

EMPIRICAL RESEARCH: THE IMPACT OF FOOD SECURITY ON ECONOMIC GROWTH (CASE STUDY IN INDONESIA)

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Abstract: The world is perceived to be experiencing an acute food crisis which will continue until 2023. The Ministry of Finance of the Republic of Indonesia estimated that the upcoming global economic growth will weaken. Drops in the economy can be influenced by the uncertain global financial markets, inflationary pressures, increasing stagflation rate, and geopolitical situations. The problem research is: Does food security have an impact on Indonesia's economic growth? This study adopts real GDP (Y) as a proxy for economic growth; labor force (Lf) as a proxy for labor; Gross Capital formation (CI) as a proxy for capital; food production index (FS) as a proxy for food security; and trade openness (TO) is proxied by the sum of total export and total import divided by real GDP. This study examines and compares the impact of food security on economic growth in Indonesia using VECM method using 30 years of data, ranging from 1991 to 2020. The estimated results signified that food security in Indonesia plays a pivotal role in stimulating economic growth although the level of influence varies.

Keywords: *economic, Indonesia, food safety*

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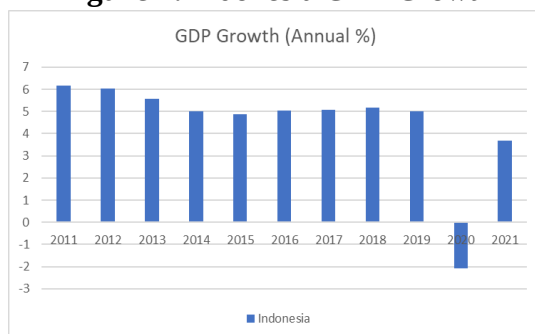
1. Introduction

The world is perceived to be experiencing an acute food crisis which will continue until 2023. At the G20 meeting, world food security is an important item on the agenda (Santosa, 2022). On August 8 2022, the Ministry of Finance of the Republic of Indonesia estimated that the upcoming global economic growth will weaken. Indonesia's Minister of Finance, Sri Mulyani announced that the International Monetary Fund (IMF) revised their global economic growth projections in 2022 from 3.6% to 3.2% and in 2023 from 3.6% to 2.9%. Furthermore, the IMF also forecast that the 2022 inflation in developed countries will be as high as 6.6% and even higher in developing countries at 9.5%. Such drops in the economy can be influenced by the uncertain global financial markets, inflationary pressures, increasing stagflation rate, and geopolitical situations. In response to the impending unfavorable economic status, the government will intervene by creating a combination of economic policies such as monetary, fiscal, and structural policies.

The Covid-19 pandemic has undoubtedly caused global economic conditions to deteriorate over the past three years (Jackson et al. 2021; Zhilenko et al. 2021). The detrimental impacts

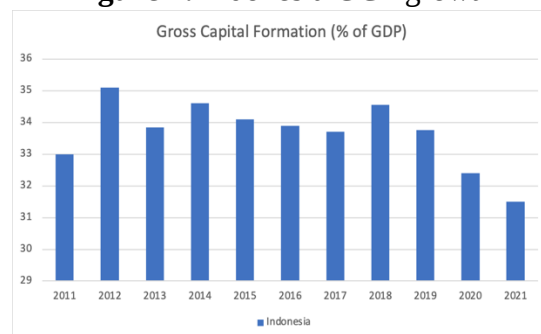
are evident from the increase in economic uncertainty throughout the globe (Altig et al. 2020; Szczygielski et al. 2022), decrease in productivity of global financial markets (Ullah 2022; Zhao et al. 2022), increase in pressure on currencies worldwide (Jamal et al. 2022; Sharma et al. 2021), and setting off capital reversal of financial assets (Beirne et al. 2020). Additionally, closed borders between countries have limited transportation which caused global supply disruptions, declining demand, and decreasing economic agent confidence (Jackson et al. 2021) which led to a reduced world economic outlook. As a consequence, the tourism and commodity export revenue is projected to decline drastically (Fotiadis et al. 2021; McKibbin and Fernando 2020) and cause the current account deficit of 2020-2022 to further widen (Kaufman and Leigh 2021). Furthermore, trade fluctuations may slow down investment growth (Utomo and Hanggraeni 2021) and lower investor confidence (Teresiené et al. 2021).

Figure 1: Indonesia GDP Growth



Source: The World Bank

Figure 2: Indonesia GCF growth

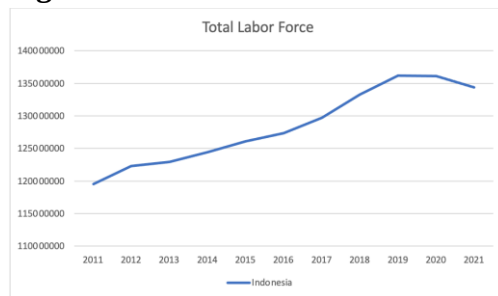


Source: The World Bank

There are a vast number of factors which constitute economic growth, including capital intensity, labor forces, food security, and trade openness (Setyari et al. 2016; Manap and Ismail 2019; Utami et al. 2021). According to data from The World Bank, Indonesia maintained consistent growth but experienced a drop from 2011 to 2019. The GDP growth rate was 6,17% in 2011, 4,88% in 2015, 5,02% in 2019, but due to the pandemic outbreak, it was only 2,07% in 2020. However, it increased to 3,69% in 2021.

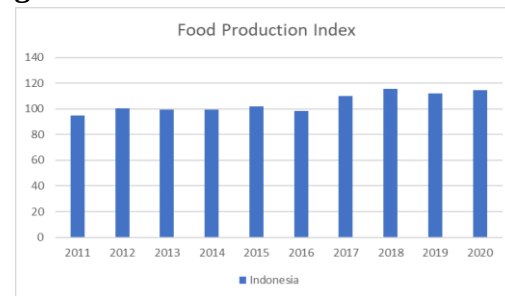
According to a study conducted by Setyari et al. (2016) on the capital intensity in the ASEAN-5 countries (Indonesia, Malaysia, Philippines, Thailand, and Singapore), capital intensity and trade openness does not always have a positive trend on economic growth. Nevertheless, the limitations of this study are that the indicators of trade liberalization levels were not established; therefore, measurement of trade openness was indefinite. It is clearly evident in Figure 1 that in 2020, during the start of the Covid-19 pandemic, there was a significant decline in GDP growth of Indonesia, which signifies a drop in economic growth. Furthermore, Figure 2 shows that there was a decrease in Indonesia's Gross Capital Formation in 2020, which portrays the correspondence between economic growth towards capital intensity and vice versa. In addition, there was an overall downwards trend of Indonesia's GCF from 2011 to 2021.

Figure 3: Indonesia Total Labor Force



Source: The World Bank

Figure 4: Indonesia Food Production Index

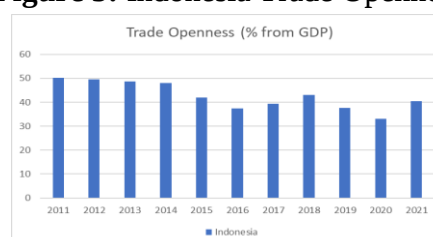


Source: The World Bank

A study conducted by Azam et al. (2020) approves that in accordance with the theory of Malthus (1798), population growth has a positive trend on economic growth, whereas the population growth is directly proportional to the number of people available to do labor, thus labor force participation is one of the main factors making up economic growth (Yakubu et al. 2020). According to Utami et al. (2021), an increase in population can both impose a positive or negative impact on economic growth. An increase in the number of people in the age group of the labor force will increase the average productivity of a population, which can prompt an increasing rate of economic growth. Meanwhile, an increase in the number of people in the non-age group of the labor force will decrease the average productivity of a population. Therefore, Indonesia's regional characteristics, such as increasing labor force growth will stimulate further economic growth. In Figure 3, similarly to the plummet of economic growth in 2020, there was a slight decrease in the total labor force in 2020 which was followed by a sharper decline in 2021.

The concept of food security is defined as the availability of sufficient food based on its quantity, quality, how it is distributed at an affordable price, and safe for consumption so it can be used as a source of energy to power daily activities. However, food security cannot be evaluated solely through a global perspective, instead it is important to take into account how evenly it is distributed in a national, regional, and even household level. Throughout the Covid-19 pandemic, the food security condition has raised concerns as it has continuously declined due to extreme supply chain disruptions. Furthermore, restricted daily activities have led to the falling demand of food supply which resulted in a drop in agricultural commodity prices and further aggravated food insecurity. Consequently, numerous businesses in the culinary industry were running poorly due to the continuous decline in food supply and demand. According to the given graph, Indonesia has a fairly high food production index. Economist Impact estimates that Indonesia's global food security index will be 60,2 in 2022. The sufficiency of food availability, stability of food availability, food accessibility, and quality/food safety are the four components which make up food security.

Figure 5: Indonesia Trade Openness



Source: The World Bank

A study conducted by Keho (2017), proved that there is a strong positive causal relationship between trade openness and capital formation. Furthermore, capital formation poses different impacts on countries with different income levels. An empirical study by Topcu et al. (2020) argued that an increase in gross capital formation: 1) positively impacts high-income countries, 2) leads to GDP growth in middle income countries, and 3) negatively impacts low-income countries. The pandemic had led to lockdowns in numerous countries, causing a decline in mobility, hence halting most economic activities (IMF 2020). Moreover, during this period of uncertainty, lockdowns had adverse negative impacts on Indonesia's household income and expected income (Ridhwan et al. 2021). The World Bank (2022) reported that as a result of the global financial impairment caused by the pandemic, as of July 2021, Indonesia's status shifted from upper-middle income countries to lower-middle income countries. Therefore, it suggests that Indonesia's increase in trade openness can give rise to the GDP growth of the country, resulting in Indonesia's improving economic growth.

Figure 5 depicts a decline in Indonesia's trade openness from 2011 to 2016, from 50.18% (2011) to 37.42% (2016). The percentage of trade in GDP varied quite a little from 2016 to 2021; the highest percentage was in 2018, at 43.07%, and the lowest was in 2020, at 32.97%. It is clearly evident that in 2021 there was an increase in Indonesia's trade openness, which is in accordance to the significant rise of GDP growth during the same year (Figure 1). Indonesia's export growth of 34.78% and import growth of 28.36% in 2021, allowed Indonesia to benefit from a trade surplus, thus further justifying the upward trend in trade openness following the post-COVID conditions (Cahyadin et al. 2022).

A theoretical argument could be made that "food security encourages decision productivity and health (the aspect of Labor) so that it attracts a lot of big capital (capital intensity) leading to economic liberalization which will ultimately increase economic growth." Therefore, the research's main topic is: Does food security have an impact on Indonesia's economic growth? For this reason, the focus of this research is to measure the influence of capital intensity, labor forces, food security, and trade openness on economic growth in Indonesia. This was done to get an idea of how the local economic policies affected the economic growth of Indonesia.

2. Literature Review

Economic growth is a significant source of concern for researchers and economists. Unquestionably, the availability of food affects economic growth. Food security refers to the availability of sufficient quantities and types of food which are distributed at affordable prices, safe for consumption, and may be used for daily activities. Due to the modernization of the economic structure, which has increased food security for all socioeconomic levels, there is a strong association between economic growth and food security (Timmer 2005). The rate and distribution of economic growth, also referred to as pro-poor growth, the stabilization of food prices generally, and the stabilization of domestic pricing to increase sector efficiency marketing are strategic methods to achieve food security (Manap and Ismail 2019).

Another research on food security in developing nations between 1970 and 1990 identified six critical problems: militarism, urban bias, neo-Malthusian population pressure, modernization, economic dependency, and urban bias (Jenkins and Scanlan 2001). Regarding household resources and access to food in local markets, policymakers have established certain conditions at the macro level (Timmer 2000). Because this study focuses primarily on Asia regarding food price volatility on the global rice market, level of income distributions, and trade policies which affect food security and economic growth, the results show that food security has a modest impact on economic growth.

Additionally, the idea of human capital is intimately tied to food security. Human knowledge and health investments, such as those made in education, physical activity, and proper nutrition, are referred as human capital. People's life expectancy will be longer, and they will experience more economic growth when they know about good health and the advantages of diet. In addition to boosting health to spur economic growth, nutritional intake is crucial for raising worker productivity in decision-making (Strauss 1985). Deolalikar (1988), who discovered that nutrition based on minimum energy requirements (MDER) is crucial in determining labor productivity. Food instability and malnutrition have long-term negative consequences on a person's physical and mental growth, which lowers productivity and limits their potential. An adequate diet encourages normal brain development and allows people to realize their maximum potential, especially during the early years. Indonesia may invest in its human resources by providing food security, thus creating a more knowledgeable and effective workforce which can promote innovation, entrepreneurship, and economic diversification.

Food security is essential for Indonesia to experience sustained economic growth and development. The availability, accessibility, and affordability of food are essential for national stability, poverty reduction, and general prosperity in this diversified archipelago with a population of over 275 million people. Inadequate access to nutritious and affordable nourishment can increase income disparities, prolong cycles of poverty, and obstruct social advancement. The government can reduce poverty, strengthen social cohesion, and quell unrest by providing adequate food, especially for vulnerable groups like low-income households and rural communities. Increased productivity, better health outcomes, and higher educational attainment contribute to economic growth due to improved food security (Suryahadi et al. 2010).

Aside from food security, accomplishing social and regional development goals depends on the workforce. The labor force helps reduce poverty, promote social mobility, and raise living standards by creating employment opportunities and generating revenue. Regional imbalances can be reduced, and balanced economic development across the nation's regions is promoted by policies prioritizing inclusive growth, investing in human capital, and supporting equitable access to employment opportunities. A healthy labor market guarantees that all facets of a society can profit from economic progress and participate in it, fostering social cohesion and stability (Department for International Development 2008). Investments in machines and plants are vital for generating growth, and so are investments in education and skills. Investment in this human capital is particularly enticing because it directly promotes human development while also promoting economic progress.

Furthermore, the value of international trade's contribution to the economy must be considered since it is one of several factors which drive productivity and growth (Fetahi-Vehapi et al. 2015). The broad literature's main finding is that nations with a global presence typically produce more than those which simply cater to domestic markets (Sachs et al. 1995; Edwards 1998; Frankel and Romer 1999). International commerce also promotes effective resource allocation and can lead to higher growth which can increase factor accumulation, especially in nations where technology and knowledge spillovers are prevalent. No nation has ever seen sustained growth without a successful integration into world markets. This has two aspects: integration into the markets for goods and inputs, particularly integration into the markets for financial capital.

As trade is liberalized, nations with much capital can grow their capital-intensive industries and export their products. Consequently, the return on capital in capital-intensive industries rises. The findings of Setyari et al. (2016)'s study, which employed the Fixed Effect and

Feasible General Least Square (FGLS) methodologies, demonstrate that capital flows are the main driver of economic growth. While according to the trade-led growth theory, trade openness serves as a nation's main engine of economic growth. Technology transfer, productivity, and resource allocation can all be facilitated by international trade (Baldwin et al. 2005; Trejos and Barboza 2015; Krugman 1994), which will ultimately lead to greater economic growth. The difficulty in achieving openness is present in each of these contexts. To ease the transition for local producers, change must be implemented in the right order and at the right pace. For the integration of the capital markets, this is especially crucial (Department for International Development 2008). For businesses to invest in new projects, extend their operations, and adopt new technologies, they need access to finance. Through financial institutions, capital markets, and investment, capital formation ensures funds are available for investment. Indonesia can boost economic activity and generate job possibilities by fostering an environment favorable for investments, creating sound financial systems, and easing access to funds. The mobilization of financial resources necessary for economic expansion is aided by capital formation (OECD 2015).

3. Research Method

3.1. Theoretical Framework

In order to investigate how food security affects economic growth, this study uses an augmented production function paradigm. The following equation displays the general production function framework:

$$Y_t = f(CI_t, LF_t)$$

(1)

Y_t represents the gross domestic product, whereas capital formation and labor force are represented by CI_t and LF_t , respectively. The two most important inputs used in production are CI_t and LF_t .

The physical conversion of inputs into outputs is described by the production function. The shape of this transformation must be specified for it to be of any usefulness in the application. It must be able to describe how the output varies due to input changes. According to Lewin (1995), this function is a metaphorical construct used to explain how economies expand. In an effort to determine what causes the economy's observed growth and to what extent, it serves as the foundation for modern growth theory. It is observed that applying the aggregate inputs of capital formation (CI) and labor forces (LF) leads to aggregate output Y inevitably and inexorably. With the use of various statistical aggregations, all three have been located.

Food security emerges as the most independent variable in this study because the research aims to examine economic growth's impact on food security. Trade openness is integrated into the scope of this study as the significance of international trade has also been highlighted in earlier economic growth studies (Chin et al. 2022; Grossman and Helpman 1990; Barro and Sala-i-Martin 1995). The following equation illustrates how it changes the general production framework into an expanded production function framework:

$$Y_t = f(CI_t, LF_t, FSt, TO_t)$$

(2)

FSt stands for food security, and TO_t is for trade openness. Solow (1994) cannot explain the growth in measured output in the above formulation only by considering measured CI and LF as inputs. This investigation must therefore look elsewhere for an alternative explanation for

the residual. Capital formation, labor force development, food security, and trade openness contribute to growth.

With a resurgence of growth theories focused on capital formation, labor forces, food security, and trade openness, the discourse has significantly expanded in recent years. Instead of acting as an exogenous (unexplained) shift parameter, it now explains technological advancement in terms of decisions driven by economic considerations. Endogenous growth theory is the term of it (Grossman and Helpman 1990; Romer 1990, 1994; Solow 1994). Examining the $\ln Y_t = B_0 + \beta_1 \ln FS_t + \beta_2 \ln CI + \beta_3 \ln LF_t + \beta_4 \ln TO + \varepsilon_t$ consequences of the production function method in greater detail will allow for a deeper investigation.

Theoretically, any outcome may always be accounted for by correctly identifying all pertinent inputs. The challenge is to classify inputs and outputs in such a way that the progress of economic growth is thought to be explained. The black box method used in the production function framework's limitations prevents it from thoroughly explaining how the link and the process in time work. Particularly, it disregards non-economic aspects like the institutional and political environment (see Scully 1992).

3.2. Data and Sources

This study adopts real GDP (Y) as a proxy for economic growth; labor force (Lf) as a proxy for labor; Gross Capital formation (CI) as a proxy for capital; food production index (FS) as a proxy for food security; and trade openness (TO) is proxied by the sum of total export and total import divided by real GDP. Food Production Index serves as the most important independent variable while other independent variables, namely, gross capital formation, labor force and trade openness will serve as control variables. The details of the variables are illustrated in Table 1.

This study extracts all data from World Bank's World Development Indicator to ensure consistency. The sample period of this study is 30 years ranging from 1991 to 2020, due to data limitations. This study adopts the time series data for Indonesia, respectively. All variables are transformed into natural logarithm form. The empirical model of this study is shown as follows:

(3)

Table 1: Data Description

Variable	Name	Description
Dependent	<i>Real GDP</i>	GDP (constant 2015US\$)
Independent	<i>FS</i>	Food Production Index
Control Variable	<i>CI</i>	Gross Capital Formation (% of GDP)
Control Variable	<i>LF</i>	Labor force, total
Control Variable	<i>TO</i>	Total exports and Imports (% of GDP)

3.3. Econometric Analysis

This study aims to examine and compare the impact of food security on economic growth in Indonesia. Hence, the Vector Error Correction Model (VECM) will be employed for the estimation over the period of 1991 to 2020.

Prior to running the regression, there are two-unit root tests, namely, Augmented Dickey-Fuller (ADF) and Weighted Symmetric. ADF is employed to identify the stationarity of a series. The non-stationary variable(s) can be converted into stationary data after differentiation. If the unit root tests result signified that all of the series is integrated at the first difference, $I(0)$, the Johansen Juselius (JJ) will be adopted to ensure that the empirical model is cointegrated

and has a long-run linkage between the dependent variable and the independent variables. The equation of the JJ test in VAR of order p is shown below:

$$Y_t = A_1 Y_{t-1} + \dots + A_p Y_{t-p} + \beta X_t + \mu_t \quad (4)$$

Where Y_t = k-vector of non-stationary I(1) variables; X_t = d-vector of deterministic variables; μ_t = vector of innovation.

The JJ test is crucial to be carried out as it ensures that the model is cointegrated and has a long-run relationship to reduce the chance of spurious regression in the empirical by using trace statistical analysis or maximum eigenvalue test statistic. Once the time series is proven cointegrated and has a long-run relationship, the Vector Error Correction Model (VECM) will be computed. VECM is able to take into consideration any cointegrating relationships among the variables. The one characteristic of VECM is that it includes the lagged error correction term (ECT), which is the cointegration term. The disequilibrium in the short run will go through a self-adjustment/correction period and eventually revert to equilibrium in the long run. For instance, if there are only two variables in the VEC model with one cointegration without a lagged difference term, the VEC model is expressed below:

$$Y_{2,t} = \gamma Y_{1,t} \quad (5)$$

While the corresponding VECMs are as the following:

$$\Delta Y_{1,t} = \lambda_1 (Y_{2,t-1} - \gamma Y_{1,t-1}) + \varepsilon_{1,t} \quad (6)$$

$$\Delta Y_{2,t} = \lambda_2 (Y_{2,t-1} - \gamma Y_{1,t-1}) + \varepsilon_{2,t} \quad (7)$$

Error correction term lies on the right-hand side of the variable. In the long run, the term will exhibit a zero value. Conversely, ECT will show a nonzero value if it is in a short-run equilibrium, and the variable will gradually adjust to equilibrium. The regression result generated from VECM will determine the coefficient of each independent variable. After that, diagnostic tests will ensure that the empirical models are free of heteroscedastic and autocorrelation problems and that the estimated results are robust.

4. Results and Discussion

4.1. Results

Granger and Newbold (1974) noted that the regression results from the VECM models using non-stationary variables would be spurious. Hence, Unit root tests using Augmented Dickey Fuller (GLS) and Weighted Symmetric ADF (WS) tests were carried out. The results indicated that all data is not stationary at level but all series becomes stationary and intergraded in I(1) after transforming to first difference. Table 2 exhibits the unit root test results for I(1) for Indonesia respectively.

Table 2: Unit Root Test for Indonesia

Augmented Dickey Fuller (GLS)	Weighted Symmetric (WS)	ADF
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	Constant trend	without trend	Constant with trend	Constant trend	without trend	Constant trend	with trend
Variable	First different		First different		First different		First different
LGDP	-3.82*** (0.00)		-3.767*** (0.00)		-3.74*** (0.00)		-3.65*** (0.04)
LCI	-4.34*** (0.00)		-4.69*** (0.00)		-4.57*** (0.00)		-4.52*** (0.00)
LTO	-6.56*** (0.00)		-6.72*** (0.00)		-7.37*** (0.00)		-7.46*** (0.00)
LLF	-4.30*** (0.00)		-4.83*** (0.00)		-3.63*** (0.01)		-4.28*** (0.01)
LFS	-4.86*** (0.00)		-4.90*** (0.00)		-5.37*** (0.00)		-5.26*** (0.00)

Note: *** denotes significant at 5% significance level.

Since the data meets the stationary criteria and is integrated into an order of I(1), the Johansen cointegration test was applied after selecting the optimal number of lags. Both Akaike Information Criterion (AIC) and Schwarz Criterion (SIC) suggest that the optimal lag is 2. The criterion which has the smallest AIC and SIC values is the lag used. The Johansen's technique was employed in order to establish how many cointegration equations exist between variables. The results of Johansen Cointegration tests are shown in Table 3.

Table 3: Johansen Cointegration Indonesia

Hypothesizes No. of CE (s)	Trace Statistic	Max Eigen Statistic	Critical Value (Trace)	Critical Value (Max)
None*	102.88	52.06	69.81	33.88
At most 1*	50.82	23.12	47.86	27.58
At most 2	27.70	14.26	29.80	21.13
At most 3	13.43	11.08	15.50	14.26
At most 4	2.34	2.34	3.84	3.84

*Significant at 0.05 level

The results show that the maximum eigenvalue statistic suggests the presence of one and four cointegrating equations among the five variables for Indonesia (Table 3). The tests result suggested that the set of cointegrated time series has an error-correction representation, which reflects the long-run adjustment mechanism.

Vector Error Corrección Model (VECM)

VECM approach is therefore adopted to estimate the impact of each independent variable on the economic growth in the long run. Hence, the long-run equation for Indonesia is as follows:

$$\begin{aligned}
 \text{LGDP}_{t-1} = & -366.9 + 31.36\text{LFS}_{t-1} + 16.32 \text{ LCI}_{t-1} + 18.46 \text{ LTO}_{t-1} - 32.83\text{LLF}_{t-1} \\
 (8)
 \end{aligned}$$

s.e	(7.00)	(2.38)	(2.66)	(7.58)
t-stat	[-4.47]	[-6.85]	[-6.92]	[4.33]

4.2. Discussion

Based on the regression result, food security positively and significantly impacted Indonesia's economic growth. Besides that, trade openness and gross capital formation also positively and significantly impacted economic growth at a 5% significance level. Therefore, it suggests that when food security, trade openness, and gross capital formation increase by 1 percent, the LGDP will increase by 31.36, 16.32, and 18.46 percent, respectively. Food security in Indonesia is consistent with the country's policy to be food self-sufficient. It is worth mentioning that Indonesia is the producer and exporter of agricultural products, supplying essential commodities such as palm oil, natural rubber, cocoa, coffee, rice, and spices to the rest of the world. Meanwhile, when the labor force increases by 1 %, LGDP will decrease by 32.83%, indicating a negative relationship. Although the labor force size is very high in Indonesia due to its large population, many are unemployed. Indonesia's labor market has faced limited employment opportunities and a low-quality labor force for many years, forcing Indonesians to be unemployed (Allen 2016).

In theory, Malthus explained that when population growth is still low, food supply can be strengthened so that excess food production can increase per capita income (Fernandes and Samputra 2022). Based on the estimation, it is noticeable that the impact of food security on economic growth is higher in the case of Indonesia. It is evidence that various efforts had been made by the Indonesian government to improve food security, such are (1) increasing production capacity, (2) diversifying local food, (3) strengthening food reserves and logistics systems, (4) developing modern agriculture, and (5) implementing three times export movement program (Ministry of Agriculture of the Republic of Indonesia 2021). In addition, Indonesia responded to the threat of a global food crisis by launching a large-scale agricultural program (known as Food estate) (Santosa 2022). A global food crisis occurs when there is a large change in the supply or demand for food which causes a large spike in prices in a short time. The world has experienced three global food crises 3 times, namely 1972-1974; 2007–2008; and 2011.

Likewise, the results noted that that trade openness (TO) in Indonesia, positively impacts economic growth in line with the comparative advantage theory of David Ricardo. This theory explains that the state will produce and export goods with a comparative advantage, but the state will import goods with more expensive production costs (Mankiw 2009). Liberalization encourages countries to be able to compete in the world market. Resources are allocated efficiently and with greater economies of scale. David Ricardo's theory was further developed by Hecksher-Ohlin and Samuelson, namely that the state does not only trade in goods but also in factors such as labor and capital. This theory is in line with endogenous growth theory, which explains that increasing liberalization from the trade side will create capital inflows for a country, thereby accelerating capital accumulation and technology transfer in the long term. Ultimately, it will increase economic growth in the production function or the existence of externalities arising from trading activities from exports and imports (Romer 1990b). Increased trade openness through imports of raw materials can increase exports and needs to be supported by increased value added to goods and services produced in Indonesia.

On the other hand, the estimation signified that capital formation (CF) imposes a positive impact on economic growth in Indonesia. It is noticeable that the Indonesian state is aggressively increasing its economic growth through specific strategies in the field of investment for the formation of capital goods. One of the strategies pursued is to strengthen foreign investment in the country through a foreign direct investment (FDI) promotion policy intended for multinational companies so that it will increase production capacity by increasing

capital goods in a company. An increase in total production will affect the total income of companies which will continuously affect the total national income of a country. In this case, it shows that when there is an increase in CF, it will affect the country's national income in Indonesia. Capital formation will create an expansion of economies of scale, output per worker, high efficiency and provide certainty in the business world.

Besides, the results suggested that the quality and productivity of human resources in Indonesia are still very low. Working hours in Indonesia are only 40 hours (Citradi 2019). Indonesia is a country that implements 40 working hours a week or 5 working days following the Constitution Law Number 13 of 2003.

Diagnostic Tests

The Breusch-Pagan-Godfrey theorem shows that the residuals obtained are not heteroscedastic. The P-values for both countries are greater than 0.05. The outcome reflects that the null hypothesis cannot be rejected; rather, accepting the null hypothesis indicates that the residuals are homoscedastic, which allows the model to fit. Based on the Breusch-Godfrey Serial Correlation LM Test results, both models have no autocorrelation problem, and the estimation results are robust.

5. Conclusion

This study examines and compares the impact of food Security on economic growth in Indonesia using VECM method using 30 years data, ranging from 1991 to 2020. The estimated results signified that food security in Indonesia plays a pivotal role in stimulating economic growth although the level of influence is varying. Hence, policy makers should exchange the idea of current efforts in order to formulate a comprehensive policy to elevate food security which in turn stimulates the economic growth and creates a win-win situation. In addition, Indonesia should also formulate exclusive policy to stimulate growth owing to the different impact of determinants, apart from food security on economic growth.

References

- Ahdiat, A. (2022). *Ketahanan pangan Indonesia menguat pada 2022* [Indonesia's food security strengthens in 2022]. Databoks, December 2, 2022. <https://databoks.katadata.co.id/datapublish/2022/12/02/ketahanan-pangan-indonesia-menguat-pada-2022#>
- Allen, E. R. (2016). *Analysis of trends and challenges in the Indonesian labor market*. ADB Papers on Indonesia no. 16, Asian Development Bank. <https://hdl.handle.net/1813/87128>
- Altig, D., Baker, S. R., Barrero, J. M., et al. (2020). Economic uncertainty before and during the COVID-19 pandemic. *Journal of Public Economics*, 191, 104274. <https://doi.org/10.1016/j.jpubeco.2020.104274>
- Azam, M., Khan, H. N., and Khan, F. (2020). Testing Malthusian's and Kremer's population theories in developing economy. *International Journal of Social Economics*, 47(4), 523-538. <https://doi.org/10.1108/ijse-08-2019-0496>
- Beirne, J., Renzhi, N., Sugandi, E. A., et al. (2020). *Financial market and capital flow dynamics during the COVID-19 pandemic*. ADBI Working Papers 1158, Asian Development Bank Institute. <https://ideas.repec.org/p/ris/adbiwp/1158.html>
- Cahyadin, M., Patoni, A. S., and Setiawati, U. E. (2022). International trade policy to improve Indonesia's economy in a sustainable manner. In A. P. Sunjaya, Y. B. Wang, R.

- Sagita, & D. Sugiharti (Eds.), *Indonesia Post-Pandemic Outlook: Rethinking Health and Economics Post-COVID-19*, pp. 279-308. BRIN Publishing.
<https://penerbit.brin.go.id/press/catalog/download/537/540/11651?inline=1>
- Chin, M., Meyer, D., Ong, S., et al. (2022). The impact of infrastructure investment on economic growth in countries participating in the belt and road initiative: A comparative analysis between Africa and Asia. *Contemporary Chinese Political Economy and Strategic Relations: An International Journal*, 8(1), 1-43.
<https://hdl.handle.net/10210/501649>
- Citradi, T. (2019). *Orang Malaysia kerja 46 jam seminggu, Indonesia 'cuma' 40 jam* [Malaysians work 46 hours a week, Indonesians 'only' 40 hours].” CNBC Indonesia, September 22, 2019.
<https://www.cnbcindonesia.com/news/20190922170639-4-101268/orang-malaysia-kerja-46-jam-seminggu-indonesia-cuma-40-jam>
- Economist Impact. (n.d.). *Global food security index (GFSI)*. Accessed April 2023.
<https://impact.economist.com/sustainability/project/food-security-index#rankings-and-trends>
- Fernandes, M., and Samputra, P. L. (2022). Exploring linkages between food security and economic growth: A systematic mapping literature review. *Potravinarstvo Slovak Journal of Food Sciences*, 16, 206-218. <http://dx.doi.org/10.5219/1734>
- Fetahi-Vehapi, M., Sadiku, L., and Petkovski, M. (2015). Empirical analysis of the effects of trade openness on economic growth: An evidence for South East European Countries. *Procedia Economics and Finance*, 19, 17-26. [https://doi.org/10.1016/s2212-5671\(15\)00004-0](https://doi.org/10.1016/s2212-5671(15)00004-0)
- Fotiadis, A., Polyzos, S., and Huan, T. T. C. (2021). The good, the bad and the ugly on COVID-19 tourism recovery. *Annals of Tourism Research*, 87, 103117.
<https://doi.org/10.1016/j.annals.2020.103117>
- International Monetary Fund (IMF). (2020). The great lockdown: Dissecting the economic effects. In *World Economic Outlook, October 2020: A Long and Difficult Ascent*, pp. 65-84. <https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020>
- Jackson, J. K., Weiss, M. A., Schwarzenberg, A. B., et al. (2021). *Global economic effects of COVID-19*. Congressional Research Service. <https://sgp.fas.org/crs/row/R46270.pdf>.
- Jamal, A., and Bhat, M. A. (2022). COVID-19 pandemic and the exchange rate movements: Evidence from six major COVID-19 hot spots. *Future Business Journal*, 8(17).
<https://doi.org/10.1186/s43093-022-00126-8>
- Kaufman, M., and Leigh, D. (2021). *How the pandemic widened global current account balances*. IMF Blog, August 2, 2021.
<https://www.imf.org/en/Blogs/Articles/2021/08/02/blog-how-the-pandemic-widened-global-current-account-balances>.
- Keho, Y. (2017). The impact of trade openness on economic growth: The case of cote d'Ivoire. *Cogent Economics & Finance*, 5(1), 1332820.
<https://doi.org/10.1080/23322039.2017.1332820>
- Manap, N. M. A., and Ismail, N. W. (2019). Food security and economic growth. *International Journal of Modern Trends in Social Sciences*, 2(8), 108-118.
<https://doi.org/10.35631/ijmtss.280011>

- McKibbin, W. J., and Fernando, R. (2020). *The global macroeconomic impacts of COVID-19: Seven scenarios*. CAMA Working Paper No. 19/2020, Australian National University. <http://dx.doi.org/10.2139/ssrn.3547729>
- OECD. (2015). *Infrastructure financing instruments and incentives*. OECD Publishing. <https://www.oecd.org/finance/private-pensions/Infrastructure-Financing-Instruments-and-Incentives.pdf>
- Ridhwan, M. M., Rezki, J. F., Suryahadi, A., et al. (2023). The impact of COVID-19 lockdowns on household income, consumption, and expectations: Evidence from high-frequency data in Indonesia. *Bulletin of Indonesian Economic Studies*, 1-42. <https://doi.org/10.1080/00074918.2023.2167930>
- Santosa, D. A. (2022). *Pangan dunia dan Indonesia 2023* [Global and Indonesia food supply 2023]. Kompas, December 2, 2022. <https://www.kompas.id/baca/opini/2022/12/01/pangan-dunia-dan-indonesia-2023>
- Setyari, N. P. W., Rustariyuni, S. D., and Aswitari, L. P. (2016). Capital intensity, openness, and the economic growth of the ASEAN 5. *Journal of Indonesian Economy and Business*, 31(3), 260-278. <https://doi.org/10.22146/jieb.23268>
- Sharma, S., Yadav, M. P., and Jha, B. (2021). Impact of the COVID-19 outbreak on the currency exchanges of selected countries. *International Journal of Sociotechnology and Knowledge Development*, 14(2), 73-91. <https://doi.org/10.4018/IJSKD.2022040105>
- Szczygielski, J. J., Charteris, A., Bwanya, P. R., et al. (2022). The impact and role of COVID-19 uncertainty: A global industry analysis. *International Review of Financial Analysis*, 80, 101837. <https://doi.org/10.1016/j.irfa.2021.101837>
- Teresienė, D., Keliuotytė-Staniulienė, G., Liao, Y., et al. (2021). The impact of the COVID-19 pandemic on consumer and business confidence indicators. *Journal of Risk and Financial Management*, 14(4), 159. <https://doi.org/10.3390/jrfm14040159>
- Topcu, E., Altinoz, B., and Aslan, A. (2020). Global evidence from the link between economic growth, natural resources, energy consumption, and gross capital formation. *Resources Policy*, 66, 101622. <https://doi.org/10.1016/j.resourpol.2020.101622>
- Trejos, S., and Barboza, G. (2015). Dynamic estimation of the relationship between trade openness and output growth in Asia. *Journal of Asian Economics*, 36, 110-125. <https://doi.org/10.1016/j.asieco.2014.10.001>
- Ullah, S. (2022). Impact of COVID-19 pandemic on financial markets: A global perspective. *Journal of the Knowledge Economy*, 14(2), 982-1003. <https://doi.org/10.1007/s13132-022-00970-7>
- Utami, F., Putri, F. M. E., Wibowo, M. G., et al. (2021). The effect of population, labor force on economic growth in OIC countries. *Jurnal REP (Riset Ekonomi Pembangunan)*, 6(2), 144-156. <http://dx.doi.org/10.31002/rep.v6i2.3730>
- Utomo, C. D., and Hanggraeni, D. (2021). The impact of COVID-19 pandemic on stock market performance in Indonesia. *Journal of Asian Finance Economics and Business*, 8(5), 777-784. <https://koreascience.kr/article/JAKO202112748675199.page>
- World Bank. (2022). *The world bank in Indonesia: Overview: Context*. Accessed April 2023. <https://www.worldbank.org/en/country/indonesia/overview>
- World Bank Open Data. (n.d.). *Food production index - Indonesia*. Accessed April 2023. <https://data.worldbank.org/indicator/AG.PR.D.FOOD.XD?end=2021&locations=ID&start=2011>

- World Bank Open Data. (n.d.). *Foreign direct investment, net inflows (% of GDP) - Indonesia*. Accessed April 2023.
<https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?end=2021&locations=ID&start=2011>
- World Bank Open Data. (n.d.). *GDP growth (annual %) - Indonesia*. Accessed April 2023.
<https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?End=2021&locations=ID&start=2011>
- World Bank Open Data. (n.d.). *Gross capital formation (annual % growth) - Indonesia*. Accessed April 2023.
<https://data.worldbank.org/indicator/NE.GDI.TOTL.KD.ZG?end=2021&locations=ID&start=2011>
- World Bank Open Data. (n.d.). *Labor force, total - Indonesia*. Accessed April 2023.
<https://data.worldbank.org/indicator/SL.TLF.TOTL.IN?end=2021&locations=ID&start=2011>
- World Bank Open Data. (n.d.). *Trade (% of GDP) - Indonesia*. Accessed April 2023.
<https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?end=2021&locations=ID&start=2011>
- Yakubu, M. M., Akanegbu, B. N., and Jelilov, G. (2020). Labour force participation and economic growth in Nigeria. *Advances in Management and Applied Economics*, 10(1), 1-14. https://ideas.repec.org/a/spt/admaec/v10y2020i1f10_1_1.html
- Zhao, L., Rasoulinezhad, E., Sarker, T., et al. (2022). Effects of COVID-19 on global financial markets: Evidence from qualitative research for developed and developing economies. *The European Journal of Development Research*, 35(1), 148-166.
<https://doi.org/10.1057/s41287-021-00494-x>
- Zhilenko, V. Y., Amirova, E. F., Lomakin, D. E., et al. (2021). The impact of COVID-19 pandemic on the global economy and environment. *Journal of Environmental Management and Tourism*, 12(5), 1236-1241.
[https://doi.org/10.14505/jemt.v12.5\(53\).08](https://doi.org/10.14505/jemt.v12.5(53).08)