

Population Growth and Poverty Prediction in Lanao del Sur Using Computational Analysis

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Sigmund A. Ramirez

Tanjay City Science High School, Barangay XI, Opao, Tanjay City, Negros Oriental

Kurt Q. Siray

Tanjay City Science High School, Barangay XI, Opao, Tanjay City, Negros Oriental

John Nicko Samente Zerna

Tanjay City Science High School, Barangay XI, Opao, Tanjay City, Negros Oriental

Abstract

This research focuses on predicting the future of poverty and population growth in Lanao Del Sur, a province in the Bangsamoro Autonomous Region in Muslim Mindanao that is currently seeing a rapid increase in residents. By using computational methods like growth rate calculations and population projections based on data from the Philippine Statistics Authority, this study aims to forecast how these two factors will interact in the coming years. The data shows that Lanao Del Sur had a high annual growth rate of about 2.69 percent between 2015 and 2020. Based on this trend, the research predicts that the population will continue to rise significantly, which is expected to keep poverty rates high across many towns. However, this prediction indicates that widespread poverty will pose a serious problem if employment opportunities or economic growth fall short of the growing population. Ultimately, this study highlights that understanding these future population trends is essential for local leaders. By using these predictions to create better economic strategies, the province may be able to change this path and finally reduce poverty levels.

Keywords: Population growth, poverty incidence, Lanao del Sur, computational analysis, socio-economic prediction

Introduction

Lanao del Sur is a province of the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) located in the southern Philippines. This province is highly well-known for its outlasting cultural heritage of the Maranao people and the presence of the Islamic City of Marawi. The region is naturally wealthy due to its agricultural land and Lake Lanao. International concerns suggest that rapid population growth in developing countries can increase poverty rates. This happens when a population grows faster than the economy, placing a heavy burden on natural resources and social services. This research uses these international patterns to predict the future management of resources in Lanao Del Sur through a computational model. Local data from the 2020 census shows that the population of the province reached 1,195,518, which is an increase from the 1,045,429 residents recorded in 2015. The average annual growth rate is currently 2.7 percent, making it one of the most populous provinces in its region.

This study aims to help predict future challenges in providing services such as healthcare, education, housing, and employment. The analysis indicates that the demand for these services is expected to surpass the capacity of the government in the near future if the current situation continues. The prediction model depends heavily on the current state of the economy. According to the Philippine Statistics Authority, approximately 68 percent of households are living below the poverty line in 2021. In areas like Pagayawan and Bacolod-Kalawi, poverty rates have remained between 85 and 90 percent, despite some progress made since 2015. The computational model predicts that these high poverty levels will continue even as the population in the province expands. Significant change is only expected if new livelihood initiatives and clean water sources are established to improve the economic standing of the province. This research provides a predictive framework to help leaders understand the urgency needed for sustainable development strategies.

Review Literature

Poverty is a complex proposition that includes deprivation of income, insufficient education, poor health conditions, and unmet basic service needs. Lanao del Sur has been identified by the Philippine Statistics Authority (PSA) as one of the poorest provinces in the Philippines, having a relatively higher poverty rate compared to the national average.

Population growth and poverty are interlinked and are known to be two of the most significant causes of socio-economic conditions for developing nations. From a global perspective, it is commonly depicted that a higher growth rate of population results in less access to resources and fewer employment opportunities. In turn, this creates a cycle of relative as well as absolute poverty at a persistent rate (Todaro & Smith, 2020). Research studies indicate that higher population increases competition for necessary economic resources such as land, food, healthcare, and jobs, thereby posing stress on already strained systems (Bloom, 2018).

It has long been known that one of the most significant demographic elements influencing welfare and economic development is population expansion. According to Malthusian theory, poverty and social instability, also known as "negative checks," will arise when a population grows larger than it can be fed (Malthus, 1798). Even if contemporary economists contend that technological advancements can counteract population pressures, the majority of emerging nations still see notable declines in the standard of living for their populations as a result of population pressure exceeding economic capacity. It was discovered that provinces with high fertility rates in the Philippines face a dearth of employment prospects, inadequate public service delivery, and pervasive poverty (Herrin & Pernia, 2003). In particular, because of its high fertility rate, the province of Lanao del Sur has the second-fastest growth rate in the entire nation.

In relation to the Philippine setting, there are a number of studies that have attempted to identify the connection between population growth and economic factors. In one study, Orbeta (2010) concluded that large family sizes are major factors that result in lower per capita income, thereby making low-income households more susceptible to poverty, especially in rural areas. In much the same vein, other factors that are identified to hinder economic development were noted in a study by Reyes et al. (2019) to include the role played by population growth in maintaining poverty in Mindanao despite its potential in being a sustainably rich region, while other factors such as lack of infrastructure investments on the part of the government, lack of access to education, and intraregional conflicts are also hindrances. These are more prominent in BARMM itself, particularly in BARMM regions that have population growth rates that are above average in comparison to the national average.

BARMM indicates that poverty is still persistently high due to a fast population growth counterbalanced by insufficient development activities. Canlas and Aldaba (2023) observed that the absence of sustained investment in both education and employment has constrained economic mobility in the area. More current reports of BARMM suggest that while there has been better performance in peace building, poverty remains one of the highest in the country. Such conditions are attributed to high population levels and generally low productivity in key sectors of agriculture and trade.

At the provincial level, it is observed that Lanao Del Sur has unique socio-economic problems arising from demographic changes. The said province has one of the highest rates of births in the Philippines, thereby configuring high dependency ratios where dependents outnumber earnings-generating members of the household. In fact, this demographic composition restricts economic power per household and thus leads to perpetual poverty. Moreover, disparities in educational and employment opportunities have also been attributed to the high number of people who are classified as poor in this jurisdiction. The fact that most of its people depend on subsistence farming and small-scale marketing business practices verifies an unstable economic base. The degree of poverty in Lanao Del Sur is also deepened by disparities in levels of either urban or rural areas, as well as economic repercussions of internal violence, such as the Marawi City siege.

Local empirical studies further support the relationship between population growth and poverty in Lanao Del Sur. Ampuan (2020) found a positive correlation between population density and unemployment, illiteracy, and low household income across several municipalities in the said province. Moreover, population control initiatives proved

hard to implement due to cultural practices that favor large family sizes. Madale (2015) underscored that such cultural norms have caused population growth to balloon beyond the sustainable capacity of local government resources.

On the whole, the analyzed literature confirms that population growth is both a contributing factor to poverty in Lanao Del Sur, as well as a result. Unemployment opportunities, social support structures, and cultural values that regard children as a symbol of social status in Lanao Del Sur have continued to influence economic factors in the region. While research on population growth and poverty levels has been done in Mindanao in general, there is an evident research gap when focusing on Lanao Del Sur. This is because there is a lack of quantitative research that examines population growth levels in relation to poverty rates in Lanao Del Sur. Such research is crucial in comprehending specific socio-economic issues in Lanao del Sur.

Methodology

This study uses a quantitative approach with a computational and mathematical focus to investigate the relationship between population change and the prevalence of poverty in the province of Lanao Del Sur. Because quantitative approaches enable the evaluation and discovery of measurable relationships between variables, they are applicable to this study. The approach is used to ascertain how poverty conditions are impacted by shifts in population levels. This approach guarantees precision and dependability when assessing the correlation between the region's poverty levels and population growth.

Independent Variable

Population growth rate refers to the rate at which the total population of Lanao Del Sur increases annually from the year 2024. In sum, it reflects the speed at which a population grows over a specific time due to births, deaths, and migration. This present study considers population growth as the most influential variable in changing the level of poverty.

Dependent Variable

Poverty incidence. This is a proportion of the population below the official poverty line. The poverty headcount is expressed as a share of the population considered poor and is studied five years beyond 2015. This variable reflects changes in the socio-economic condition of the population that may be affected by population growth.

Controlled Variables

To keep the analysis constant, some mathematical factors in the population and poverty projection models are held constant. These are the growth exponent, which normalizes the population growth over time; the initial population, referring to the population size of Lanao Del Sur in the base year 2024; and the constant multiplier, 100, used to express poverty incidence in percentage form. This would hold these factors constant to isolate the relationship between population growth and poverty incidence.

The data on population and growth rates in this study were obtained from the Philippine Statistics Authority (PSA), using their official data for census returns, as well as estimates in non-census years. Data for poverty rates were derived from the results of the Family Income and Expenditure Survey conducted by the PSA, aside from official poverty data, which represents the universally accepted measure for poverty in the Philippines. In this study, the population growth model used involves basic formulas for an exponential growth rate.

Materials

1. A Quantitative Analysis of Population Growth and Poverty Incidence in Lanao Del Sur: Trends, Correlations, and Implications for Development.
2. Population Growth and Poverty in Lanao Del Sur: A Quantitative Study on Demographic Change and Socio-Economic Conditions (2024–2029).
3. Measuring the Relationship Between Population Growth and Poverty in Lanao Del Sur: A Quantitative Approach.
4. A Quantitative Examination of Population Dynamics and Poverty Incidence in Lanao Del Sur, Philippines.

5. The Interplay of Population Growth and Poverty in Lanao Del Sur: A Quantitative Analysis for Policy and Development Planning.

Procedure

1. Data Collection Collected official population figures for Lanao Del Sur based on the 2015 and 2021 PSA censuses. Obtained provincial poverty incidence estimates from PSA and PSA-BARMM reports in 2025 and 2023. Examined other BARMM reports and press releases for background context on recent development investments (housing, health, livelihood programs).

2. Data Processing

Calculated the absolute population change and geometric annual growth rate between 2015 and 2024. Tabulated the poverty incidence rates for 2015 and 2023 and computed percentage-point and relative (%) change over the years. Standardized data into graphs and tables (trend in population, trend in poverty incidence, combined chart).

3. The input consists of the independent variable, dependent variable, and controlled variable. The independent variable of the study is the rate of the population in 2024. The dependent variables are the increase in poverty rates every 5 years and the number of years after 2023. The controlled variable is the mathematical formula. The treatment that will be used is a quantitative approach using mathematical computation.

The process begins with the collection of data needed in the analysis, such as Government and Institutional Reports, Demographic Records, and Time-Series Data. After the collection of data, it is then analyzed and processed using the mathematical formula.

4. Interpretation and Validation

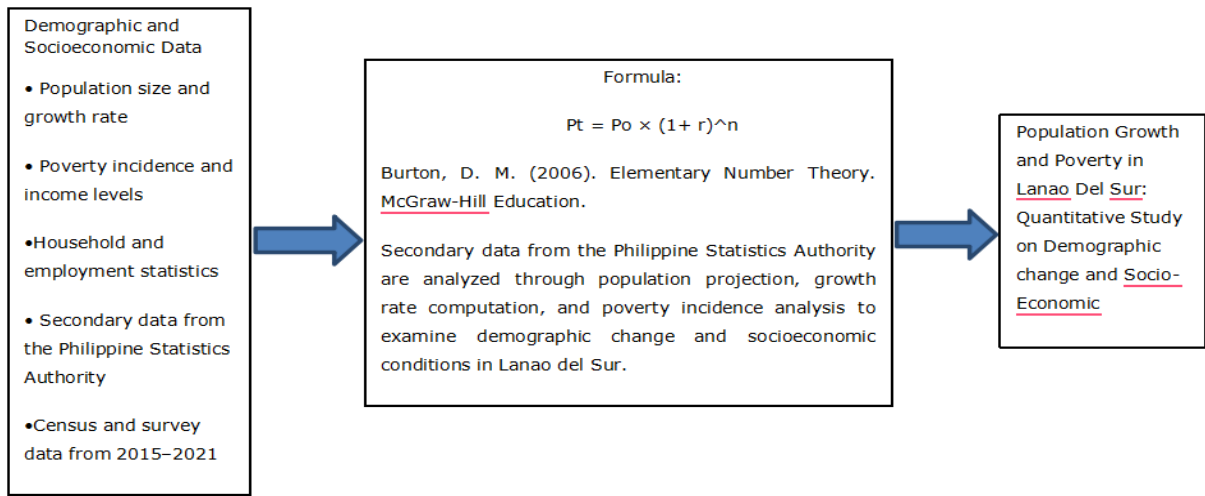
Ranked findings against prior BARMM-level investigations to ensure validation of consistency. Integrated contextual evidence from policy documents to describe potential causal mechanisms (e.g., how housing, health, and education programs contribute to poverty reduction in the face of rapid population growth).

Conceptual Framework

Through a mathematical investigation using a formula analyzed by the researchers, they will be able to derive an approximate poverty growth in the next 5 years, based on the past accumulated data. This study has undergone three phases to arrive at the target result, namely: a. input; b. process; and c. output.

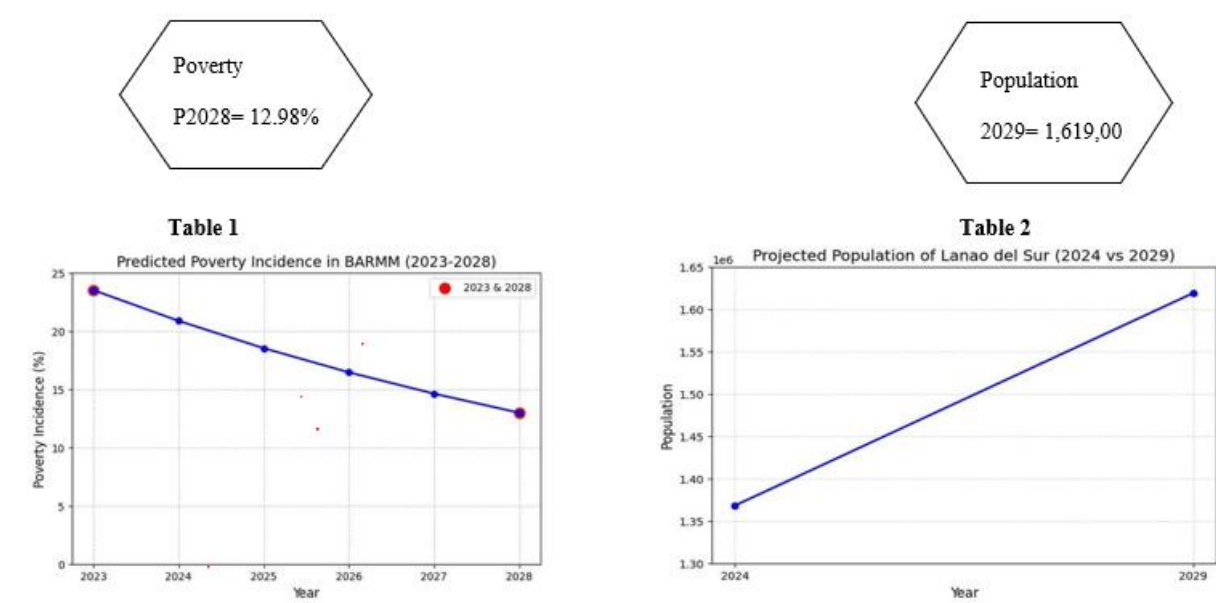
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Result

This section presents the results of the study’s objectives. It is presented in graphs below.



Solution

Formula
Poverty

$$r = [(P_t / P_o)]^{1/n} - 1$$

Where:

Pt=Population incidence in the later year

Po=poverty incidence in the earlier year

N=number of years between the two measurements

$$r = (P_{2023}/P_{2021})^{1/2} - 1$$

P2023=0.235(23.5% poverty in 2023)

P2021=0.298(29% poverty in 2021)

$$r = (0.235/0.298)^{1/2} - 1$$

$$r = (0.7893)^{1/2} - 1$$

$$r = -0.112$$

$$r = 11.2\%$$

$$P_t = P_o \times (1+r)^n$$

Pt= Predicted poverty incidence in the target year (%)

Po = Poverty incidence in the base year (%)

r = Average annual rate of change (as a decimal; negative if decreasing)

n = Number of years from the base year to the target year

$$P_t = 23.5 \times (1 - 0.112)^5$$

$$P_t = 23.5 \times (0.888)^5$$

$$P_t = 23.5 \times 0.553$$

$$P_t = 12.93\%$$

Population

$$P_t = P_o \times (1+r)^t$$

Pt=projected population in future year

Po= base population in 2024 (1,368,137)

r= annual growth rate (as a decimal) (r = 3.43% = 0.0343)

t= number of years from 2024 to 2029 (t=5)

$$P_t = 1,368,137 \times (1 + 0.0343)^5$$

$$P_t = 1,368,137 \times (1.0343)^5$$

$$P_t = 1,368,137 \times 1.184$$

$$P_{2029} = 1,619,000$$

Discussion

It has long been known that one of the most significant demographic elements influencing welfare and economic development is population expansion. According to Malthusian theory, poverty and social instability, also known as "negative checks," will arise when a population grows larger than it can be fed (Malthus, 1798). Even if contemporary economists contend that technological advancements can counteract population pressures, the majority of emerging nations still see notable declines in the standard of living for their populations as a result of population pressure exceeding economic capacity.

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This case study encompasses another key factor that can impact poverty reduction efforts in Lanao Del Sur: the effectiveness of governance practices and public service delivery. Though there is progress, if the impact of development is not felt due to implementation failures, a lack of monitoring, and challenges in governance, then the poorest of the poor would not be able to take advantage of the benefits of development. If, as a result of development, public expenditure on education, health, and social welfare is not handled properly, then there would be inequality.

The influence of conflict as a reason for maintaining high levels of poverty is due to conflict and security issues in certain areas of Lanao del Sur. Conflicts can disrupt economic and daily lives, and they also deter private sector investments because investors would feel insecure investing in an area where they are not sure if their investments will be secure or if they themselves will be secure. This also affects educational and health facilities since those displaced often lose their source of income and thus will end up poorer.

The increasing growth rate of the youth population can be viewed as a problem as well as an opportunity. On the one hand, the young population can be a source of fuel for economic growth. However, the lack of employment opportunities and education can lead to a problem of unemployment or underemployment. It can also increase the dependency ratios, thus increasing the burden of expenditure for the households. The increasing population can continue to undermine efforts aimed at overcoming poverty.

Poverty reduction is also affected by inequities in benefits that urban areas derive in comparison to rural areas in Lanao del Sur. Rural areas have limited market access, infrastructure, and services, making it difficult for this population to raise their incomes. Population growth makes this inequitable distribution worse because it adds to the land and services that everyone competes for.

The poverty rate in Lanao Del Sur is expected to decrease from 23.5% in 2023 to around 13% by 2018. This change is connected to both economic and population factors. When the population grows quickly, it puts more pressure on available resources like food, housing, and jobs. A fast-growing population can lower the income that each person receives and make it harder for families to access important services such as education and health care. Because of these challenges, reducing poverty becomes more difficult, and more effort is needed from both the government and communities to help people improve their living conditions. Providing equal chances for everyone to learn, work, and improve their skills is also very important for poverty reduction.

Those that involve social protection, education, and rural development are very effective in helping households improve their lives. Social protection initiatives, such as providing financial assistance to poor households, can prevent them from becoming poorer. Educational projects will enable the young and old alike to acquire skills that will give them better employment prospects in the years to come.

At the same time, policies that encourage economic growth for all people can help reduce poverty even as the population grows. Economic growth that benefits everyone, not just a few, allows more families to earn a steady income and meet their basic needs. However, studies in the Philippines show that differences in income, job opportunities, and access to education can limit how much poverty is reduced. This means that while growth is important, it is not enough on its own. Rural development projects may generate more employment opportunities and services in rural areas, which are mostly home to the poor. By working together, integrating these projects with economic growth, households can access more opportunities, gain more income, and improve their overall quality of life. By doing all these, it is possible that poverty can be alleviated even when the population is still steadily rising.

Conclusion

This study gives valuable insights into how rapid population growth in Lanao Del Sur contributes to the perpetuation of poverty, as it creates pressure on inadequate infrastructure, public services, and job opportunities. By highlighting the interconnections between population dynamics, low educational attainment, limited economic opportunities, inadequate infrastructure, and conflict impact, this research should enable local communities and policymakers to better appreciate the structural underpinnings of poverty in the province. Understanding this is quite essential in developing appropriate strategies that address the actual needs of the population.

The study calls for a more integrated approach to solutions in Lanao Del Sur, considering the complex way these various factors are intertwined. Investment in education enhances human capital and opens up wider employment opportunities. Livelihood and skills-training programs could be developed or extended to further increase household income and economic resilience. Stronger family planning and reproductive health programs can contribute to better management of population growth, hence decreasing pressure on social services and local resources. Further infrastructure development-especially roads, schools, and health facilities-will stimulate economic activities and improve access to basic services.

Government intervention must also play an important part in properly addressing these issues facing the country. Well-formulated development plans with the inclusion of population growth tendencies could help ensure that investments keep up with the growth of the population. Past studies revealed that when the management of the population, human capital, and infrastructure development of the provinces in the Philippines was addressed, they achieved sustainable poverty reduction (World Bank, 2018; Philippine Institute for Development Studies, 2020).

All things considered, this study adds to the increasing amount of proof that poverty in Lanao Del Sur is a complex problem that calls for a sustained, concerted response. It is possible to make sure that population growth becomes a catalyst for progress rather than a barrier to it by addressing it in conjunction with infrastructure development, education, livelihood creation, and peace building.

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