# Impact of Rice Production and Environmental Damage on Food Security Challenges in Bangladesh

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## Abstract

Bangladesh is one of the nations that is highly susceptible to changes in climate. Since the recent social, agricultural, and environmental upheaval, food insecurity has evolved as Bangladesh's most pressing issue. Early-life food insecurity may have long-term impacts, particularly on an individual's and the nation's economic productivity. In response to these challenges, the present analysis explores the linkages between food insecurity, economic growth, education, environmental risks, and rice production in Bangladesh employing annual data sets from 2001 to 2019. This study estimates a symmetric autoregressive distributed lag (ARDL) model. The long-term econometric results reveal a positive linkage between Bangladesh's food insecurity and carbon dioxide emissions. Additionally, expanding government investment on education reduces the severity of food insecurity; yet, rice production continues to have a favorable relationship with food insecurity in Bangladesh. However, in the short term, the consequences of carbon dioxide emissions and government spending on education to reduce food insecurity are obviously different from long-term projections where a rise in rice output reduces food insecurity in Bangladesh. As a result, it is proposed that Bangladesh should work to reduce its challenges with food insecurity by enhancing socioeconomic and environmentally favorable policies.

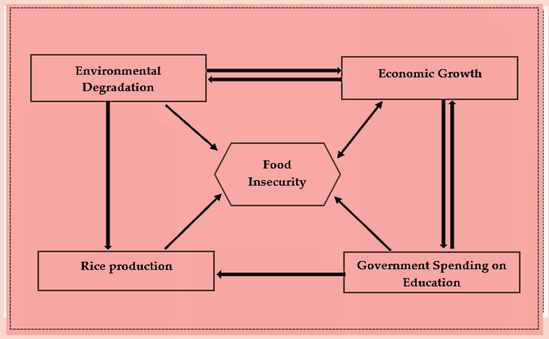
## Introduction

In Bangladesh, food security has been acknowledged as a vital focus for economic and social development due to rising population and poor human quality of life. To address food scarcity, the Bangladesh government instituted the National Food Policy Plan. Rice is the staple meal and it is indeed a valuable driver of earnings and employment in Bangladesh. Accordingly, increasing self-sufficiency in the output of rice is a viable tactic for reducing food insecurity at the national and regional scales. The only area of the economy that is reportedly anticipated to consistently supply a level of food security for the country's booming population is the rice production. Bangladesh is a nation that relies heavily on agriculture, so damages to the environment can make matters worse. Due to the shrinking arable land and the increased scarcity of fresh water, environmental degradation has made it extremely difficult to meet this aim. Moreover, more days spent in school immediately spur innovation, which then leads to increasing work prospects, disposable income and access to food, which together translate into lesser costs of food insecurity. The evidence indicates that education is an important criterion for assessing food security.

## Research Objectives

- To examine the effects of rice production and education on food security in Bangladesh.
- To discover whether and how environmental degradation influences the food security in Bangladesh.
- To suggest policy recommendations for further improvements.

## Theoretical Framework




## Methodology

In this analysis, the cointegration approach is subjected to Autoregressive Distributed Lag (ARDL). The tests for residual developed by Engle and Granger, the maximum likelihood-based Johansen and the Johansen cointegration techniques. An ARDL model is characterized as:

$$Y_t = \alpha_t + \beta_t X_t + \mu_t \quad (1)$$

Where, $Y_t$ is the dependent variable (food insecurity), $X_t$ is the independent variables (economic growth, carbon dioxide emissions, education, and rice production),.

$$Y_t = \alpha_t + \sum_{i=1}^{m} \gamma_t Y_{t-1} + \sum_{i=1}^{n} \beta_t X_{t-1} + \mu_t \quad (2)$$

The following short-term and long-term models in Equations (3) and (4) will be calculated concurrently if a demonstration of a long-term connection between the components is found:

$$FS_t = \beta_2 + \sum_{i=1}^{m} \alpha_2 FS_{t-1} + \sum_{i=0}^{m} \delta_2 EG_{t-1} + \sum_{i=0}^{m} \omega_2 CO_{t-1} + \sum_{i=0}^{m} \vartheta_2 GEE_{t-1} + \sum_{i=0}^{m} \varphi_2 RP_{t-1} + \mu_t \quad (3)$$

$$\Delta(FS)_t = \beta_3 + \sum_{i=1}^{m} \alpha_2 \Delta(FS)_{t-1} + \sum_{i=0}^{m} \delta_2 \Delta(EG)_{t-1} + \sum_{i=0}^{m} \omega_2 \Delta(CO)_{t-1} + \sum_{i=0}^{m} \vartheta_2 \Delta(GEE)_{t-1} + \sum_{i=0}^{m} \varphi_2 \Delta(RP)_{t-1} + \sum_{i=0}^{m} \beth ECT_{t-1} + \mu_t \quad (4)$$

## Table 1. Variable Description

| Variables | Descriptions | Data Sources |
|---|---|---|
| **RP** | Rice production | United States Department of Agriculture |
| ***EG*** | Economic growth | World Development Index |
| ***CO*** | Carbon dioxide | World Development Index |
| ***GEE*** | Government expenditure on education | World Development Index |
| ***FS*** | Food security | World Development Index |

## Table 2. Long-run Estimates

| Variables | Long-run coefficient | Standard error | t-value |
|---|---|---|---|
| $ECM_{t-1}$ | -1.05*** | 0.003 | -404.65 |
| ***EG*** | -1.25*** | 1.15 | -108.54 |
| ***CO*** | 50.25*** | 0.38 | 132.27 |
| ***GEE*** | -0.05** | 0.002 | -24.66 |
| ***RP*** | 0.0002*** | 3.43 | 64.47 |
| ***Constant*** | 12.54*** | 0.08 | 156.44 |

## Table 3. Short-run Estimates

| Variables | Coefficient | Standard error | t-value |
|---|---|---|---|
| ***ΔFS (-1)*** | 0.06** | 0.004 | 14.42 |
| ***ΔFS (-2)*** | 0.55*** | 0.003 | 145.68 |
| ***ΔEG*** | 2.00 | 5.97 | 3.35 |
| ***ΔEG (-1)*** | -2.69*** | 6.41 | -42.00 |
| ***ΔCO*** | -29.60*** | 0.25 | -119.16 |
| ***ΔGEE*** | -0.0002 | 0.002 | -0.14 |
| ***ΔGEE (-1)*** | 0.03** | 0.002 | 019.51 |
| ***ΔGEE (-2)*** | 0.0009* | 0.001 | 6.77 |
| ***ΔRP*** | -0.0002*** | 3.28 | -75.89 |

## Results and Discussion

- At a 1% level of significance, the impact of environmental degradation (CO) on food insecurity is significant with correct sign. A long-term increase in carbon dioxide emissions of 1% causes a 50.25 percent increase in food insecurity, following the carbon dioxide emissions coefficient (50.25).
- At a 5% level of significance, the impact of government spending on education (GEE) has significant impact to reduce food insecurity.
- Another important contributing factor to Bangladesh's food insecurity is rice production (RP). Positive results are seen for RP's impact on food insecurity at a 1% level of significance.
- The results do, however, demonstrate a long-term, symmetric, and unfavorable linkage between economic growth and food insecurity at a 1% significance level.
- It is also observed that Bangladesh still needs to import large amount of rice from international market to fulfill its population's demand.

## Policy Recommendations

- The Bangladesh government need to take long term plan to boost up rice production.
- The Bangladeshi government should try to create a trustworthy outline on socioeconomic, agricultural, and environmental factors like education, economic growth, carbon dioxide emissions, and rice production in order to lessen the severity of the food insecurity.

## References

- Timmer, C. P. (2010). The changing role of rice in Asia's food security.
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