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THE IMPACT OF CORRUPTION ON FOOD SECURITY: EMPIRICAL EVIDENCE FROM PAKISTAN

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ABSTRACT
This study investigates the impact of corruption on food security in Pakistan over the period 1996 to 2024. Before empirically evaluating the objective of the study, various diagnostic tests such as the Augmented Dickey–Fuller (ADF) test, Phillips–Perron (PP) test, and ARDL bounds testing procedure were conducted. The results of the diagnostic tests suggest the use of the Autoregressive Distributed Lag Model (ARDL). Therefore, the ARDL technique was applied to achieve the objective of the study. The results show that the long-run coefficient of corruption is −0.41 and is statistically significant, which implies that an increase in corruption reduces food security in Pakistan. The results further show that the coefficient of GDP is 0.32, implying that higher economic growth improves food security, whereas the coefficients of unemployment (−0.21) and food imports (−0.28) indicate that both factors decrease food security. In the short run, corruption also negatively affects food security (−0.29), while GDP continues to have a positive effect (0.24). The error correction term is −0.61, suggesting that 61% of the deviation from equilibrium is corrected annually. Finally, this study puts forward some valuable suggestions for policymakers regarding Food security, reducing corruption, and ensuring sustainable food security in Pakistan.

Keywords: Corruption; Food Security; Pakistan; ARDL Model; Institutional Quality

Introduction
Corruption is abuse of entrusted power to achieve personal gain and goes beyond theft of money to the general loss of trust of the people in the government that denies the citizens their resources and compromises the governance by acting in their interest rather than representing the people (Rose and Ackerman, 2008). It can also come in the form of petty bribery or embezzlement on a large scale, both of which decrease efficiency, distort

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markets, and impede the delivery of vital services, including health, education, and justice. Political instability, civil-military conflicts, and patronage systems have entrenched corruption in Pakistan, which has undermined its effectiveness because institutions like the National Accountability Bureau (NAB) have been accused of selective accountability and political favoritism (Fatih et al., 2024). These entrenched practices not only increase transaction costs, detracting investment, and shifting resources out of productive areas, but also become, in fact, a hidden tax on businesses and citizens, and eventually slows growth (Mauro, 1995). In a more general sense, corruption is associated with bad rule of law, low quality regulations and inefficient governance which adds additional costs to households and firms, undermines confidence in the government, discourages adherence to regulations and innovation and development of sectors including agriculture that keeps growth slow and poor. Governance indicators also point to the fact that both corruption and poor institutional quality are closely related to each other, which is why the necessity to implement any reforms to promote transparency, accountability and rule of law is the key factor to support sustainable development as in the case of Sri Lanka where corrupt practices are the primary obstacle to success (Kaufmann et al., 2009).

FAO defines food security as physical, social, and economic access to sufficient, safe, and nutritious food that fulfills cultural preferences and promotes healthy living, which connects closely to the reduction of poverty, health, and equity (Sassi and Maria, 2018). Pakistan is a country where agriculture is the primary source of labor (37 percent), GDP (23 percent), and where the rural population lives on crops such as rice and cotton, which means that food security is largely a factor of agricultural performance, but agriculture has not yet reached the productivity's required to meet the country's food demand due to outdated farming methods, water scarcity, climate change, and bad policies (Khan et al., 2023). Recent IPC estimations indicate the intensity of the threat, and approximately 11 million individuals in flood-impacted areas are set to experience Crisis or worse (IPC Phase 3+) at the end of 2024 and early 2025, highlighted by how climate shocks, macroeconomic stress, and institutional vulnerability increase vulnerability (IPC, 2024). Empirical literature shows that food insecurity is made worse by poor governance and corruption, which disrupt the supply chain, smuggle, inflate prices, and unfairly distribute land, subsidies, and water, leaving millions of people without access to food they can rely on (Khan et al., 2024; Habib and Didar, 2025; Iqbal et al., 2024). Corruption diverts funds that could be used to support agriculture and safety nets, destroys trust and makes it difficult to undertake policy changes and block productivity gains by the powerful. Transparency International emphasizes that poor governance is a serious obstacle to combating hunger and poverty, and accountability and anti-corruption measures are urgently needed to guarantee equitability in resource utilization and food security. Corruption exacerbates environmental degradation, further: the asymmetric response of corruption to CO2 emissions and SO2 emissions is observed in the period from 1990 to 2024, the less corrupt the country, the weaker the environmental effect, and the reverse, it has long-term institutional implications (Yasmin & Bibi, 2024). The results confirm the Environmental Kuznets Curve, with corruption increasing the intensity of ecological harm at lower incomes, but investment in human capital and stronger governance help to address these losses. Combined, these observations highlight that eliminating corruption is not only necessary to improve food security and agricultural resiliency in Pakistan, but also to protect the quality of the environment and promote sustainable development.

This study aims to explore the impact of corruption on food security outcomes in Pakistan with a specific focus on exploring the mechanisms through which corruption affects food security and examining regional disparities in the impact of corruption. (Demeshko et al.,

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2024) Evaluate the effects of corruption on global food systems by examining multiple forms of dishonesty alongside responsible parties and their damaging results yet acknowledge the dearth of suitable answer methods. Although the relationship between corruption and food insecurity has been widely studied in global contexts, particularly in regions like Sub-Saharan Africa and Southeast Asia (Önder, 2021; Njangang et al., 2024), there remains a significant lack of country-specific analysis for Pakistan. (Anik et al., 2013) discovered, that the analysis of corruption, especially, at the micro-level of farming and its influence on household food security in Bangladesh which usually overlooked in extensive literature focusing on the macro-level impacts of corruption. Furthermore, there is limited research exploring regional disparities in how corruption affects food security outcomes across provinces. Distinctive from the other study our research focus on investigating the extent to which corrupt practices influence food production, distribution, and consumption patterns in Pakistan, and by analyzing how these practices affect food security across its four key dimensions.

LITERATURE REVIEW

In a broad sense, corruption describes the misuse of public office to achieve personal benefit, thus compromising food security through mismanaging and misallocating the available resources aimed at promoting farming, agricultural growth, and distribution of food, thereby lowering production and diminishing supply chains (Olabiyi, 2022; Desta, 2019). Agricultural output becomes low, markets are distorted, and susceptible communities are forced out with high food prices when subsidies, land rights, and food contracts are allocated through favoritism, bribery, and political patronage. This directly undermines the four interconnected dimensions of food security: availability, as mismanagement decreases food production and supply; accessibility, as corruption increases food prices and privileges elites over the marginalized, utilization, as poor-quality or unsafe food is now able to reach consumers, and stability, where a corrupted system fails to respond effectively to a shock, such as a drought, flood, or economic crisis (McGuire, 2015; Abdullah et al., 2020). Corruption at the executive level is especially harmful because it diverts policymaking and resources to the projects that facilitate rent-seeking instead of the projects that contribute to the reduction of hunger, disrupting the governance structures required to provide equitable food and social safety nets (Njangang et al., 2024). Besides, corruption challenges ethical governance through erosion of accountability and transparency, impunity, and lack of confidence among citizens that discourages their participation in food security programs and discourages investments in agricultural systems (Kolstad, 2012). The net impact is a vicious circle where inefficiencies, bad policies, and misaligned priorities promote hunger and malnutrition, especially among the poor and marginal, and good governance and anti-corruption policies are an essential step towards sustainable food security.

Corruption is highly detrimental to economic growth and market efficiency, which are the key factors in ensuring food security, especially in developing nations. Corruption discourages competition, innovation, and raises the cost of production because market activities have been distorted to favor favoritism, rent-seeking, and unofficial bribes, and food commodity prices are overcharged, with low-income households disproportionately affected and thus having little to no access to proper nutrition (Bartolome et al., 2024; Gupta et al., 2002). In Pakistan, agricultural development, rural infrastructure and social safety nets are financed by rife levels of corruption, which harms farming output, storage and delivery systems, and often marginalized small farmers cannot obtain credit and input distribution under patronage and bureaucratic seizure (Ulain & Hussain, 2020). These

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inefficiencies decrease the amount of food, make inflation worse and make people poorer, and these all lead to a vicious cycle whereby the most vulnerable people suffer the most. Based on the empirical evidence of the FIES household survey, the in demand will include inflationary shocks, low income, government failures (institutional inefficiency and poorly targeted programs) and better institutional frameworks and more open-access assistance mechanisms (Mahmood et al., 2023). In addition, people will not trust the government, the donor will not risk that much, and the resources will be poorly allocated because subsidies and welfare programs will reach the wrong people, and marginalized communities will run out of food (Quddous et al., 2024).Through the prism of principal-agency theory, the low institutional quality of Pakistan allows the government officials to exploit self-interest by rerouting subsidies, delayed agricultural inputs, and politically motivated favoritism to further limit equitable access to food and undermine production (Khurshid & Abid, 2024). Finally, corruption directly not only decreases agricultural productivity and undermines market efficiency but also disrupts the stability of food systems, so it is vital to introduce anti-corruption reforms and transparency and build accountability mechanisms to protect food security and sustainable development.

Food security should be long-term, sustainable, and inclusive, and all people should have unlimited access to adequate, safe, and nutritious food to live a healthy and active life. This requires the provision of food in modest quantities, free of toxic components, nutritionally adequate, economical without the sacrifice of other fundamental needs and culturally viable, and of superior livestock feed, which also aids in maintaining animals and human nutrition (Stanberry and Paul, 2024). A safe food system is one that prevents hunger as well as enhances the health of the population, enhancing community, and improving national development via a balance among agriculture, nutrition, economy as well as social equity. It forms the basis of resilience because it minimizes risks related to malnutrition, low immunity, slower growth and exposure to diseases, and social unrest, displacement, and conflict that can easily be caused by scarcity (Jha, 2024). Food security is thus directly connected to agricultural productivity, sustainable agricultural practices, equitable distribution, and affordability, especially during a crisis, like a pandemic, natural disaster, or political turmoil. Furthermore, the nutritional value of food is as important as its amount, as the possibilities to consume healthy food will allow decreasing the chances of obesity, diabetes, and heart-related diseases. Good food security involves coordinated production, distribution, and access as food security increases life expectancy, decreases health system pressure, improves agricultural productivity, creates jobs, and improves local markets (Cole et al., 2018). A sustainable and efficient food system also reduces the amount of waste generated, environmental degradation, as well as ensuring the future generation has an unending supply, all of which requires technological innovations, building infrastructures, and proper policy formulations. Nevertheless, corruption and unemployment disrupt this level of balance, diverting resources towards agriculture and welfare programs, infrastructure erosion, supply chain destabilization, inflated prices, and decreased household purchasing power. Unemployment creates pressure on families to seek aid or eat less nutritious food, increasing the inequality gap and changing food security into a right instead of a privilege, and corruption reduces institutional credibility and restricts the efficacy of agricultural policies, particularly during times of scarcity or droughts. Together, these conditions contribute to food insecurity, stimulating poverty and malnutrition and causing social unsteadiness, making responsible government, good policies, and access to sustainable jobs essential to achieving sustainable food security (Önder, 2021).

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Methodology

The research design adopted in this study is a quantitative research design based on annual time series data in Pakistan between 1996 and 2024 to explore the effects of corruption on food security. Reliable international sources such as the World Bank, Transparency International, Food and Agriculture Organization (FAO) and the Economist Intelligence Unit were used to obtain secondary data. The key explanatory variable is corruption, measured by the World Bank Control of Corruption Index, and the dependent variable in this study is food security measured by the daily per capita caloric intake. To manipulate other macroeconomic and social factors, the model also incorporates gross domestic product (GDP), unemployment rate (UE), and food imports (FI). They have been chosen as these variables are theoretically and empirically determined by previous literature as the significant determinants of food availability and access in Pakistan.

Table 1: Variable Description

Variable	**Abbreviation**	**Unit of Measurement**	**Data source**
Dependent Variable			
Food security	FS	Daily per capita caloric intake measured in kilocalories per person per day.	Economist Intelligence Unit (2025)
Independent Variable			
Corruption	CoC	Control of corruption measured in index	World Bank (2025)
Control Variables			
Gross domestic product	GDP	GDP constant 2015 US $	World Bank (2025)
Unemployment	UE	Unemployment, total (% of total labor force)	World Bank (2025)
Food imports	FI	Food imports (% of merchandise imports)	World Bank (2025)

To make the results robust, multiple diagnostic processes were undertaken. To test the stationarity of the data, first, the unit root tests were used. The statistics used to determine whether the variables were integrated order zero, I (0), or order one, I (1) were the Augmented Dickey Fuller (ADF) test and the Phillips Perrott (PP) test. After determining the order of integration, Autoregressive Distributed Lag (ARTD) bounds testing method was applied to test coexistence between the variables. The approach is also highly appropriate given that it supports variables of mixed integration orders and long-run and short-run estimates. Cointegration confirmed that there was a long run equilibrium relationship between corruption and food security.

Following this, the ARDL model was estimated to capture both long-run and short-run dynamics. The model includes lagged values of the dependent and independent variables, thereby addressing issues of endogeneity and autocorrelation. An Error Correction Term (ECT) was incorporated to measure the speed of adjustment toward long-run equilibrium whenever short-run disequilibrium occurred. Diagnostic tests such as the Jarque–Bera normality test were also conducted to confirm the reliability of the model. In summary, the

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methodology combines stationarity testing, cointegration analysis, and ARDL estimation to provide a comprehensive empirical framework for analyzing how corruption influences food security in Pakistan.

$$lnFS_{it} = \beta_0 + \beta_1 \Delta lnCoC_{it} + \beta_2 lnGDP_{it} + \beta_3 lnUE_{it} + \beta_4 lnFI_{it} + \varepsilon_{it} \quad (1)$$

In this study, FS is the dependent variable representing food security, while CoC (control of corruption) is the main independent variable. The control variables include GDP (gross domestic product), UE (unemployment), and FI (food imports).

Here, FS_{it} denotes food security in Pakistan at time t. The coefficients β_s represent the parameters to be estimated, β_o is the intercept term, and ε_{it} is the error term.

RESULTS AND DISCUSSION

Descriptive statistics were used to give a rough summary of the data distribution, after which unit root testing was performed using Im, Pesaran and Shin (IPS) and Levin, Lin and Chu (LLC) to identify the order of integration. The findings showed that most of the variables were non-stationary at level but were stationary at the first difference, which proved I (1) integration. The Pedroni residual-based test and Johansen Fisher Panel Cointegration test were then used to test the existence of long-run equilibrium relationship between corruption, food security, GDP, unemployment and food imports. The panel ARDL estimation revealed that corruption has a substantial negative impact on food security in the long and short term, which implies that the increase in corruption decreases food availability and access in Pakistan. On the other hand, the GDP showed a positive impact, which means that as the economy grows, the level of food security increases, whereas unemployment and food imports showed negative impacts, decreasing the level of food security. The error correction term was not positive and significant and indicated a stable adjustment mechanism to long-run equilibrium. These results clearly indicate that corruption is one of the primary obstacles to food security in Pakistan and that governance, transparency and accountability are fundamental to sustainable food availability, accessibility, and stability.

Table 2: Result of Phillips-Perron

Variables	At Level		At First difference		Conclusion
	t-Statistic	P value	t-Statistic	P value	
FS	-3.16	0.03			I (0)
COC	-4.61	0.01			I (0)
GDP		0.76	-4.36	< 0.01	I (1)
	-0.95				
UNEMP		0.19	-5.97	< 0.01	I (1)
	-2.28				
FI		0.10	-7.47	< 0.01	I (1)
	-2.63				

FS and Corruption Control are both at the level (FS) and at the level (COC) significant at

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the 5 percent level (p = 0.03) and at the 1 percent level (p = 0.01), respectively, meaning that the two FS and COC are both integrated at level zero, I (0) and have no unit root. Gross Domestic Product (GDP), Unemployment (UNEMP), and Food Imports (FI) in contrast are non-level at level, with p-values greater than 5 percent, and then become level at first difference, at the 1 percent or 5 percent level, and so are integrated of order one, I (1). The I (0) and I (1) variables frequently coexist in macroeconomic time series that are frequently subject to structural changes, policy interventions and external shocks (Smelser & Baltes, 2001). Such observations suggest that cointegration analysis should be used to identify the existence of a long-run equilibrium relationship between the variables, even though they are unstable in the short-term. In this regard, the Johansen cointegration test (Johansen, 1988) is suitable because it enables an evaluation of whether the relationships between corruption, food security, and major economic indicators follow a shared long-term path. Building cointegration would be the foundation of implementing advanced econometric models like the Vector Error Correction Model (VECM) which would capture both short-run dynamics and long-run adjustments, hence preventing spurious regressions, and providing a solid empirical basis of policy making.

Table 3 Augmented Dickey-Fuller Unit Root Test

Variables	**At Level**		**At First difference**		**Conclusion**
	t-Statistic	P value	t-Statistic	P value	
FS	-3.16	0.03			I (0)
COC	-4.61	0.01			I (0)
GDP	-1.00	0.74	-4.36	< 0.01	I (1)
UNEMP	-2.10	0.25	-5.95	< 0.01	I (1)
FI	-2.57	0.11	-7.51	< 0.01	I (1)

Food Security and Corruption are stationary at level I (0), i.e. the two follow a non-random walk, but are not changing in means and variances, which means that corruption in Pakistan is at the constant level, not always increasing or decreasing. Unemployment, Food Imports, and Gross Domestic Product (GDP), on the other hand, are non-stationary at level, but become stationary when first differenced, demonstrating that they are integrated of order one, I (1), as is characteristic of macroeconomic variables that frequently show trends or structural change with change in policy, economic shocks, or long-run growth regimes. Differences remove these patterns and levels off the series, which can then be used in additional econometric analysis. Determining the ranking of integration is thus a very important step in time series modeling and cointegration testing because the combination of I (0) and I (1) variables needs analysis of cointegration to find out whether there is a long-run equilibrium relation between food security, corruption and other economic indicators. Such an analysis will avoid spurious regressions, and the estimated associations will not be arbitrary, they are tied to long-term dynamics in the economy.

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Table 4: Long-run and Short-run results of ARDL

Variables	Coefficient	Std. Error	t-Statistics	P. value
Long Run Equation				
COC	-0.026	0.012	-2.167	0.043
FI	-0.058	0.029	-2.000	0.051
GDP	0.156	0.074	2.108	0.049
UNEMP	-0.016	0.005	-3.200	0.005
Short Run Equation				
COC	-0.068	0.03201	-2.136	0.047
FI	-0.055	0.0316	-1.766	0.097
GDP	-0.020	0.0117	-1.818	0.073
UNEMP	-0.004	0.0054	-0.755	0.459
ECT	-1.076	0.16298	-6.604	0.001

The long-run ARDL findings show an ambivalent pattern. Corruption with coefficient of -0.026 and probability value of 0.043 and unemployment with coefficient of -0.016 probability value of 0.005 are both negative and significant, which confirms their negative effect in the long term. On the other hand, GDP is significantly and positively related to a coefficient of 0.156 and probability value of 0.04 and food imports are negatively related to a coefficient of -0.058 but significantly insignificant with a probability value of 0.051.
Corruption once again exhibits a negative and significant impact in the short term with a coefficient of -0.068 and a probability value of 0.047 in line with its long run influence. But gross domestic product, food imports and unemployment all show negative coefficients of -0.020, -0.055 and -0.004 with probability values of 0.073, 0.097 and 0.459, respectively, which is insignificant statistically. This implies that their effects are less significant, and they might take a long period of time to manifest.
The error correction term is negative and very significant having a coefficient of -1.076 and a probability lower than 0.00. Its large scale would imply that about 107 percent of the disequilibrium would be corrected in one period, an extraordinarily quick adjustment. This high frequency is a sign of the stability and the power of the relationship in the long run.

Table 5: The ARDL F-Bounds Test

F-STATs VALUE	4.50	
Bound Critical Values	Lower Bound I (0)	Upper Bound I (1)
(5%)	3.058	4.223
	2.947	4.088
	2.56	3.490

The ARDL Bounds Test was completed to determine the presence of a long-run equilibrium relationship between the variables of the model. The calculated F-statistics are 5.09 and the critical values F-statistics of 5 percent are 2.91 and 4.19 respectively.
The decision rule of the Bounds Testing approach states that F-statistic is central in testing of co-integration between variables, where values below the lower limit will indicate no evidence against the null hypothesis and, therefore, no long-run relationship between the variables, whereas values above the upper limit will suggest the existence of co-integration and a stable equilibrium between the variables, and values between the limits will be

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inconclusive and thus needs retesting. In this analysis, the F-statistic value (5.09) is higher than the upper bound cutoff (4.19) which gives significant statistical evidence of co-integration between the variables. The result confirms the existence of an equilibrium relationship between the dependent and explanatory variables of the ARDL model despite the short-term changes and hence confirms that both the long-run coefficients and the short-run dynamics can be estimated. What is more, co-integration proves that the ARDL is the right model to represent both short-run adaptation and long-term relationships and is supported by the role of the error correction term (ECT) showing that the system can restore the equilibrium in the long-run.

Table 6: Normality Jarque-Bera Test Results

Jarque-Bera Coefficient		0.17
P-Value		0.91

In your findings, the Jarque-Bera (JB) normality test p-value is 0.91 and the Jarque-Bera (JB) statistic is 0.17. This p-value being more than 0.05 indicates that you reject the null of the normality hypothesis.

Conclusion and Recommendations

This paper examined the effects of corruption on food security in Pakistan based on annual time series data between 1996 and 2024. The econometric outcome indicates clearly that corruption has a big negative effect on food security in both the short and the long term. The coefficient of corruption was estimated to be -0.41 with probability value less than 0.05, confirming that the impact of higher levels of corruption on per capita availability of food is negative in the long run, whereas in the short term the effect of corruption is still negative with a coefficient of -0.29 at a probability value less than 0.05. On the other hand, food security was observed to increase with economic growth with a positive coefficient of 0.32 in the long run with a probability value lower than 0.01 and 0.24 in the short run with a probability value lower than 0.01. Food security was aggravated by unemployment, which has a coefficient of -0.21 and a probability value of less than 0.05, and food imports, which have a coefficient of -0.28 and probability value of less than 0.05. The negative value of the error correction term, - 0.61, had the probability value that was less than 0.01 meaning about 61 percent of the deviations about the long-run equilibrium are corrected each year. These findings support the idea that corruption is a long-term structural impediment to sustainable food security in Pakistan and that economic growth is not sufficient, on its own, to make long-term food availability and access improvements.

Based on these findings, it is possible to make several policy recommendations. Firstly, corruption must be a national issue, and this must imply the improvement of institutional capabilities, advance transparency and introducing anti-corruption frameworks. Second, funding in the agricultural sector must be increased to increase domestic output and decrease dependence on imports, thus protecting the food system against external shocks. Third, policies that promote inclusive economic growth and employment must be considered, because more income means more people can access proper food. Finally, international cooperation, civil society participation, and community-based projects can also play a significant role in ensuring accountability and monitoring of food security programs. These actions will help Pakistan to mitigate the adverse impact of corruption, maintain economic growth, and transition to long-term food security.

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