan Publik*, *3*(1), 47–63. https://doi.org/10.22212/jekp.v3i1.173.

Ingesti, P. V, & Handojo, B. (2019). Impor Gula Mentah (Raw Sugar) Versus Swasembada Gula. *Majalah Ilmiah Bahari Jogja*, *17*(2), 98–109. https://doi.org/10.33489/mibj.v17i2.214.

Keerthipala, A. P. (2016). Development of Sugar Industry in Sri Lanka. *Sugar Tech*, *18*(6), 612–626. https://doi.org/10.1007/s12355-016-0485-3.

Kurniasari, R. I., Darwanto, D. H., & Widodo, S. (2015). Permintaan Gula Kristal Mentah Indonesia. *Ilmu Pertanian*, *18*(1), 24–30. https://doi.org/doi:10.22146/ipas.6173.

Maitah, M., & Smutka, L. (2016). Restoration and Growth of the Russian Sugar Market. *Sugar Tech*, *18*(2), 115–123. https://doi.org/10.1007/s12355-015-0383-0.

Marpaung, Y. T. F., Hutagaol, P., Limbong, W., & Kusnadi, N. (2011). Perkembangan Industri Gula Indonesia dan Urgensi Swasembada Gula Nasional. *Indonesian Journal of Agriculture Economics*, *2*(1), 1-14. http://doi.org/10.31258/ijae.2.1.1-14.

Ministry of Agriculture. (2019). *Outlook Komoditas Perkebunan Tebu*. Jakarta: Ministry of Agriculture.

Ministry of Agriculture. (2020). *Outlook Komoditas Perkebunan Tebu*. Jakarta: Ministry of Agriculture.

Ministry of Trade. (2015). *Peraturan Menteri Perdagangan No. 117/M-DAG/PER/12/2015 tentang Ketentuan Impor Gula*. Jakarta: Ministry of Trade.

Mudzofar, A., & Bowo, A. P. (2020). Analisis Determinan Impor Gula Indonesia. *EFFICIENT Indonesian Journal of Development Economics*, *3*(3), 880–893. https://doi.org/10.15294/efficient.v3i3.43508.

Muhaimin, W., & Sari, D. (2019a). Factors Affecting the Demand and Import of Indonesian Sugar. *Journal of Global Economics*, *7*(2), 1-3.

Najafi, P., Sani, M. F., Bostan, Y., & Ardakani, F. (2020). Estimation of Iran's Sugar Import Demand Function (ARDL approach). *Journal of Sugar Beet*, *35*(2), 207–216. https://doi.org/10.22092/jsb.2020.127496.1226.

Nurjanah, S. (2015). Faktor-Faktor yang Mempengaruhi Impor Gula di Indonesia. *Economics Development Analysis Journal*, 4(2), 182–191. https://doi.org/10.15294/edaj.v4i2.14822.

Pipitpukdee, S., Attavanich, W., & Bejranonda, S. (2020). Climate Change Impacts on Sugarcane Production in Thailand. *Atmosphere*, *11*(4), 408. https://doi.org/10.3390/atmos11040408.

Popescu, A. (2022). The Importance of Production and Import for Ensuring Food Availability in Romania. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, *22*(1), 533-548.

Prabowo, D. W. (2014). Pengelompokan Komoditi Bahan Pangan Pokok dengan Metode Analytical Hierarchy Process. *Buletin Ilmiah Litbang Perdagangan*, *8*(2), 163–182. https://doi.org/10.30908/bilp.v8i2.81.

Rahayu, S. E. (2017). Analisis Perkembangan Impor Gula di Indonesia. *Jurnal Kajian Ekonomi dan Kebijakan Publik*, *2*(2), 1-10.

Rahman, M. S., Khatun, S., & Rahman, M. K. (2016). Sugarcane and Sugar Industry in Bangladesh: An Overview. *Sugar Tech*, *18*(6), 627–635. https://doi.org/10.1007/s12355-016-0489-z.

Rumánková, L., & Smutka, L. (2013). Global Sugar Market - The Analysis of Factors Influencing Supply and Demand. *Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis*, 463–471. https://doi.org/doi:10.11118/actaun201361020463.

Saputra, I. K. E., & Swara, I. W. Y. (2014). Pengaruh Produksi, Konsumsi, Harga Eceran, Inflasi dan Kurs Dollar AS terhadap Impor Gula Indonesia. *E-Jurnal EP Unud*, *3 (8)*, 356–365.

Siringo, H. B., & Daulay, M. (2014). Analisis Keterkaitan Produktivitas Pertanian dan Impor Beras di Indonesia. *Jurnal Ekonomi dan Keuangan*, *2*(8), 488–499.

Solomon, S. (2016). Sugarcane Production and Development of Sugar Industry in India. *Sugar Tech, 18,* 588-602. https://doi.org/https://doi.org/10.1007/s12355-016-0494-2.

Solomon, S., Swapna, M., Xuan, V. T., & Mon, Y. Y. (2016). Development of Sugar Industry in ASEAN Countries. *Sugar Tech*, *18*(6), 559–575. https://doi.org/10.1007/s12355-016-0497-z.

Sugiyanto, C. (2007). Permintaan Gula di Indonesia. *Jurnal Ekonomi Pembangunan*, *8*(2), 113–127. https://doi.org/doi:10.23917/jep.v8i2.1036.

Suriani, & Putra, J. (2012). Faktor-Faktor yang Mempengaruhi Permintaan Gula di Indonesia. *Jurnal Ekonomika Universitas Almuslim Bireuen-Aceh*, *3*(6), 1–9.

Tando, E. (2017). Review : Peningkatan Produktivitas Tebu (Saccarum Officinarum I.) pada Lahan Kering Melalui Pemanfaatan Bahan Organik dan Bahan Pelembab Tanah Sintesis. *Jurnal Biotropika*, 5(3), 90–96. https://doi.org/10.21776/ub.biotropika.2017.005.03.6.

USDA. (2018). *Indonesia Sugar Annual Report*. USDA Foreign Agriculture Service.

Yunitasari, D., Hakim, D. B., Juanda, B., & Nurmalina, R. (2015). Menuju Swasembada Gula Nasional: Model Kebijakan untuk Meningkatkan Produksi Gula dan Pendapatan Petani Tebu di Jawa Timur. *Jurnal Ekonomi dan Kebijakan Publik*, *6*(1), 1–15. https://doi.org/10.22212/jekp.v6i1.160.

Zainuddin, A., & Wibowo, R. (2018). Analisis Potensi Produksi Tebu dengan Pendekatan Fungsi Produksi Frontir di PT Perkebunan Nusantara X. *Jurnal Pangan*, *27*(1), 33–42. https://doi.org/10.33964/jp.v27i1.404.