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RESEARCH

Export Performance of Biopharmaceutical Products in Indonesia during the Covid-19 Pandemic

Erlambang Budi Darmanto[1]*, Lilis Yuliati[2], Yunita Satya Pratiwi[3]
[1]Department of Economics, Universitas Terbuka, Jakarta, Indonesia
[2]Department of Economics, Universitas Jember, Jember, Indonesia
[3]Department of Food Technology, Universitas Pembangunan Nasional "Veteran" Jawa Timur, Surabaya, Indonesia
*Correspondence: erlambangbudi_d@ecampus.ut.ac.id; Universitas Terbuka, Jakarta, Indonesia
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ABSTRACT
The demand for biopharmaceutical products as herbal products is increasing both in the domestic market and the global market. This study examines the factors that affect the export performance of biopharmaceutical products in Indonesia. The analytical method used is multiple linear regression. The results of the study show that GDP, export prices of biopharmaceutical commodities, and the COVID-19 dummy variable have a significant positive effect on the export performance of Indonesian biopharmaceutical commodities. Meanwhile, the exchange rate variable did not show a significant effect on the export performance of biopharmaceutical commodities. Therefore, the right supply chain structure will encourage the competitiveness of biopharmaceutical commodities in the domestic and global markets, which is also accompanied by product diversification. The fulfillment of national product standardization is also a concern because it is related to the sustainability of marketing biopharmaceutical products in the global market.
Keyword: biopharmaceutical; Covid-19; sustainability; trade

INTRODUCTION
Biopharmaceutical plants consist of thousands of plant species, there are about 40,000 known types of biopharmaceutical plants worldwide and 90% of the total biopharmaceutical plants come from the Asian region.(1) Around 30,000 types of biopharmaceutical plants can be grown and bred in the territory of Indonesia. In Indonesia, only 4% of biopharmaceutical plants have known benefits and are used as the basis for making herbal medicines. Meanwhile, according to statistical data, biopharmaceutical plants in Indonesia are divided into 15 plants, namely Ginger, Turmeric, Galangal, Kencur, Temulawak, Temu Irang, Temu Kunci, Lempuyang, Dringo, Noni, Cardamom, Aloe Vera, Kejibeling, Sambiloto, and Mahkota Dewa.(1,2)

The increase in demand for biopharmaceutical product commodities in the last two years was caused by the COVID-19 pandemic. Thus, the opportunity for biopharmaceutical commodities can increase in line with the amount of demand in the global market.(3-5) The increase in demand and prices for biopharmaceutical products in the global market has a positive impact on the export performance of Indonesian biopharmaceutical products.

Various efforts have been made by the government to increase market share and international market interest in Indonesian biopharmaceutical products in the international market both before the COVID-19 pandemic and after the Covid 19 Pandemic. However, the challenges faced by the Indonesian people to increase exports of Biopharmaceutical products are still very large. Improving the export performance of biopharmaceutical commodities to create Indonesia as a branding commodity on the international market, it will take a long time. The purpose of this study was to determine the factors that determine the export of Indonesian biopharmaceutical products in the world market by considering the impact of the pandemic.

Anggrasari & Mulyo (2019)(6) used the Grubel-Lloyd Index (GLI) method to detect the pattern and dominance of the spice trade in Indonesia. Then to determine the trade performance and market share of Indonesian spices, the Intra-Industry or Inter-Industry Trade Analysis method is used. They show that trade in Indonesian spice commodities in the international market and among its main trading partners is categorized as a partial industry. Indonesia as a whole dominates the spice trade with its main trading partners. Furthermore, based on research by Ghimire et al. (2016)(5) medicinal and aromatic plants (MAP) have been identified as one of the potential high-value commodities in Nepal with great prospects for economic development. Asl et al. (2017)(4) also explain that the global market structure of medicinal and aromatic plants is largely competitive and reveals that Singapore, Japan, Germany, Malaysia, and the US have the highest import advantages for these products. Globally, this sector is experiencing high growth rates coupled with cost pressures, technological advances, and increasingly fierce competition and regulation.(7-10)

The COVID-19 pandemic can cause food crises in developing countries both through the supply side and the demand side. Movement restrictions due to the pandemic have slowed economic activity, potentially affecting food production and reducing food supply.(11,12) Food export controls by major exporters, such as direct export bans and other measures including export taxes, can exacerbate supply shocks already generated by restrictions and safeguards.(13,14) Several countries have used these measures to varying degrees, but globally, they have not been serious enough to substantially affect food supplies in international markets.

The impact of the pandemic on the biopharma sector has not been evenly distributed. Companies in the pharmaceutical sector are focused on the continued demand for essential products and the increasing demand for production directly related to COVID-19 (including vaccines and anti-viral drugs). Several companies are also facing demand-side shocks in light of the cancellation of

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elective operations in many countries due to the pandemic. In connection with this situation, this study aims to identify what factors affected biopharmaceutical commodities during the pandemic that occurred especially in Indonesia.

According to the Heckscher-Ohlin theory, a nation's exports are often goods with intensively plentiful local production components. If a country's production factors are more plentiful than those of its trading partners, it is considered to have an abundance of production factors.[15,16] According to the theory of international commerce, there are disparities in commodity pricing that result from a variety of factors, such as variations in technology and demand. Later, Heckscher-Ohlin challenged this hypothesis, claiming that variations in the proportions of the application of production elements were to blame for price discrepancies across countries in export commodities.[17] According to a different hypothesis, each country's opportunity cost determines its relative advantage in a trade rather than the absolute cost.[18-20]

Tang et al. (2022) developed a two-stage game and reverse solution method that aims to obtain the company's optimal output in importing and exporting countries before and after the pandemic. They describe the outcome of the game between the two countries (importers and exporters) during a pandemic that firms in the exporting country face a double threat from the pandemic and the cost of import quarantine. The increase in import quarantine duties reduces the social welfare of the exporting country. Collection of reasonable import quarantine fees by importing countries can encourage bilateral trade, but excessive collections would be counterproductive.[13] A case study in Kenya by Mold & Mveyange (2020) explains that the pandemic's impact on trade was initially significant, but less alarming when considering seasonality. In addition, they also show the results of research that EAC neighboring Kenya—especially landlocked countries—that the figures for re-exports and intra-regional exports show an alarming scale of disruption to intra-regional trade.[21]

A study in Nigeria by Nwakoby & Manasseh (2021)[22] shows that the contribution of exports during the pre-covid-19 era to the Nigerian economy was much higher three years before the outbreak of the pandemic, but dropped dramatically in 2020 when the pandemic was at its peak. In addition, the contribution of other indicators (standard of living, life expectancy, level of happiness, poverty, and prosperity index, health expenditure, national income, national savings, per capita income, and unemployment) to the Nigerian economy was negatively affected during the covid-19 era, except for imports and the term of trades. The impact of the pandemic also affects the trade in food commodities, as the results of a study conducted. In the quarter following the outbreak of the pandemic, global food export supplies may fall by between 6 and 20 percent, and global prices on average increase between 2 and 6 percent.[23] Increasing export restrictions would multiply the initial shock by a factor of 3, with world food prices rising by an average of 18 percent. Countries that depend on imported food, most of which are developing and least developed countries, will be most affected.

This research aimed to analyze and investigate macroeconomic factors and the impact of the Covid-19 Pandemic on the export performance of Indonesian biopharmaceutical commodities on the global market.

METHODS

This research was quantitative study that aimed to analyze and investigate macroeconomic factors and the impact of the Covid-19 Pandemic on the export performance of Indonesian biopharmaceutical commodities on the global market. The data used in this study is secondary time series data in monthly form between 2015 January to 2021 December. The data comes from several related data sources, including BPS, the Ministry of Agriculture and the Ministry of Trade and UN-Comtrade.

The analytical method used is the multiple linear regression method to analyze the determinants of factors that affect the export performance of Indonesian biopharmaceutical commodities. Several variables that will be included in the research model include the exchange rate variable model, GDP, export prices of biopharmaceutical products and dummy variables to see the impact of the Covid-19 pandemic on biopharmaceutical export performance. The specifications of the model used are as follows:

$$Value\ of\ Export_t = \beta_0 + \beta_1 GDP_t + \beta_2 ER_t + \beta_3 Price_t + Dummy_t + e_t$$

With a statement that the value of export is the total export value of biopharmaceutical products in US$; GDP is Indonesia's real GDP in US$ units; ER is the real exchange rate in US$ units; price is the price of the biopharmaceutical commodity itself with units of USD per kg and Dummy is a variable that describes the Covid-19 Pandemic phenomenon where 0 describes without a Covid-19 Pandemic and 1 describes a Covid-19 Pandemic; t is the time series symbol of the data used; is a parameter or coefficient of the variable.

RESULTS

This study uses a multiple linear regression method intending to see the effect of macroeconomic variables consisting of GDP to reflect the economy, exchange rates that reflect the base currency for international transactions, export prices of biopharmaceutical commodities themselves, and dummy variables reflecting the COVID-19 phenomenon. in influencing the export performance of Indonesian biopharmaceutical commodities. The results of the analysis found that GDP; The export price of biopharmaceutical commodities and the Covid-19 dummy variable have a significant positive effect on the export performance of Indonesian biopharmaceutical commodities. Meanwhile, the exchange rate variable did not show a significant effect on the export performance of biopharmaceutical commodities.

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Table 1. Estimation results of the research model

Variable	Coefficient	Probability	Description
ER	-645.2056	0.2693	Insignificant
GDP	0.003262	0.0713	Positive significant
PRICE_EXP	7.380008	0.0000	Positive significant
DUMMY_COVID	3086905.	0.0001	Positive significant
Probability (F-statistic)		0.000000	
Adjusted R-squared		0.561466	

The results of this data analysis are shown by the probability value which shows the level of significance based on 5% and 10% alpha and the coefficient value which indicates the direction of influence of each variable. The results of data analysis are in Table 1. Economic growth as reflected in GDP data shows a significant positive influence in influencing the export performance of Indonesian biopharmaceutical commodities. This result is indicated by the coefficient value of 0.0713 which is smaller than 10% alpha and the coefficient value of 0.003262. This result can be interpreted that when there is an increase in GDP by one unit, it will affect the increase in exports of biopharmaceutical commodities by the coefficient value of 0.003262 and vice versa, if there is a decrease in GDP by one unit, it will affect the decline in export performance of biopharmaceutical commodities by 0.003262. GDP which reflects the aggregate output of economic activity in general in a country has a significant impact on export performance. In GDP there are constituent components that contain the output of each sector of the business field. In each sector of the business field, there are types of export commodities, one of which is biopharmaceutical exports, which are dominantly derived from the primary sector, namely the agricultural and plantation sectors. So when there is a decline in GDP, one of which is from the primary sector, it will have an impact on decreasing export performance, in this case, the number of commodity exports. And conversely, when there is an increase in GDP which reflects the output of sector production in export commodities, it will also increase export performance.

The results on other variables also confirm that the price of the biopharmaceutical commodity itself also has a significant positive impact on the export performance of the biopharmaceutical commodity. This result is indicated by the coefficient value of 7.380008 and the probability value is smaller than alpha 1%, 5%, and 10%, namely 0.0000. This result can be interpreted when there is an increase in the price of a biopharmaceutical commodity by one unit, it will increase the export performance of the commodity by a coefficient value of 7.380008 and vice versa when there is a decrease in the price of the commodity by one unit, it will reduce the export performance of the commodity by the coefficient value, namely 7.380008. Prices of biopharmaceutical commodities have a major role in influencing the performance of the export value of these commodities. The price formation mechanism for this commodity also depends on the balance of the market mechanism so that it depends on the demand from consumers and the amount of supply or supply produced as a form of output for the commodity production. On average, biopharmaceutical products have prices that tend to be high in certain seasons because the need or large demand is not proportional to the available supply.

Based on this study which highlights the export performance of biopharmaceutical commodities during the Covid-19 pandemic, this study uses a dummy variable where 1 reflects when the Covid-19 pandemic occurs and 0 when the Covid-19 pandemic does not occur. The results of the analysis confirm that the dummy for the COVID-19 phenomenon has a significant positive effect on Indonesia's biopharmaceutical export performance. This result is indicated by the coefficient value of 3.086905 and the probability value is smaller than alpha 1%, 5%, and 10%, which is 0.0001. This result means that when the Covid-19 phenomenon occurs, the export performance of Indonesian biopharmaceutical commodities increases by the coefficient value and vice versa when the Covid-19 pandemic does not occur, it will reduce the export performance of biopharmaceutical commodities by the coefficient value. It is known that for almost the last 3 years, the Covid-19 pandemic has become a global phenomenon that has resulted in massive economic sluggishness and recession. This happens due to social restrictions which resulted in the economy stagnating, demand decreased so that production output in general also decreased. However, this applies differently to the export performance of biopharmaceutical commodities which are known as the basic ingredients for making herbal medicines. Biopharmaceuticals are a unique commodity owned by Indonesia so their products have great strength in the international market. This condition can encourage the existence and high selling power in the international market.

The F test also confirms the probability value of 0.0000 which indicates that all variables simultaneously have a significant effect on the export performance of Indonesian biopharmaceutical commodities in the international market. Meanwhile, the independent variables consisting of exchange rates, biopharmaceutical commodity prices, GDP and the covid-19 pandemic dummy together contributed 0.56 or around 56%. So 44% is influenced by other variables outside the research model used.

DISCUSSION

The COVID-19 pandemic highlights the importance of consumers' rights to harmless products. Good regulatory practices by the Government by involving all stakeholders should protect the health and safety of consumers, while not adding unnecessary trade costs.[14,23] Governments should adopt or encourage the implementation of appropriate measures, including legal systems, safety

regulations, national or international standards, voluntary standards and the maintenance of safety records to ensure that products are safe for their intended or normally foreseeable use.

Biopharmaceutical plants or medicinal plants are a type of horticultural plants that have a large enough market potential to support commercial economic activities. Horticultural crops can be cultivated in various places such as yards, plantations, forests, and fields. The increasing need for forest resources and cultivated land requires solutions in forest management to achieve sustainable land use. Smart agroforestry (SAF) is a set of agricultural and silvicultural knowledge and practices aimed not only at increasing profitability and resilience for smallholders but also at improving environmental parameters, including climate change mitigation and adaptation, increasing biodiversity, and soil and water conservation while ensuring proper management sustainable landscapes.[24,25]

Maximum tillage has the potential to reduce mycorrhizal fungi and increase runoff thereby reducing soil organic matter, while conservation tillage by minimizing soil damage can increase the presence of mycorrhizal fungi, as well as absorption of phosphorus and soil aggregates.[24,26] Land management system solutions to reduce deforestation rates are smart efforts to overcome food crises and climate change mitigation that are prospectively applied, especially in social forestry areas. Optimal use of forest land can be achieved by implementing SAF and applying silvicultural and crop cultivation techniques to optimize productivity and meet sustainability and adaptability objectives. Sustainable agroforestry is considered a future agricultural practice as an alternative to unsustainable conventional farming.[24,27]

Minister of Environment and Forestry Regulation Number 9, 2021 concerning social forestry stipulates forest criteria and types of social forestry businesses that can be developed.[28] Social forestry activities that are allowed in areas with good vegetation cover or conservation areas should be more in the form of environmental services, such as ecotourism activities, while AF activities are directed at unproductive forest land or land that has been degraded to increase land cover. Land use for horticultural crops including biopharmaceuticals makes the land productive and helps meet consumer demand for raw materials for herbal medicines.

The 15 types of biopharma plants are most widely used and cultivated in Indonesia, including Ginger, Turmeric, Galangal, Kencur, Temulawak, Lempuyang, Temuireng, Temu Kunci, Dringo/Dlingo, Noni/pace, Cardamom, Aloe Vera, Kejibeling, Sambiloto, and Mahkota Dewa.[2,29] Figure 1 shows the production results for biopharmaceuticals in 2021. Ginger has the highest biopharmaceutical production, with a total production of 303,530,755 kg and a share of 38% of Indonesia's total biopharmaceutical production. Turmeric is the second highest production, with a total production of 167,178,773 kg and a production proportion of 21% of Indonesia's total production of biopharma plants. The third is the cardamom plant with a total production of 124,386,777 kg with a production percentage of 16% of the total biopharmaceutical production in Indonesia in 2021.

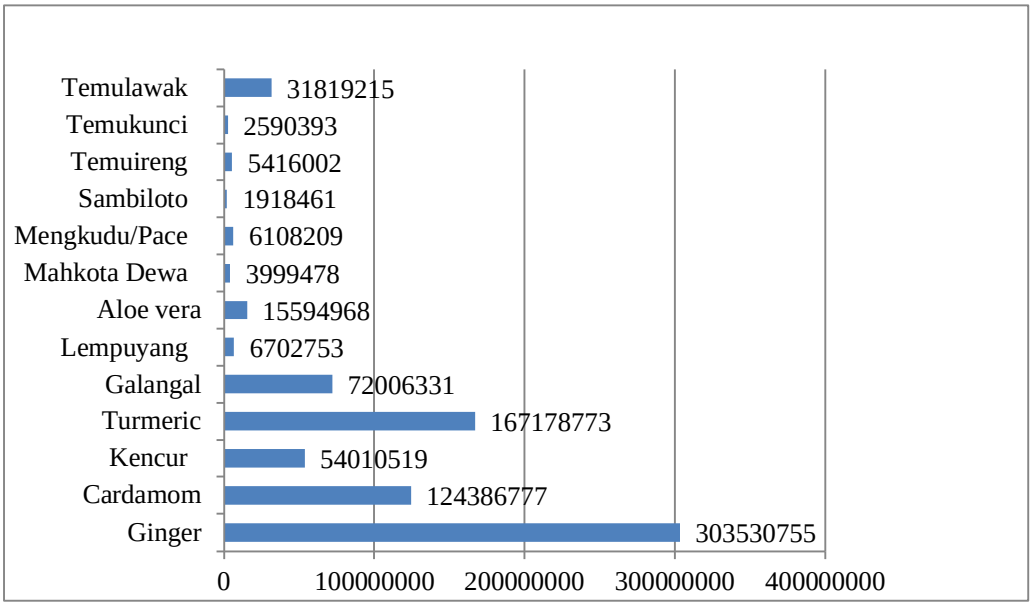

Figure 1 Production of Biopharmaceutical Plants in Indonesia in 2021.[2]

Some of the many biopharmaceutical plant productions that have been used have also been exported worldwide, both as original products and as derivative products. Ginger was the most commonly exported biopharmaceutical crop in 2015-2017, followed by turmeric and cardamom.[30] However, from 2018 to 2021, the most exported plants are turmeric and cardamom, followed by ginger.[31] This demonstrates that the global community's demand for and interest in Indonesian biopharmaceutical goods has transformed.

Most people in the herbal manufacturing and consumption industries rely on indigenous knowledge and lack access to information about the pharmacodynamics and pharmacokinetics of most herbal therapies.[32] This will promote a better understanding of the enabling environment for end markets and priority actions for interventions. Therefore, she explain that the

commercialization of medicinal plants must be prioritized by multi-stakeholders, as the main determinant of their use for income and employment, profit sharing, product varieties, technology and knowledge, skills improvement, and collaboration.

Another major national structural issue affecting the fertility of business model innovation is the relative strength of a country's private equity investment market. With relatively weak equity capital investment markets, such as in continental Europe where bank-driven forces prevail, new biopharmaceutical companies are challenged to find a large amount of investment capital needed.[33,34] This leads to the prevalence of choosing business models that are service- or platform-based as they require less capital than models focused on therapeutic development. Finally, is the role played by differences in national labor markets. From an industry perspective, small and medium enterprises need flexibility in their workforce resources because companies may need to react quickly to opportunities or threats.[33,35]

At the microeconomic level, the stability of the participation of farmers and workers in the horticultural export chain – and how this is guaranteed in contractual agreements – is important because it determines their purchasing power and long-term access to food.[36] explains that farmers and workers in the horticultural chain often derive a large share of their income from the horticultural sector, which results in increased income, purchasing power, and food security. However, the stability of their food security depends on risks in production and employment contracts with export companies and long-term access to these contracts.[37,38] For suppliers, contract farming entails lower production and marketing risks than spot market transactions due to the delivery of inputs on credit and guaranteed market access, often at guaranteed prices.[34,36]

SAF is a strategy to revive rural economies and people's well-being through optimal utilization of local resources and a form of intelligent land use and landscape management that has a critical role to play in soil and water conservation, bioenergy, climate change response, and enhanced biodiversity conservation.[24,25] Law Number 6, 2014 concerning rural development programs, with the main objective of fostering community welfare, is in line with the goals of achieving Sustainable Development Goals (SDGs) 1, 2, 3, and 15: eradicating poverty and hunger, improving health and welfare, and conserving terrestrial resources limited. In its implementation, Law Number 6, 2014 recommends optimal utilization of local resources through the application of applicable technology, especially locally-based innovations. As a system that is environmentally friendly and can meet the socio-economic needs of the community, AF can also open new jobs for gender-friendly rural economic development.[39] Apart from generating income, agroforestry can also play an important role in socio-cultural stimulation among communities which starts with studying common problems, rediscovering existing knowledge and traditional wisdom, and integrating new knowledge.[25]

Farmers' capacity for implementing agroforestry systems remains rather poor, particularly in terms of managerial capacity. These variables differ according to the Indonesian region's economic, social, and cultural development. There are various places in Indonesia where technology has been incorporated into the manufacturing process, but it is also not uncommon for other regions to have more traditional manufacturing. Finally, we must remember that each region has unique characteristics relating to the biophysical and socioeconomic situation of farmers. The agricultural sustainability strategies offered are not always suitable for all local and regional contexts. More research is needed to examine successful economically focused intensive farming and agroforestry systems and assess how these cases might be replicated.

CONCLUSION

This study aims to identify what factors affected biopharmaceutical commodities during the pandemic that occurred especially in Indonesia. The results of the analysis show that GDP; The export price of biopharmaceutical commodities and the Covid-19 dummy variable have a significant positive effect on the export performance of Indonesian biopharmaceutical commodities. Meanwhile, the exchange rate variable did not show a significant effect on the export performance of biopharmaceutical commodities. The first best approach to address the COVID-19 challenge to food security is by minimizing disruptions to the supply of food and essential commodities such as biopharmaceuticals, such as ensuring that workers in the sector can continue to produce in good health and safety, removing barriers that undermine food supply chains, and ensure that trade in key inputs in food and biopharmaceutical production can flow smoothly across borders. This research cannot focus on biopharmaceutical commodities by considering the crisis due to the COVID-19 pandemic. In addition, this research identifies the factors that influence the growth of Indonesia's biopharmaceutical exports. Thus, further research is expected to be able to identify sustainability strategies for biopharmaceutical commodities to create sustainable national economic growth.

Ethical consideration, competing interest and source of funding

-All ethical principles are upheld in this research.
-There is no conflict of interest related to this publication.
-Source of funding is authors.

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