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ANALYSIS OF THE DETERMINANTS OF MALNUTRITION AMONG CHILDREN UNDER FIVE IN THE REGENCIES AND CITIES OF BALI PROVINCE, 2019–2023

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Abstract: Malnutrition is a condition caused by an imbalance between what a person eats and what is needed to maintain good health. Malnutrition remains one of the major public health issues, especially in developing countries, affecting infants, toddlers, and women of reproductive age. The purpose of this study is to analyze both simultaneously and partially the effects of economic growth, healthcare facilities, environmental sanitation, women's education level, and poverty on the number of malnourished toddlers in the regencies/municipalities of Bali Province. The study covers the period from 2019 to 2023 and uses panel data, which is a combination of time series and cross-sectional data. The results of the study indicate that simultaneously, economic growth, healthcare facilities, environmental sanitation, women's education, and poverty have a significant effect on malnutrition. Partially, economic growth has a negative and significant effect, poverty has a positive and significant effect, while healthcare facilities, environmental sanitation, and women's education level have negative but not significant effects on malnutrition. It is expected that this study can provide incentives for policymakers in strengthening posyandu (integrated health post) programs that directly target toddlers across all social groups.
Keywords: Malnutrition; Toddlers; Economic Growth; Healthcare Facilities; Sanitation; Education; Poverty; Welfare

INTRODUCTION

Economic development has traditionally been understood as a country's effort to increase its output at a rate that exceeds population growth, thereby achieving sustainable growth in per capita income. This increase in output is measured through Gross Domestic Product (GDP), which serves as an indicator of overall economic welfare (Todaro & Smith, 2012). In addition, the concept of GDP together with the components of GDP available in national financial reports can be useful and provide a lot of information that is closely related to the welfare of the population (Dynan and Sheiner, 2018).

However, both GDP and GRDP (district/city GDP) are considered insufficient in indicating the welfare of a country or region. According to Amartya Sen (1999), well-being focuses on achieving a person's condition (functioning) in the sense of how well (well) things are achieved/done (being) by a person. This achievement refers more to

the quality obtained by a human being compared to quantity and depends on the characteristics of the commodity (Sen, 1999: 3,7,8).

Based on this understanding, welfare cannot only be measured by income, either through GDP or GRDP. The United Nations Development Programme (UNDP) has classified the welfare of various countries by considering health and education achievements in addition to the income of these countries through the Human Development Index (HDI) (Todaro & Smith, 2020: 8). The Human Development Index (HDI) is an index that measures national socio-economic development based on a combination of adjusted measures of education, health, and real income per capita. In addition to the HDI, UNDP also issues other indices, namely the Multidimensional Poverty Index (MPI) and the Gender Inequality Index (GII) as part of the Inequality-Adjusted Human Development Index (IHDI) to compensate for the increase in the HDI which causes the gap to widen (Todaro & Smith, 2020: 48). Thus, based on what Amartya Sen said about human welfare, health in terms of being healthy, nutritious, and living long plays an important role in economic development because health is a human capital input in production activities that allows for increased income and becomes an output that directly affects welfare.

The World Health Organization (WHO, 1948), the principal agency of the United Nations (UN) dealing with global health issues, defines health as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO, 1948). Based on the Multidimensional Poverty Index (MPI), health has two dimensions, namely nutrition and child mortality. First, a household is categorized as malnourished if there are children who are stunted or underweight and family members aged 15 years and over are below the body mass index (BMI) limit which is an indicator of the nutritional dimension for family members aged 15 years and over. Second, a household is considered deprived if a child has died in the family within five years before the survey was conducted (Todaro & Smith, 2020: 247).

Malnutrition plays a significant role in cognitive problems in poor communities. Malnutrition reduces physical strength and cognitive function, including difficulty concentrating and thinking clearly. In a randomized controlled trial of rickshaw pullers in India, providing malnourished rickshaw pullers with additional calories significantly improved their performance by about 12 percent, resulting in them earning more than before (Schilbach et al., 2016). The trial reflects that high poverty rates can indicate low levels of well-being in an area. Poor communities are more vulnerable to malnutrition. The link between poverty and malnutrition makes both important issues to be addressed through the Sustainable Development Goals (SDGs) with the main goal of improving well-being, especially in developing countries.

However, malnutrition is a widespread societal problem that affects the global population at some stage in life. This public health epidemic targets everyone, but the

most vulnerable groups besides the poor include children, adolescents, the elderly, those who are sick and have weak immune systems, and lactating and pregnant women (Dukhi, 2020). Stunting, which is a type of malnutrition that occurs in Indonesia, is not only experienced by poor or underprivileged families/households, but also by families/households that are above 40 percent of the social and economic welfare level (Rumlah, 2022).

According to the World Health Organization (2024), malnutrition refers to a deficiency or excess of nutrient intake, an imbalance of essential nutrients, or impaired nutrient utilization. The double burden of malnutrition consists of undernutrition and overweight and obesity, as well as non-communicable diseases related to diet. So that the form of malnutrition is divided into 3, namely undernutrition, overnutrition, and vitamin and mineral deficiencies. Malnutrition itself includes 3 parts as follows: wasting is a lack of weight for height; stunting is a lack of height for age; and underweight is a lack of weight for age (WHO, 2024).

Early onset malnutrition results in lower school achievement, lower adult wages, and makes children less likely to escape poverty as adults (Martorell, 2017). The most vulnerable groups, namely women and children, will experience lifelong health and cognitive development consequences, including reduced education, lost income, and a devastating intergenerational cycle of malnutrition that leads to lost productivity, soaring health care costs, lost human capital, and reduced gross domestic product across countries and globally. Therefore, ending malnutrition is an important input for economic and human development, prosperity, equity, and for increasing human resources. Economically, every $1 invested in preventing malnutrition is estimated to provide a net benefit of $23. This can also show how much loss is faced if malnutrition is not immediately addressed (World Bank, 2024: 4, 32).

Indonesia is one of the countries with the highest malnutrition rates in the world, where one in twelve toddlers is wasted and one in five children is stunted. To date, Indonesia has achieved quite good results in efforts to overcome the problem of malnutrition, especially stunting and wasting. Although progress has been made, Indonesia still faces three burdens of nutritional problems, namely malnutrition (stunting and wasting), micronutrient deficiencies, and overweight or obesity. All of these require continuous efforts to ensure that all children receive optimal nutrition (UNICEF Indonesia, 2023: 16).

Bali Province is a province in Indonesia that is ranked as the province with the lowest prevalence of malnutrition in Indonesia. When compared to West Nusa Tenggara Province - which has a number of babies weighing in almost the same range, namely around 3,500 children - there is a significant difference in the prevalence of malnutrition between the two provinces. The prevalence of malnutrition in Bali is much lower than that in West Nusa Tenggara. The latest data from the Ministry of Health, namely the

Indonesian Health Survey (2023), shows that although the number of babies monitored in the two provinces is not much different, health and nutrition efforts in Bali Province appear to be more effective in reducing malnutrition rates in children (Ministry of Health, 2023).

Although Bali Province is an area with a low prevalence of malnutrition, the problem of malnutrition in Bali Province has not been fully resolved and continues to be a concern. Although overall Bali has the lowest prevalence of malnutrition in Indonesia, cases of malnutrition still occur in various regions. In addition, there is a disparity in the distribution of malnutrition cases between districts/cities, where several areas still record a fairly high prevalence of malnutrition. This disparity shows that the challenge of malnutrition in Bali is uneven and still requires a special approach to reduce cases in areas with higher prevalence. Overview of the distribution of malnutrition prevalence in districts/cities in Bali Province and a comparison of malnutrition prevalence rates in districts/cities in three consecutive years, namely 2021 to 2023 is shown in Table 1 below:

Table 1. Distribution of Toddler Nutritional Status in Regency/City of Bali Province 2021-2023 (Percent)

Regency/City	Stunting			Waste			Underweight		
	2021	2022	2023	2021	2022	2023	2021	2022	2023
Jembrana	14.3	14.2	8.7	2.0	3.9	3.2	7.3	10.6	6.9
Tabanan	9.2	8.2	6.3	4.1	2.1	3.3	4.7	6.4	6.7
Badung	8.7	6.6	4.9	3.2	2.8	1.7	5.1	5.6	3.5
Gianyar	5.1	6.3	6.3	1.9	2.2	2.3	3.7	4.8	5.8
Klungkung	19.4	7.7	4.9	6.5	2.5	1.4	15.9	5.7	3.7
Bangli	11.8	9.1	10.2	0.9	1.7	1.7	7.3	5.8	4.3
Karangasem	22.9	9.2	6.4	2.6	1.9	2.4	10	7.3	6.1
Buleleng	8.9	11	6.2	2.8	4.1	5.1	7.5	10.3	5.4
Denpasar	9.0	5.5	10.8	5.3	2.6	6.5	8.0	5.1	7.3
Bali Province	**12.1**	**8.6**	**7.2**	**3.3**	**2.6**	**3.1**	**7.7**	**6.8**	**5.5**

Source: SSGI, 2021-2022 and SKI, 2023

Based on the report of the results of the Studi Status Gizi Indonesia (SSGI) presented in Table 1, during 2021 and 2022, the results showed that the percentage of underweight and malnourished toddlers in Bali Province decreased by 0.9 percent in 2022. When viewed according to its distribution per district/city, it is known that the percentage of underweight prevalence is still quite high in several areas such as Jembrana and Buleleng. Then, the percentage of short and very short toddlers (stunting) in Bali Province decreased by 3.5 percent in 2022 and when viewed by distribution per district/city, the percentage of stunting prevalence in several areas is still quite high such as Jembrana, Buleleng, Karangasem, and Bangli. Furthermore, the percentage of thin and very thin toddlers (wasting) also decreased in 2022 by 0.7 percent and when viewed by distribution per district/city, the percentage of wasting in Bali Province is good, this is indicated by the majority of the wasting prevalence

percentages not exceeding 5 percent. However, based on data from the Indonesian Health Status (SKI) 2023, there was a significant increase in the prevalence of malnutrition in Denpasar City which almost doubled in cases of stunting and wasting. This shows that in 2023, malnutrition, especially in Denpasar City, experienced a significant increase in the prevalence of malnutrition and needs to be given serious attention from the local government.

Although Bali Province has recorded significant progress in handling malnutrition, major challenges still remain considering that malnutrition cases in the districts/cities of Bali Province have not been fully resolved. If the prevalence of malnutrition in toddlers is still > 5 percent, then the nutritional problem is considered a health problem with a moderate category threshold that has not reached the low health problem category (Director General of Public Health & Director of Public Nutrition, 2020). The magnitude of the problem of malnutrition in toddlers which is still considered a public health problem is if the prevalence of malnutrition is > 5 percent (Bali Provincial Health Office, 2023). Several areas in Bali Province still show malnutrition prevalence above 5 percent, indicating the need for more attention in efforts to address nutritional problems. Then, disparities in malnutrition prevalence between regions are also in the spotlight, where some areas have low prevalence rates, while others are much higher, this reflects the need for a more focused and comprehensive strategy in certain areas.

According to Amartya Sen (1999), factors that influence a person's nutrition, including toddlers, include body metabolic rate, body weight, age, gender, activity level, infectious diseases, access to health facilities, knowledge and education, and climate conditions (Sen, 1999: 17). In addition, based on the UNICEF Conceptual Framework on Maternal and Child Nutrition, factors that influence children's and women's nutrition are divided into three layers of determinants. Direct determinants include food intake (diet) and care patterns, such as breastfeeding, nutritious complementary foods, and hygienic practices and stimulation of child development. Fundamental determinants include the availability of nutritious food, responsive feeding practices, and adequate health, sanitation, education, and social protection services. Meanwhile, supporting determinants consist of government governance that guarantees nutritional rights, the availability of financial and environmental resources, and inclusive socio-cultural norms, including gender equality. Where these three layers of determinants interact with each other where political, economic, environmental, and cultural factors determine access to quality food, essential services, and optimal care practices that affect the risk of short-term malnutrition and long-term impacts such as health disorders, cognitive development, and productivity (UNICEF, 2021).

For that reason, this study decided to take a study in the form of an analysis of malnutrition determinants in toddlers referring to nutritional determinant factors by Amartya Sen and UNICEF, both those that play a direct and indirect role. The factors

used in this study consist of economic growth, health facilities, environmental sanitation, women's education level, and poverty. The five factors each represent each HDI achievement in the form of living standards through economic growth and poverty, health through health facilities and environmental sanitation, and education through women's education levels.

Economic growth is the percentage change in GDP or GRDP continuously through changes in production measured in terms of real GDP increases at a certain time and region. Economic growth brings additional income and output growth that are distributed to capital owners while income levels and employment are distributed to workers. Total GDP will increase and there will be an increase in aggregate social welfare measured, for example, in terms of more widely distributed benefits in income and employment.(Todaro & Smith, 2020: 128). When income levels are very low, the nutritional status of the population tends to deteriorate, increasing vulnerability to potentially fatal infectious diseases. This problem also affects maternal health during pregnancy and lactation, and in extreme cases can lead to famine.

Thus, economic growth is known from the changes, either up or down, in GDP or GRDP in several time periods that describe the aggregate welfare of the local community. Based on the Central Statistics Agency, economic growth is calculated through the percentage change in the value of GDP output. BPS Bali Province data shows the percentage change in GRDP in nine regencies/cities in Bali Province as follows:

Table 2. Economic Growth/GRDP (Percent) by Regency/City in Bali Province, 2019-2023

Regency/City	2019	2020	2021	2022	2023
Jembrana	5,56	-4,98	-0,65	2,98	3,66
Tabanan	5,58	-6,17	-1,98	2,93	3,56
Badung	5,81	-16,55	-6,74	9,97	11,29
Gianyar	5,62	-8,39	-1,05	4,04	5,06
Klungkung	5,42	-6,38	-0,23	3,12	4,7
Bangli	5,45	-4,1	-0,33	2,8	3,5
Karangasem	5,5	-4,49	-0,56	2,58	3,1
Buleleng	5,51	-5,8	-1,27	3,11	3,64
Denpasar	5,82	-9,44	-0,92	5,02	5,69
Bali	5,59	-7,37	-1,53	4,06	4,91

Source: Website of BPS Bali Province, 2019-2023

Based on the data in Table 2, the economic growth/GRDP of Bali Province in 2019 to 2023 fluctuated due to the Covid-19 pandemic so that in two consecutive years, economic growth was recorded as minus in all districts/cities. Economic growth is related to the large value of output from an economic activity that leads to an increase in employment and aggregate population income. Areas that have low economic growth or income show the purchasing power of their people, such as choosing to consume products at more affordable prices and in smaller quantities. This is due to

financial constraints that force residents of these areas to be more selective in spending. Thus, they often have to prioritize basic needs and avoid non-essential goods. (Silvia et al., 2021). Therefore, increasing economic growth/GRDP allows us to illustrate that a person is more able to buy more goods, including more food or more nutritious food.

According to the United Nations International Children Emergency Fund (UNICEF, 2023), it is stated that health services and sanitation are supporters of maternal and child health, where the fulfillment of both of these things can support the main priorities, namely reducing infant mortality rates, overcoming the lack of immunization coverage, improving the quality of newborn care, and preventing the transmission of diseases that are the main causes of death in toddlers and are related to stunting.(UNICEF Indonesia, 2023). For that, by increasing the number of hospitals will provide goodness and convenience for the community so that the community can obtain health facilities quickly, cheaply, and affordably. Medical and non-medical facilities provided in the hospital should be used optimally so as to support the healing process. One way that can be done to overcome nutritional problems, both malnutrition and excess nutrition, is to increase integrated nutritional service efforts and referral systems starting from the Integrated Service Post (Posyandu) level to Health Centers and Hospitals(Lailani et al., 2022).

The limited number of health facilities contributes to the increasing number of cases of disease in the community. In other words, the existence of adequate health facilities, both in terms of quantity and quality, plays an important role in reducing the incidence of disease. When health facilities are sufficient and of good quality, the community will find it easier to access the necessary medical services so that they can carry out prevention and treatment more effectively. Good health facilities also allow for early detection of disease, better management of health conditions, and increased awareness of the importance of maintaining health. Conversely, the lack of health facilities can cause delays in disease treatment, which has the potential to worsen the overall health condition of the community. Therefore, investment in the development and improvement of health facilities is essential to create a healthier and more productive society (Hasibuan et al., 2022).

Furthermore, environmental sanitation is an important effort in maintaining daily health which includes behaviors to maintain and protect environmental cleanliness (Annisa & Susilawati, 2022). In the context of the family, environmental sanitation has a very vital role in preventing the spread of disease and maintaining the health of all family members. Sanitation actions carried out by families include disposing of waste properly, maintaining the cleanliness of the area around the house, cooking food hygienically, and ensuring the cleanliness of the water used for daily activities (Ambarayana et al., 2020). Inadequate sanitation can contribute to serious health problems, such as stunting, which is often caused by recurrent diarrhea in children (Rosidin et al., 2024). Therefore,

the implementation of good sanitation practices is not only important for physical health but also for the overall development of children. With a clean and healthy environment, the risk of infectious diseases can be minimized, thereby significantly improving the quality of life of families.

The following is the distribution of access to proper sanitation in districts/cities in Bali Province during 2019-2023.

Table 3. Percentage of Access to Adequate Sanitation (Percent) in Districts/Cities in Bali Province

Regency/City	2019	2020	2021	2022	2023
Jembrana	94,31	93,03	96,24	85,84	96,05
Tabanan	95,23	94,7	98,34	79,35	95,56
Badung	98,55	98,88	99,59	87,77	98,98
Gianyar	96,61	97,98	93,48	91,77	99
Klungkung	93,77	94,44	95,91	93,39	97,7
Bangli	88,42	90,53	87,01	82,43	91,58
Karangasem	81,54	85,44	87,36	89,55	90,55
Buleleng	89,03	91,71	94,15	80,9	90,99
Denpasar	99,75	98,74	99,97	98,51	99,92
Provinsi Bali	93,02	93,94	94,67	87,72	95,59

Source: Website of BPS Bali Province, 2019-2023

Table 3 shows that the average household in the districts/cities of Bali Province has more than 90 percent access to proper sanitation. This provides information that almost the entire population of Bali Province has access to proper sanitation.

In addition, the level of parental education and parental knowledge also play a role in the incidence of malnutrition. It will be more difficult for parents, especially mothers with low education, to adjust to new information and change their eating habits or routines. A person's ability to assimilate knowledge, especially about nutritious food, is positively correlated with their level of education. The level of education has a major impact on how families raise their children and how they eat. Parents with higher education are often more concerned about their children's health. In addition, the level of parental education is also significantly related to the family's socio-economic status (Sianturi et al., 2023).

Table 4. Comparison of Average Length of Schooling for Boys and Girls (Years) per Regency/City in Bali Province

Regency/City	Average Length of Schooling									
	Boys					Girls				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Jembrana	9,24	9,25	9,26	9,37	9,4	7,38	7,39	7,53	7,9	7,91
Tabanan	9,75	9,76	9,95	9,96	10,01	8,23	8,24	8,53	8,56	8,78
Badung	10,92	10,93	11,08	11,09	11,32	9,69	9,7	9,97	10,07	10,52
Gianyar	9,77	9,78	9,98	10,28	10,38	8,16	8,34	8,61	8,86	9,19
Klungkung	9,21	9,22	9,23	9,5	9,51	7,12	7,13	7,14	7,5	7,63
Bangli	8,09	8,1	8,11	8,22	8,23	6,31	6,47	6,48	6,87	7,15
Karangasem	7,34	7,35	7,36	7,44	7,45	5,24	5,28	5,29	5,65	5,66
Buleleng	7,95	8,15	8,16	8,4	8,41	6,29	6,43	6,44	6,81	6,82
Denpasar	11,62	11,87	11,88	11,9	11,91	10,9	11,13	11,14	11,15	11,17
Provinsi Bali	9,66	9,68	9,76	9,99	10,04	8,03	8,21	8,36	8,71	8,8

Source: Website of BPS Bali Province, 2019-2023

Based on Table 4, it is shown that the average length of schooling for girls in all districts/cities in Bali Province is lower than the average length of schooling for boys. The average length of schooling for girls in Bali Province is the highest at around 9 years, which means that the average length of schooling for girls aged 15 years and above is only up to Junior High School (SMP) level, which is 9 years of schooling.

Finally, people living in poverty are among the groups most vulnerable to malnutrition. A decline in income, while inequality measures do not change in reality, can lead to a sharp increase in hunger, malnutrition, and arguably poverty as well (Chakravarty, 1983). According to Amartya Sen's perspective (1999), poverty should be seen as a loss of basic capabilities and not just as low income which is the standard criterion for identifying poverty (Sen, 1999b: 109).

METHOD

This study employs a quantitative associative approach aimed at examining the relationships and effects among variables using numerical data and statistical procedures. Grounded in the post-positivist paradigm, this approach utilizes techniques such as surveys and statistical analysis to objectively test hypotheses. In this context, the research focuses on the influence of independent variables economic growth, healthcare facilities, environmental sanitation, women's education level, and poverty on the dependent variable, namely the number of malnutrition cases among children under five in the regencies/municipalities of Bali Province during the 2019–2023 period, using panel data regression.

The study was conducted in nine regencies/municipalities in Bali Province, selected due to the persistent and uneven prevalence of child malnutrition across the region. The research objects include the number of under-five malnutrition cases, analyzed in relation to the five identified independent variables. The data used are

secondary in nature and were obtained from official publications by the Central Statistics Agency (BPS) and the Bali Provincial Health Office. Data collection was carried out through non-participant observation, which involves examining documents without the researcher's direct involvement in collecting primary data.

The analytical technique employed in this study is panel data regression, which combines cross-sectional data (from 9 regencies/municipalities) and time series data (from 2019 to 2023), resulting in a total of 45 observations. This model allows the researcher to comprehensively observe the simultaneous effects of multiple variables on child malnutrition. Each variable has been operationally defined for example, economic growth is measured by Gross Regional Domestic Product (GRDP), healthcare facilities are represented by the ratio of units per 1,000 population, and poverty is expressed as the percentage of the population living below the poverty line—with the aim of generating accurate and relevant findings to support efforts in combating malnutrition in Bali.

RESEARCH RESULTS AND DISCUSSION

Results of Analysis of Research Data

Model Selection Test

Table 5. Chow Test Results

Fixed Effect Model
Redundant Fixed Effects Tests
Equation: Untitled

Cross-section fixed effects test

Effects Test	Statistics	df	Prob.
Cross-section F	12,509,456	-8.31	0.0000
Cross-section Chi-square	64,880,433	8	**0.0000**

Source: Eviews 9 2025, Processed Data

The results of Table 5 show that the cross-section chisquare has a probability of 0.0000 lower than 0.05. Therefore, according to the decision criteria, this test was chosen to use fixed effects.

Because in the chow test the selected model is a fixed effect model, it is necessary to conduct further testing with the hausman test to determine whether the fixed effect or random effect model is used. In determining the results of the hausman test, it is by assessing the probability of the cross-section being random, if the probability < 0.05 then the model used is a fixed effect, but if the probability > 0.05 then the model used is a random effect.

The results of the Hausman test in this study show that the selected model is the random effect model and is shown in Table 6 below:

Table 6. Hausman Test Results

Random Effect Model
Correlated Random Effects - Hausman Test
Equation: Untitled

Cross-section random effects test

Test Summary	Chi-Sq. Sta	Chi-Sq. df	Prob.
Random cross section	8,570,871	5	**0.1275**

Source: Eviews 9 2025, Processed Data

The results of Table 6 show that the random cross-section probability value is 0.1275, which is greater than 0.05, so that the selected Hausman test results are random effect models. Because the selected Hausman test is a random effect model, it is necessary to conduct the last test, namely the Lagrance multiplier test, to determine whether the model used is a random effect or a common effect. If the cross-section probability is < 0.05, then the model used is a random effect, but if the probability is > 0.05, then the model used is a common effect.

The results of the Lagrance multiplier test in this study show that the selected model is a random effect model and is shown in Table 7 below:

Table 7. Lagrange Multiplier Test Results

Lagrange Multiplier Tests for Random Effects
Null hypothesis: No effects

Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided			
	Cross section	Time	Both
Breusch Pagan	39.28982	0.172340	39.46216
	(0.0000)	(0.6780)	(0.0000)

Source: Eviews 9 2025, Processed Data

The results of Table 7 show the cross-section probability in the Breusch-Pagan test of 0.0000 is lower than 0.05. This result means that the selected model is a random effect model.

Based on the results of the panel data model selection, to assess the panel data regression test, this study uses a random effect model in determining the decision on the results of this study.

The following are the results and equations of panel data regression using the random effect model and are shown in Table 8 below:

Table 8. Panel Data Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4,626,779	4,858,465	0.952313	0.3468
X1	-6,980,132	2,489,824	-2,803,464	0.0078
X2	-8,146,953	1,030,808	-0.790346	0.4341
X3	-3,585,709	3,431,297	-1,045,001	0.3025

X4	-0.552324	2,786,013	-0.019825	0.9843
X5	6,001,451	2,708,726	2,215,600	0.0326

Source: Eviews 9 2025, Processed Data

Panel Data Regression Equation

$$\hat{Y} = 4.626 - 6.980X1 - 8.147X2 - 3.586X3 - 0.552X4 + 6.001X5$$

Classical Assumption Test

1. Normality Test

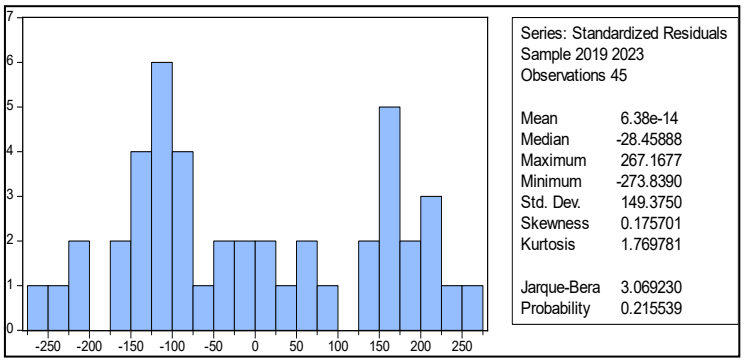

Figure 1. Normality Test Result

Based on Figure 1, the results of the normality test with the Jarque-Bera test show that the Jarque-Bera statistical value is 3.069230 with a probability of 0.2155. The probability value is greater than α = 5 percent (0.05), this means that the residual data has been normally distributed by 21 percent so that the regression model that has been created is suitable for further analysis.

2. Multicollinearity Test

Table 9. Multicollinearity Test Results

Variable	VIF
Economic growth	1.150834
Health Facilities	1.233191
Environmental Sanitation	1.183657
Women's Education Level	1.600120
Poverty	1.400362

Source: Eviews 9 2025, Processed Data

Based on Table 9, it can be seen that the variables Economic Growth (X_1), Health Facilities (X_2), Environmental Sanitation (X_3), Women's Education Level (X_4), and Poverty (X_5) do not contain multicollinearity. Each variable contains a VIF value of less than 10 so that it passes the multicollinearity test.

3. Heteroscedasticity Test

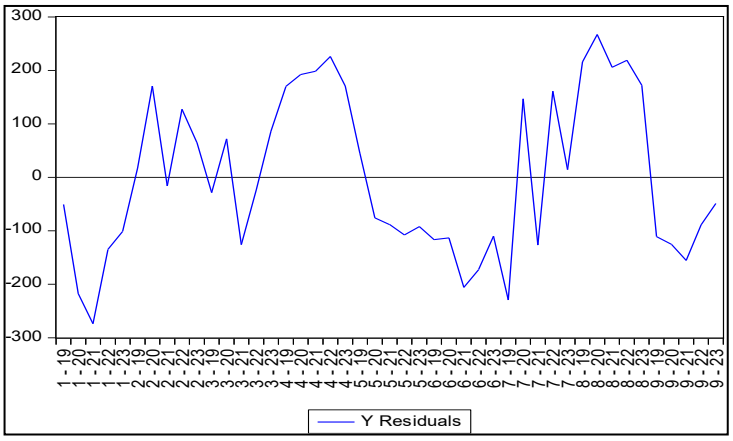

Figure 2. Heteroscedasticity Test Result

Based on Figure 2, heteroscedasticity test results using the residual graph (blue color) it can be seen that it does not cross the limits (500 and -500), meaning that the residual variance is the same. Therefore, there are no symptoms of heteroscedasticity or it passes the heteroscedasticity test (Napitupulu et al., 2021).

4. Autocorrelation Test

Table 10. Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	2,375,294	Prob. F(2,36)	0.1074
Obs*R-squared	5,129,396	Chi-Square Prob.(2)	0.0769

Source: Eviews 9, 2025 Processed Data

Based on Table 10, the Obc R-Squared value is 0.0769 > 0.05, so it can be concluded that the autocorrelation test assumption has been met or the data has passed the autocorrelation test.

Hypothesis Testing with Panel Data Regression

Simultaneous Effect Test Results

Table 11. Simultaneous Test Results (F)

R Square	Adjusted R Square	Std. Error of the Estimate	F	Sig.
0.265	0.17	8,888	2,808	0.029

Source: Eviews 9, 2025 Processed Data

Based on Table 11, it is known that the Fcount value is greater than Ftable, which is 2.808 > 2.456 with a significance level of 0.029 < 0.05. Through these results, it can be concluded that the variables of Economic Growth (X_1), Health Facilities (X_2),

Environmental Sanitation (X_3), Women's Education Level (X_4), and Poverty (X_5) together have an influence and are statistically significant on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

Coefficient of Determination Test (R2) Result

The coefficient of determination (R_2) value is 0.265 or 26.5 percent. The coefficient of determination value shows that the proportion of the influence of independent variables consisting of Economic Growth (X_1), Health Facilities (X_2), Environmental Sanitation (X_3), Women's Education Level (X_4), and Poverty (X_5) is able to explain the dependent variable of Toddler Malnutrition (Y) in the districts/cities of Bali Province by 26.5 percent, while the remaining 73.5 percent is explained by other variables that are not included in this research model.

Partial Test Results

1) Influence Economic Growth (X_1) on Toddler Malnutrition in Districts/Cities of Bali Province

The partial calculation results of the influence of Economic Growth (X_1) on Toddler Malnutrition (Y) have a probability value of 0.008 < 0.05 and $-t_{count} < -t_{table}$, namely -2.803 < -1,679, then H_0 is rejected and H_1 is accepted. This shows that the Economic Growth variable (X1) has a negative and significant effect on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

The regression coefficient value is -6,980. This means that if other variables are constant and Economic Growth increases by 1 percent, the Toddler Malnutrition will decrease by 6,980 case, likewise if the value of the other variables is constant and Economic Growth experiences a decrease of 1 percent then Toddler Malnutrition will experience an increase of 6,980 case. The negative sign on the regression coefficient indicates that the relationship between economic growth and toddler malnutrition is inverse.

2) Influence Health Facilities (X_2) on Toddler Malnutrition in Districts/Cities of Bali Province

The partial calculation results of the influence of Health Facilities (X_2) on Toddler Malnutrition (Y) have a probability value of 0.434 > 0.05 and $-t_{count} > -t_{table}$, namely -0.790 > -1,679, then H_0 is accepted and H_1 is rejected. This shows that the Health Facilities variable (X_2) has a negative but insignificant effect on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

The regression coefficient value is -8,147. This means that if other variables are constant and Health Facilities increases by 1 unit per 1000 population, the Toddler Malnutrition will decrease by 8,147. In other cases, vice versa, if the value of the other variables is constant and Health Facilities experiences a decrease of 1 unit per 1000 population, then Toddler Malnutrition will experience an increase of 8,147 case. The

negative sign on the regression coefficient indicates that the relationship between health facilities and toddler malnutrition is inverse.

3) Influence Environmental Sanitation (X_3) on Toddler Malnutrition in Districts/Cities of Bali Province

The partial calculation results of the influence of Environmental Sanitation (X_3) on Toddler Malnutrition (Y) have a probability value of 0.303 > 0.05 and $-t_{count} > -t_{table}$, namely -1.045 > -1,679, then H_0 is accepted and H_1 is rejected. This shows that the Environmental Sanitation variable (X_3) has a negative but insignificant effect on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

Regression coefficient valueas big as -3,586. This means that if other variables are constant and Environmental Sanitation increases by 1 percent, the Toddler Malnutrition will decrease by 3,586. In other cases, vice versa, if the value of the other variables is constant and Environmental Sanitation experiences a decrease of 1 percent, then Toddler Malnutrition will experience an increase of 3,586 case. The negative sign on the regression coefficient indicates that the relationship between environmental sanitation and toddler malnutrition is inverse.

4) Influence Women's Education Level (X_4) on Toddler Malnutrition in Districts/Cities of Bali Province

The partial calculation results of the influence of Women's Education Level (X_4) on Toddler Malnutrition (Y) have a probability value of 0.984 > 0.05 and $-t_{count} > -t_{table}$, namely -0.019 > -1,679, then H_0 is accepted and H_1 is rejected. This shows that the variable of Women's Education Level (X_4) has a negative but not significant effect on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

Regression coefficient valueas big as -0.552. This means that if other variables are constant and Women's Education Level increases by 1 year, the Toddler Malnutrition will decrease by 0.552 case, vice versa, if the value of the other variables is constant and Women's Education Level experiences a decrease of 1 year, then Toddler Malnutrition will experience an increase of 0.552 case. The negative sign on the regression coefficient indicates that the relationship between women's education level and toddler malnutrition is inverse.

5) Influence Poverty (X_5) against Toddler Malnutrition in the districts/cities of Bali Province

The partial calculation results of the influence of Poverty (X_5) on Toddler Malnutrition (Y) have a probability value of 0.033 < 0.05 and $t_{count} > t_{table}$, namely 2.215 >1,679, then H_0 is rejected and H_1 is accepted. This shows that the Poverty variable (X5) has a positive and significant effect on Toddler Malnutrition (Y) in the districts/cities of Bali Province.

Regression coefficient valueas big as 6,001 have. This means that if other variables are constant and Poverty increases by 1 percent, the Toddler Malnutrition will increase

by 6,001. In other cases, vice versa, if the value of the other variables is constant and the Poverty experiences a decrease of 1 percent, then Toddler Malnutrition will experience a decrease of 6,001 case. A positive sign on the regression coefficient indicates that the relationship between poverty and toddler malnutrition is unidirectional.

Discussion

The Effect of Simultaneous Variables on Toddler Malnutrition

The results of the panel data regression analysis show that economic growth, health facilities, environmental sanitation, women's education, and poverty simultaneously have a significant effect on the rate of toddler malnutrition in the districts/cities of Bali Province. This is in line with the UNICEF conceptual framework (2020) which emphasizes that malnutrition is a multidimensional problem influenced by social, economic, and environmental factors. With a significant F test, this model is statistically feasible to use.

Empirically, these results are supported by various previous studies. Astrid et al. (2020), Ihsan et al. (2020), and Apriliana et al. (2021) showed that various social and economic variables, including sanitation, income, and education, jointly influence the prevalence of stunting and malnutrition in Indonesia.

Partial Effect of Economic Growth

Economic growth has a negative and significant effect on toddler malnutrition. Economic growth expands employment opportunities, increases household income, and people's purchasing power for nutritious food. Conversely, economic slowdown reduces purchasing power and worsens toddler nutritional conditions. The FAO report (2024) states that food sector GDP growth significantly increases access to healthy food, and ignoring the issue of stunting can cause economic losses of up to 1.2% of national GDP.

Local governments have an important role in distributing economic growth evenly through strengthening MSMEs, job training, and providing nutritious food subsidies. This finding is in line with research by Karyati (2021) and Febriyanti (2022), which shows that economic growth is negatively related to stunting rates.

Partial Effect of Health Facilities

Health facilities showed a negative but insignificant effect on toddler malnutrition in Bali. This is because the indicators used cover all types of health facilities, not those that specifically handle toddler nutrition. Other factors such as service quality, geographic access, and costs also affect the effectiveness of these facilities.

Agustina et al. (2022) emphasized the importance of quality services and ease of access. Optimization of integrated health posts and training of nutrition cadres is essential so that services are more targeted. Studies by Alamsyah et al. (2017) and

Istiono et al. (2009) also found that access to health is not necessarily directly correlated with the nutritional status of toddlers.

Partial Effect of Environmental Sanitation

Environmental sanitation has a negative but insignificant effect on toddler malnutrition. The majority of areas in Bali already have access to sanitation above 90%, so marginal improvements do not significantly affect malnutrition rates. In addition, the availability of good sanitation is not automatically accompanied by hygienic community behavior.

Riski et al. (2019) showed that the availability of sanitation infrastructure must be accompanied by clean living behavior to effectively reduce malnutrition. Therefore, sanitation education and promotion of healthy lifestyles, such as washing hands with soap, need to be intensified by health cadres so that the benefits of infrastructure are truly felt.

Partisal Effect of Woman Education Level

Women Education Level has a negative but no significant effect on toddler malnutrition. Increasing women education levels can reduce the number of toddlers affected by malnutrition but the effect is not significant. In some areas of Bali Province, there is quite a large inequality and can cause data variations that are too large so that the effect of education is not statistically detected.

Low maternal education levels tend to increase the risk of stunting in toddlers (Wardanu et al., 2022). Therefore, posyandu cadres as parties who are directly in contact with pregnant women and toddlers can insert nutrition and parenting materials in gender equality programs or provide women's skills training and involve local women's figures as Bali nutrition promotion agents.

Partisal Effect of Poverty

Poverty has a positive and significant effect on Toddler Malnutrition in districts/cities in Bali Province. Poverty causes a person or group of people to be vulnerable to hunger and malnutrition due to limited access to quality food. The FAO publication (2024), namely The State of Food Security and Nutrition in the World, states that poverty and affordability are the main determinants of food access and contribute directly to food security and malnutrition.

Aurellia et al. (2021) stated that poor people have limited incomes so that both the quantity and quality of food that can be purchased are also limited, thus affecting low food consumption which then disrupts the adequacy and needs of nutritional intake

CONCLUSION

1) Economic growth, health facilities, environmental sanitation, women's education levels, and poverty have a significant influence simultaneously on malnutrition in the regency/cities of Bali Province.
2) Economic growth has a negative and significant effect on child malnutrition. This indicates that an aggregate improvement in the community's economic welfare can reduce the number of malnutrition cases among children under five.
3) Poverty has a positive and significant effect on child malnutrition. This suggests that an increase in poverty can lead to a higher number of malnutrition cases among children under five. Conversely, a reduction in poverty can decrease the incidence of malnutrition in this age group.
4) Healthcare facilities, environmental sanitation, and the education level of women of productive age do not show a significant effect on child malnutrition. This implies that the mere availability of health and education infrastructure is insufficient without improvements in service quality, the development of supporting facilities and public infrastructure, behavioral changes, and the adoption of a more holistic approach.

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