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Food Wastage, Poverty and Economic Growth

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ABSTRACT

This paper attempts to identify the impact of food wastage on economic growth using the data for 165 countries over the 2014-2018 period. With the help of ordinary least squares (OLS) and generalized linear model (GLM), the study shows that food wastage and poverty impact GDP growth negatively. Poverty and food wastage are positively related. Reducing food wastage can lead to poverty reduction, and that can stimulate GDP growth. Take measures to reduce food wastage, especially in middle-income countries where the undernourishment rate is high. Reduce food wastage in various stages of production, distribution, and transporting with innovative technology.

Keywords: Poverty, food, wastage, growth, glm

1. INTRODUCTION

We can broadly classify the modern economic growth theories into two: neoclassical growth theory (Solow, 1956) and endogenous growth theory (Robert J. Barro, 1996; Lucas, 1988; P. M. Romer, 1990). Numerous variations of the Solow model exist. In the neoclassical growth theory, the critical variable of Economic Growth in the short period is an investment in

physical assets and, in the long period, technological progress. The baseline empirical growth model is the augmented Solow model (moral-Benito, 2012). With the emergence of the new endogenous growth model in the mid-1980s, knowledge investment became crucial as a physical investment (Robert J. Barro, 1996; Lucas, 1988; P. M. Romer, 1990). Investment in human stock, a complement of tangible investment accumulation, is a critical variable of Economic Growth in the endogenous growth theory (Islam, 1995; Mankiw, Romer, & Weil, 1992). Expansion of knowledge occurs through formal and informal education and training and process and product innovations (Howitt & Aghion, 1992). Productivity elements such as beneficial technological know-how and learning-by-doing are vital drivers of economic Growth (Aghion & Howitt, 1992; Lucas, 1988; Romer, 1986; Stokey, 1995). There is consensus that critical macro-economic variables are physical investment, human capital stock, and technological or productivity growth.

Since 2014, the number of people living under undernourishment has been on the rise. Nearly 8.9 per cent of the world population, or 690 million people, are hungry, increasing 10 million people a year or approximately 60 million people in five years. Two hundred thirty-five million people, or 22 per cent of undernourished people worldwide, live in sub-Saharan Africa in 2019. Central Asia and Southern Asia have more than 37 per cent (259 million) of malnourished people globally. Forty-eight million or 7.4 per cent of undernourished people live in Latin America and Caribbean countries (FAO, 2019).

Food wastage can occur at different stages of handling and packing, storing, processing, and transporting. Most people are involved in various food production stages, distribution, and consumption as farmers, agents, wholesalers, retailers, or consumers. So all the entities have the responsibility to minimize the wastage of food due to carelessness. In this study, the focus will be on examining the impact of food wastage on economic growth. We waste billions of tons of food globally every year. 6.68 billion tons of food were wasted globally in 2014, 6.73 billion tons in 2015, 6.92 billion tons in 2016, 7.01 billion tons in 2017, 6.86 billion tons in 2018. We waste 34.21 billion tons of food globally during 2014-2018 (FAO,2021). The food wastage category includes fruits and vegetables, cereals, oils, oilseeds and pulses, spices and related products, roots, milk, and meat products. Approximately 700 million people are living under undernourishment.

The primary aim of this research is to examine the impact of food wastage on GDP per capita growth. This study uses a methodology of OLS and GLM methods of regression analysis to address the research question. This study will help to formulate policies to reduce food

wastage to achieve higher GDP growth.

The rest of the paper is structured as follows. Section two describes the related literature, section three illustrates the basic model and statistical method, and section four reports the descriptive statistics. Section five presents the results, section six provides the study's policy implications, and section seven summarizes the findings.

2. RELATED LITERATURE

The study (David Dollar & Kraay, 2004) using instrumental variable analysis for 101 countries over the 1975-1997 period shows that globalization positively influences growth and poverty reduction in emerging countries. The study (Barro, 2003) involving 87 countries over the 1965-1995 period shows that human investment, terms of trade, the rule of law, and openness had a favourable influence on economic growth. The influence of the government consumption expenditure, inflation, and fertility had a significant unfavourable influence on growth. The influence of investment on economic growth is positive but weak. The study (Burnside & Dollar, 2000) uses two-stage least squares and six four-year time durations from 1970-1973 until 1990-1993 for 56 countries. The study indicates a favourable influence of aid on growth in suitable policy environments, and it can be a good policy for developing nations. The study (Grier & Tullock, 1989) observed a significant negative influence of consumption expenditure by the Government on Growth in three of four subsamples for 113 countries from 1950 to 1981. The study (Sommers & Suits, 1971) using the cross-section regression for 100 countries for 1966 shows the positive influence of domestic investment and the negative influence of population growth on economic growth.

This study focuses on two determinants of economic growth, namely, food wastage and poverty. Countries with good technology and practices to reduce food wastage can reduce poverty and achieve better economic growth. This study mainly uses World Development Indicators, WDI (2019), and food loss data from Food and Agriculture Organization - FAO (2021). This study aims to provide new empirical evidence concerning the economic growth relationships and their determinants, mainly using the variables - food wastage and poverty. This study will help formulate appropriate policies for achieving better economic growth by reducing food wastage and undernourishment, especially for middle-income and low-income countries. We require further research on the relationship of economic growth with food wastage and poverty for the following reason: 1) Almost all of the studies reviewed above are

related to the various determinants of economic growth and neglect the impact of food wastage on economic growth and poverty. The primary aim of this research isto examine the impact of food wastage on GDP per capita. Can reduction of food wastage increase economic growth?

3. METHODOLOGY

Many factors affect economic growth. This study analyzes data to examine the impact of food wastage on GDP per capita in selected 165 countries from 2014 to 2018. The availability of food wastage data from FAO limits the study period. Due to this, the study has used cross-section regression rather than a panel regression analysis. Table 1 presents a list of variables. All the variables were converted into logarithms in regression analysis. The average GDP per capita is the dependent variable during the five years, from 2014 to 2018. Using the average value for the period can reduce many estimation problems:1. It reduces business cycle effects (Grier & Tullock, 1989). 2. It reduces misspecification effects of lags ((Reed, 2009).

The following equation explains cross-country differences in the per capita GDP growth depends on fixed capital, labour force participation rate, poverty and food wastage.

$$gdpc_i = \propto + \beta 1 * food\_loss\_p_i + \beta 2 * phr_i + \beta 3 * gfcf_i + \beta 4 * lfpt_i + u_i \quad (1)$$

Where i refers to countries, α is a constant, β_1, β_2, β_3, and β_4 are parameters of explanatory variables. The study also estimates the following second equation for finding the impact of food wastage on poverty.

$$phr_i = \propto + \beta 1 * food\_loss\_pi + u_i \quad (2)$$

The central assumption of the error term ui in equations one and two is that it is independent with zero mean and variance constant and has a similar distribution across countries.

Table 1: Key Variables

Variables	Definition	Reference
gdpc	GDP per capita, PPP (constant 2017 international $)	WDI
food_loss_p	Loss of food as a percentage of domestic production plus imports	FAOSTAT
phr	Poverty headcount ratio - at $1.90 a day-2011 PPP$ - % of population	WDI

gfcf	Gross fixed capital formation - % of GDP	WDI
lfpt	Labour force participation rate, total: (Labour Force)	WDI

4. DESCRIPTVE STATISTICS

Many factors affect economic growth. This study provides an overview of GDP per capita for countries classified by the World Bank (The World Bank, 2020). It classifies one hundred sixty-five countries into four categories following the World Bank classification of countries based on GNI (Gross National Income) per capita. The thresholds for income classification are as follows: Less than US$ 1026 is a low-income country, US$ 1026 to US$ 3995 is a lower-middle-income country, US$3996 to US$12375 is an upper-middle-income country. US$ greater than 12375 is a high-income country.

The average GDP per capita for 165 countries during 2014-2018 is $US 20237.07. The average GDP per capita for high-income countries is $US 34543.44. The average GDP per capita for upper-middle-income countries is US$ 8045.59, which is 4.29 times lower than the average GDP per capita of high-income countries. The average GDP per capita of lower-middle-income countries is US$ 2416.47, which is 3.33 times lower than the average GDP per capita of upper-middle-income countries. Similarly, the average GDP per capita of low-income countries is US$ 861.05, which is 2.81 times lower than the average GDP per capita of lower-middle-income countries. The range for GDP per capita is between US$ 12403.69 and US$ 114109.97 for high-income countries; it is US$ 4020.04 and US$ 12373.04 for upper-middle-income countries; US$ 1027.21 and US$ 3952.75 for lower-middle-income countries, and US$ 761.52 and US$ 1024.60 (Table 2). There is a gap of $US 106706.8 in GDP per capita between the minimum and maximum GDP per capita for high-income countries, a gap of US$ 8353.00 for upper-middle-income countries, a gap of US$ 2925.54 for lower-middle-income countries, and a gap of US$ 263.08 for low-income countries. The standard deviation in GDP per capita was the lowest (US$ 77.85) for low-income countries, followed by lower-middle-income countries (US$ 832.49), and then upper-middle-income countries (US$ 2654.34) and highest for high-income countries (US$ 20126.85). The study observes a gap in per capita GDP among different countries in the Box plot (Figure 1).

Table 2: Descriptive Statistics for Average GDP per Capita

INCOME_LEVEL	Mean	Minimum	Maximum	Range	Std. Deviation
High Income	34543.44	12403.69	114109.97	101706.28	20126.85
Upper Middle Income	8045.59	4020.04	12373.04	8353.00	2654.34
Lower Middle Income	2416.47	1027.21	3952.75	2925.54	832.49
Low Income	861.05	761.52	1024.60	263.08	77.85
Total	20237.07	761.52	114109.97	113348.45	20597.54

Source: Calculated from World Bank

The total wastage of food from 2014 to 2018 is 34.21 billion tons. 39.88 per cent of lost food were fruitsand products. The next largest category of wasted food is Cereals (23.35 per cent). 20.56 per cent of total food wasted on spices and related products. The oil, oilseeds, and pulses category constituted 6.01 per cent of total food wastage; roots category lost 6.19 per cent, and milk and meat products constituted 4.00 per cent of total food wastage (Table 3).

Table 3: Percentage Share in Total Food Wastage

Item	Loss (1000 tons)	Loss Percentage
Fruits and products	1364126	39.876
Cereals	798634	23.346
Oil/Oil seeds/Pulses	205711	6.013
Milk and Meat Products	137110	4.008
Roots	211888	6.194
Spices and other products	703381	20.561
Total	3420850	100.000

Source: Calculated from FAO, 2021

Table 4 reports the food wastage as a per cent of total availability (production and imports). We can see that the most significant percentage of food wastage occurred in lower-middle-income countries, followed by upper-middle-income countries, than low-income countries and then high-income countries (Table 4).

Table 4: Food Losses (in Percent)

Income Level	Mean	Minimum	Maximum	Range	Std.Deviation
High Income	2.77	0.00	10.79	10.79	1.97
Upper Middle Income	4.95	0.00	18.85	18.85	2.86
Lower Middle Income	6.29	0.00	13.76	13.76	2.89
Low Income	4.66	0.00	8.52	8.52	3.34
Total	4.12	0.00	18.85	18.85	2.85

Source: Calculated from FAO, 2021

5. RESULTS

Table 5 presents the estimated results of equation 1. The food wastage elasticity is -0.59; on average, a 1 per cent decrease in food wastage is associated with a 0.59 per cent increase in GDP per capita. The poverty elasticity is -0.49; on average, a 1 per cent decrease in poverty is associated with a 0.49 per cent increase in GDP per capita. The coefficient associated with capital and Labour is not significant though it is negative. The Jarque-Bera value is 3.28, and its probability is 0.52, which is not significant at 5 per cent. There is no evidence of serious departure from the theoretical line. We can assume that the residuals are approximately normally distributed. The Breusch-Pagan-Godfrey test (Probability Chi-Square(4)=0.000) shows there is evidence of heteroscedasticity. The multiple R-squared value equals 0.643, which explains 64.3 per cent of the total variability in the model (Table 5). We estimate a generalized linear model (GLM) as it does not require a homoscedasticity assumption. PresentedGLM results in Table 5 are similar to the OLS results explained.

Table 5: Estimates of Regression Equation (1)				
	OLS		GLM	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
c	4.74***	0.64	4.74***	0.64
food_loss_p	(-)0.59***	0.09	(-)0.59***	0.09
phr	(-)0.49***	0.04	(-)0.49***	0.04
gfcf	(-)0.15	0.19	-0.15	0.19
lfpt	0.15	0.35	0.15	0.35
R-squared	0.643			
Adj.R-squared	0.635			
*** p<0.01, ** p<0.05, * p<0.1				
Source:Calculated from World Bank and FAO data				

Table 6 presents the results of regressing the poverty headcount ratio on food loss percentage. The coefficient of food loss percentage is positive and significant. The food wastage elasticity is 0.90, so on average, a 1 per cent decrease in food wastage is associated with a 0.90 per cent decrease in poverty. The Jarque-Bera value is 11.66, and its probability is 0.002, which is significant at 5 per cent. There is evidence of serious departure from the theoretical line, and we cannot see the normal distribution of residuals. The Breusch-Pagan-Godfrey test

(Probability Chi-Square(1)=0.220) shows no heteroscedasticity evidence. For the linear model, the multiple R-squared values equal 0.152, which explains 15.2 per cent of poverty's total variability.

Table 6: Estimates of Regression Equation (2)				
	OLS		GLM	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
c	0.23	0.11	0.229	0.113
food_loss_p	0.90**	0.17	0.90**	0.165
R-squared	0.152			
Adj.R-squared	0.147			
*** p<0.01, ** p<0.05, * p<0.1				
Source:Calculated from World Bank and FAO data				

We also estimate a generalized linear model (GLM) for equation two as it does not require a normality assumption. GLM results presented in Table 6 are similar to the OLS results demonstrated. Poverty and food loss percentages are highly positively correlated. Higher the food loss percentage, the higher the poverty. Higher the food loss percentage and poverty, lower the Growth of GDP.

6. POLICY IMPLICATIONS

Globally approximately 700 million people are living under undernourishment. If we give these people adequate food to live and grow, they will contribute to GDP growth. On the other hand, we waste approximately 7 billion tons of food annually. Food wastage occurs at various stages of production, distribution and consumption. The percentage of food wastage is the largest among the lower and upper-middle-income countries. The study shows poverty and food wastage negatively impacts economic growth. The results show that, on average, a one per cent reduction in food wastage is associated with a 0.59 per cent increase in GDP growth. A one per cent decrease in poverty increase GDP by 0.49 per cent. There is a positive relationship between food wastage and poverty. A one per cent decrease in food wastage is associated with a 0.90 per cent decrease in poverty. Reduce food wastage which can reduce poverty and can stimulate GDP growth. To achieve this, we need to innovate the current processes and food production methods, distribution and consumption, especially in middle-income and low-income countries.

7. CONCLUSION

The total wastage of food during 2014-2018 was 34.21 billion tons. We waste, on average, 4.12 per cent of the entire food produced per annum. The most significant percentage of food wastage occurred in lower-middle-income countries, followed by upper-middle-income countries, followed by low-income and then by high-income countries. The maximum food wastage percentage varied between 8.52 per cent 18.85 per cent. The fruits and vegetable category experienced the largest wastage (39.88 per cent), followed by cereals (23.35 per cent), spices,and related products (20.56 per cent).

The study has shown that the coefficients associated with food wastage and poverty are negative and significant. Reducing poverty and food wastage can stimulate economic growth. The study also checked the relationship between poverty and food wastage and shows a strong positive relationship. Reducing food wastage and poverty can induce Economic Growth. Higher the food loss percentage, the higher the poverty. Higher the food loss percentage and poverty, lower the Growth of GDP. Governments can promote technological innovation measures in the production, distribution, and transporting of food to reduce food wastage and poverty and stimulate Economic Growth. From farmers to distributors, wholesalers, retailers, and consumers have an essential role in reducing food wastage.

REFERENCES

[1] Aghion, P., & Howitt, P. (1992). A Model of Growth Through Creative Destruction. A Model of Growth Through Creative Destruction, 60(2).

[2] Barro, R. J. (1996). Determinants Of Economic Growth: A Cross-Country Empirical Study. Massachusetts Avenue.

[3] Barro, R. J. (1996). Determinants of Economic Growth: A cross-country empirical study. NBER WORKING PAPER SERIES.

[4] Barro, R. J. (2003). Determinants of Economic Growth in a Panel of Countries. ANNALS OF ECONOMICS AND FINANCE 4, 231–274.

[5] Burnside, C., & Dollar, D. (2000). Aid, Policies, and Growth. The American Economic Review, 90(4), 847-868.

[6] Dollar, D. (1992). Outward-Oriented Developing Economies Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985. Economic Development and Cultural Change, 40(3), 523-544.

[7] FAO(2019), http://www.fao.org/sustainable-development-goals/indicators/211/en/ FAO (2021), http://www.fao.org/faostat/en/#data/QC

[8] Howitt, P., & Aghion, P. (1992). A Model of Growth Through Creative Destruction. Econometrica, 60(2), 323- 351.

[9] Lucas, J., Robert E. (1988). On The Mechanics Of Economic Development. Journal of Monetary Economics, 22, 3-42.

[10] Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. The Quarterly Journal of Economics, 107(2).

[11] Read moral-Benito, E. (2009). Determinants of Economic Growth A Bayesian Panel Data Approach. Policy ReseaRch WoRking PaPeR, 4830.

[12] Reed, W. R. (2009). The determinants of U.S. state economic growth: A less extreme Bound Analysis. Economic Enquiry, 47(4), 685-700.

[13] Romer, P. M. (1986). Increasing Returns and Long-Run Growth. Journal of Political Economy, 94(5), 1002- 1037.

[14] Romer, P. M. (1990). Endogenous Technological Change. Journal of Political Economy, 98(5), S71 - S102. Sachs, J. D., & Warner, A. M. (1997). Fundamental Sources of Long-Run Growth. The American economic review, 87(2).

[15] Snowdon, B., & Vane, H. R. (Eds.). (2005). Modern Macroeconomics: Its origins, development and current state. Northampton, Massachusetts.: Elgar, Edward

[16] Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics, 70(1).

https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita.