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Challenges to Attaining the SDG 2 (Zero Hunger) and Future Projections: The Criticality of Types of Corruption, Human Rights, and Greenhouse Gas Emissions for Selected Asian Countries

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ABSTRACT

By the mid-21st century, the global economic system had not yet fully solved the problem of hunger. Therefore, achieving SDG 2 (Zero Hunger), one of the UN's Sustainable Development Goals (SDGs), is crucial. This study therefore aims to examine the factors that may lead to hunger in seven selected Asian countries (Afghanistan, Bangladesh, North Korea, India, Pakistan, Papua New Guinea, and Timor-Leste) between 2002 and 2022. In this context, Panel-robust estimation results have shown that rising executive corruption is a major driver of hunger. However, remarkably, hunger decreases when public sector corruption (PC) and judicial corruption (JC) boost. Another important finding is that progress in gross domestic product (GDP), human rights, and democracy play a significant role in reducing hunger. Conversely, as expected, population growth and rising greenhouse gas emissions (GHG) were found to be other factors that trigger hunger. Ridge regression results supported the other findings and also revealed that a decrease in legislative corruption (LC) triggered hunger. The results of the interaction terms indicated that an increase in *Publiccorruption* × *Humanrights*, *Publiccorruption* × *Democracy*, *Executivecorruption* × *Humanrights* and *Executivecorruption* × *Democracy* led to a reduction in hunger, while a rise in *Legislativecorruption* × *Humanrights* and *Legislativecorruption* × *Democracy* led to an increase in hunger. These results are important for policymakers, governments and countries aiming to achieve SDG 2, as they can inform policy design and proactive interventions utilizing empirical findings.

1 | Introduction

As in the past, hunger and malnutrition remain one of the most significant humanitarian challenges of today (Hassan et al. 2020; Wu et al. 2023). Hunger, a reflection of a social phenomenon, continues to be a major challenge for inclusive development, disproportionately affecting the population in some developing and particularly underdeveloped countries (Njangang et al. 2024; Vishnu et al. 2025). In this context, the United Nations' Sustainable Development Goal 2 (SDG 2) is an action plan that aims to end hunger by 2030, ensuring that vulnerable people, particularly the poor and infants, have access to safe, nutritious, and sufficient food. However, although it has been stated that combating hunger is a necessity for sustainable and inclusive development and the zero-hunger goal has been confirmed, hunger continues globally (UN 2024). For example, in 2023, approximately

733 million people worldwide faced hunger, and 2.33 billion people faced moderate or severe food insecurity (WHO 2024). Therefore, hunger remains a significant concern today (Khan, Ashraf, and Shah 2024; Khan, Bojnec, et al. 2024).

Although regional trends vary significantly, hunger and food insecurity are increasing in Africa, the Caribbean, Latin America, and parts of Asia. Today, Africa is the region with the highest percentage of people facing hunger, at 20.4%. This rate is 8.1% in Asia, 6.2% in Latin America and the Caribbean, and 7.3% in Oceania. It is reported that in 2023, 41 million people in Latin America and the Caribbean and 3.3 million people in Oceania will suffer from hunger, while 298.4 million people in Africa and 384.5 million people in Asia will face hunger. In this sense, the Asian continent is home to half of the world's hungry people (FAO 2024; FAO, IFAD, UNICEF, WFP, and WHO 2024). If current trends continue, 582 million people will be chronically undernourished or face hunger by 2030 (WHO 2024).

Poverty, climate change, weak infrastructure, technological backwardness in agriculture, education, population growth, natural disasters, armed conflicts, and economic fluctuations are important dynamics associated with hunger and malnutrition. However, studies conducted over the past quarter-century show that, in addition to political factors, poor governance, particularly corruption, is among the key determinants of hunger and malnutrition (Sahley et al. 2005; Akram et al. 2011; Anser et al. 2021; Önder 2021; Camacho 2022; Nugroho et al. 2022; Wu et al. 2023; Khan, Bojnec, et al. 2024; Maslen 2024; Njangang et al. 2024). In particular, corruption can increase poverty, impair efficiency in the allocation of public resources, weaken food security programs, cause public budgets to lose functionality, and reduce the effectiveness of public services related to food distribution and social protection (Mauro 1998; Tanzi 1998; Darnton-Hill 2001; Drèze and Sen 2013; Uchendu and Abolarin 2015; Lopez 2025).

Corruption, defined as the use of public power for private gain (Shleifer and Vishny 1993) and a key determinant of poor governance, is not only associated with weak development outcomes (Kaufmann et al. 2009) but also a powerful factor in explaining hunger and malnutrition. This is because executive corruption can lead to the misappropriation of food aid funds, while judicial corruption can undermine the use of land rights, which are vital for agriculture. On the other hand, legislative corruption can lead to deliberate legal loopholes that enable the legalization or misuse of ineffective food safety practices. Consequently, in a structure where resource allocation is distorted and institutional efficiency is weakened due to corruption, policies aimed at reducing poverty and hunger may fail (Njangang et al. 2024). This indicates that hunger is not only a result of material and resource scarcity but also a result of a governance crisis caused by moral failure (Sempiga 2012). Therefore, good and effective governance is not only a crucial factor in addressing malnutrition and ensuring sustainable well-being (Kaufmann et al. 2011), but it also emerges as an important policy for breaking the cycle of hunger. However, given the alarming levels of corruption today, it is evident that reducing poverty, ensuring access to adequate food, and combating hunger are challenging in many developing and particularly underdeveloped countries.

It is estimated that global corruption amounts to 5% of world GDP, and that this rate is even higher in some Asian countries where poor governance and institutional deficiencies are widespread (Laing 2023). Most of these countries, where corruption stemming from poor governance and institutional deficiencies is alarmingly high, are also struggling with poverty, malnutrition, and hunger (Uchendu and Abolarin 2015; Vinayagathasan and Ramesh 2022). For example, according to the 2024 Global Hunger Index, the Asian countries Afghanistan, Pakistan, India, North Korea, Papua New Guinea, and Timor-Leste are facing serious hunger. Although Bangladesh is not among the countries experiencing serious hunger, it ranks among the lowest in the list of countries experiencing moderate hunger (Global Hunger Index 2024). A common feature of these countries most affected by hunger and malnutrition is the prevalence of corruption. Indeed, the average Corruption Perceptions Index for these countries in 2024 is 27 points (Transparency International 2025). Corruption is generally a deep-rooted problem in these countries, affecting not only the public sector but also the private sector, the judiciary, and political institutions (Vinayagathasan and Ramesh 2022).

In many Asian countries facing serious hunger problems, widespread corruption, weak democratic and institutional structures, and human rights violations are also evident. In countries such as Afghanistan, Pakistan, India, North Korea, Bangladesh, Papua New Guinea, and East Timor, corruption remains widespread across political, judicial, and public institutions, while weak accountability processes and institutional fragilities continue to undermine the effectiveness of governance (McDevitt 2016; Freedom House 2023, 2024a, 2024b, 2024c, 2024d, 2025a, 2025b; Nandy 2023; Transparency International 2025; Vinayagathasan and Ramesh 2022). Such governance weaknesses can reduce the effectiveness of food security policies, disrupt the allocation of public resources, weaken agricultural support systems, and increase the risk of hunger and malnutrition (Helal et al. 2016; Anik et al. 2013; Demeshko et al. 2024).

Finally, in these countries where corruption permeates public, private, judicial, and political institutions (Vinayagathasan and Ramesh 2022), hunger and malnutrition remain significant problems. Because corruption can weaken the effectiveness of food security policies, as well as render agricultural investments ineffective, prevent subsidies from reaching eligible households, and disrupt food security policies (Mauro 1998; Anik et al. 2013; Demeshko et al. 2024). Consequently, such developments can undermine policies aimed at preventing hunger and malnutrition (FAO, IFAD, UNICEF, WFP, and WHO 2022). Therefore, understanding the comprehensive relationship between corruption and hunger is crucial for developing more effective and sustainable solutions. However, it should be noted that although there are many studies in the literature on the effects of corruption and the determinants of hunger, the relationship between corruption and hunger has been studied less (Njangang et al. 2024).

In fact, to our knowledge, the relationship between corruption and hunger remains relatively underexplored, especially in Asian countries that suffer from serious hunger problems. In this context, the aim of this study is to examine the relationship between corruption and hunger in Asian countries experiencing serious

hunger problems. By examining the relationship between corruption and hunger, we seek to answer the research question: "How does corruption affect hunger and malnutrition levels in Asian countries experiencing serious hunger problems?" The main research problem of the study is to empirically determine whether hunger, particularly in Asian countries facing serious hunger, is the result not only of economic and demographic factors but also of various forms of corruption. While the existing literature has largely focused on general corruption indicators or different regional contexts, the effects of various types of corruption on hunger in Asian countries facing serious hunger problems have largely not been studied. Based on this observation, the remainder of this article is structured as follows. Section 2 of the study addresses the gap in the literature and the contribution of this work. Section 3 presents a comprehensive literature review. Section 4 presents the model specification and data set. Section 5 discusses the empirical findings. Following a discussion based on the findings, the study concludes with results and policy directions.

2 | Literature Gap and Contribution

While studies in the literature on the social, economic, financial, and human impacts of corruption have answered some important questions, the answers to certain questions are still not satisfactory. For example, various studies have emphasized the effects of corruption on public debt, education, health, investment, economic growth, income inequality, welfare, human development, food security, and poverty (Gupta et al. 2002; Apergis et al. 2010; Dridi 2014; Sulemana et al. 2017; Benfratello et al. 2018; Sharma et al. 2021; Kostekci and Kemiksiz 2022; Mehmood et al. 2022; Chen et al. 2023; Ishfaq and Waqas 2023; Kostekci et al. 2023; Stylianou et al. 2023; Thede and Karpaty 2023; Khan, Bojnec, et al. 2024; Celik and Kostekci 2025). However, very few studies have directly investigated the relationship between corruption and hunger (Njangang et al. 2024). In particular, although Asia hosts a significant share of the world's food-insecure population (FAO, IFAD, UNICEF, WFP, and WHO 2024), the differentiated effects of legislative, executive, judicial, and public sector corruption on hunger outcomes remain largely underexplored. For this reason, this study aims to support the existing literature by examining how various types of corruption are linked to hunger issues in Asian countries where hunger is a serious problem.

In this respect, our study contributes to the literature in several ways. First, building on the foundational work by Njangang et al. (2024) for African countries, we investigate the effects of legislative, executive, judicial, and public sector corruption on hunger in Asian countries. Unlike studies relying on aggregate governance indicators, our study separately evaluates legislative, executive, judicial, and public sector corruption in order to provide a more detailed assessment of the governance and hunger relationship. Here, different types of corruption are separately examined to provide a more detailed assessment of the relationship between corruption and hunger. Second, to observe the effects of other economic, political, and structural factors that may influence hunger levels, we include variables such as economic growth, greenhouse gas emissions, population growth, democracy, and human rights in the model. Among these variables, economic growth can affect nutrition and hunger through income. The impact of governance on hunger and malnutrition can manifest through channels such as corruption, human rights, and democracy (Drèze 2004; Rossignoli and Balestri 2018; Gamso 2024; Njangang et al. 2024). Third, the study highlights that hunger may also be linked to shortcomings in the quality of governance and institutional effectiveness. Indeed, Sempiga (2012) states that hunger cannot be explained solely by resource and material shortages and that the governance crisis stemming from moral failure also plays a role in the persistence of this humanitarian problem. Consequently, our study aims to provide a detailed analytical perspective on how various forms of corruption are linked to hunger in Asian countries facing serious hunger problems, and to contribute to the literature in this context. Our study also contributes to the literature on Sustainable Development Goal 2 (Zero Hunger) by emphasizing that the sustainable reduction of hunger may depend on the quality of governance, institutional effectiveness, and the fight against corruption.

3 | Literature Review and Transmission Channels

In today's world, the problem of hunger is closely associated not only with macroeconomic conditions but also with institutional quality and governance factors (Sempiga 2012; Vinayagathasan and Ramesh 2022; Khan, Bojnec, et al. 2024). Although a large body of literature has examined the determinants of hunger, relatively few studies have directly focused on the relationship between corruption and hunger (Njangang et al. 2024). Existing studies generally emphasize aggregate governance indicators, while the differentiated effects of legislative, executive, judicial, and public sector corruption on hunger remain insufficiently explored, particularly in Asian countries experiencing serious hunger problems. Therefore, our study contributes to the literature by examining how various dimensions of corruption are linked to the consequences of hunger in Asian countries where hunger is a serious problem.

In this framework, the literature suggests that corruption may affect hunger through several institutional and socioeconomic channels. Corruption may weaken the effectiveness of food distribution systems, distort public resource allocation, reduce the efficiency of agricultural support mechanisms, and undermine policy implementation capacity (Njangang et al. 2024). In addition, weak governance structures, weak democratic institutions, human rights violations, and limited institutional capacity can further exacerbate food insecurity and malnutrition, particularly in developing economies with fragile governance systems. Consequently, this study addresses hunger not merely as a problem of material scarcity, but also as an issue linked to the effectiveness of governance, institutional quality, and the implementation of public policies.

3.1 | The Interconnection Between Legislative Corruption and Hunger

Legislative corruption may weaken efforts to reduce hunger and malnutrition, particularly in developing and least developed

countries, by reducing the effectiveness of food security regulations and weakening institutional accountability systems. Corruption in legislative processes can distort public decision-making and increase the influence of certain interest groups on policymaking (Anggono and Wahanisa 2022). In this context, Mehmood et al. (2025) emphasize that institutional quality, government integrity, and anti-corruption mechanisms play a vital role in enhancing governance effectiveness and reducing corruption-related institutional vulnerabilities. Therefore, weak governance structures and ineffective legislative oversight can further exacerbate food insecurity and malnutrition, particularly in countries facing institutional fragility and limited administrative capacity (Akoji et al. 2025). In this context, Njangang et al. (2024) note that understanding the dynamics of legislative corruption is critical to explaining persistent hunger issues in developing economies.

Legislative corruption may also weaken the institutional credibility necessary for the effective implementation of food security policies and social protection programs. Panda (2024) argues that although public distribution systems and food assistance policies are designed to reduce food insecurity, corruption and implementation weaknesses often limit their effectiveness. Similarly, Shams et al. (2024) note that weak anticorruption mechanisms may contribute to the misuse of resources allocated to agricultural development and food aid programs. Consequently, corruption within legislative structures may undermine progress toward Sustainable Development Goal 2 (SDG-2), which aims to achieve zero hunger. Galabada (2022), using data from 108 countries for the 2000–2019 period, found that stronger governance quality contributes positively to SDG-2 performance. Njangang et al. (2024), examining 45 African countries, also reported that legislative corruption is associated with higher hunger levels. Corruption within legislative bodies can weaken the effectiveness of governance and reduce the institutional capacity needed to address hunger and food insecurity. Therefore, we hypothesize that legislative corruption undermines institutional effectiveness in combating hunger by disrupting the allocation of public resources and the process of formulating food security policies.

H1. *An increase in legislative corruption has an effect that increases the level of hunger.*

3.2 | The Interconnection Between Judicial Corruption and Hunger

Weak governance structures and ineffective legal systems may negatively affect food security by weakening institutional accountability and limiting the effective implementation of food-related rights and regulations. In particular, judicial corruption may undermine the rule of law, reduce institutional trust, and weaken the legal protection mechanisms necessary for ensuring food access and food security. As emphasized in the literature, effective legal frameworks and access to justice mechanisms play an important role in protecting the right to food and strengthening food security policies (Tura 2018). Similarly, Mohd-Rashid et al. (2023), with a focus on Asia-Pacific countries, argue that a stronger rule of law and greater governance integrity are associated with lower levels of corruption, which in turn could potentially enhance the effectiveness of public institutions in broader socioeconomic areas.

In institutional environments where judicial integrity is weakened and the rule of law is not effectively established, the misuse of resources allocated to food aid, agricultural support, and social protection programs may become more likely. Weak judicial oversight may reduce accountability in the management of public resources and limit the effectiveness of food security initiatives. In such environments, vulnerable groups may face greater difficulties in accessing food and nutrition services. Clover (2003), for example, argues that weak institutional oversight and failures in legal accountability played an important role in the food crisis and famine process experienced in Malawi. Similarly, Ogunniyi et al. (2020), examining 15 Sub-Saharan African countries for the 1996–2015 period, found evidence that stronger rule of law institutions significantly improves food and nutrition security. Subramaniam et al. (2022), analyzing 56 developing countries, also concluded that institutional quality and rule of law indicators positively contribute to food supply and nutritional outcomes.

The literature further suggests that understanding different corruption dimensions, including judicial corruption, is important for explaining persistent hunger problems in developing economies (Njangang et al. 2024). Njangang et al. (2024), using data from 45 African countries, found that higher levels of judicial corruption are associated with higher hunger levels. These findings suggest that judicial corruption may weaken the institutional and legal mechanisms necessary for the effective implementation of food security policies and the fair allocation of public resources.

Contrary to these views and findings in the literature, the positive socioeconomic effects of corruption have also been discussed in an environment characterized by a weak legal and regulatory framework. For example, Bardhan (1997) and Persson et al. (2013) have argued that, in the presence of weak legal and regulatory frameworks, corruption can serve to "grease the wheels of commerce" and thereby contribute to the economic structure. However, in light of the findings in the extensive and diverse literature, we hypothesize that judicial corruption can undermine the rule of law and the effectiveness of justice mechanisms, thereby hindering the implementation of food security policies and leading to misallocation of resources, which can limit access to food for vulnerable groups.

H2. *An increase in judicial corruption has an effect that increases hunger levels.*

3.3 | The Interconnection Between Executive Corruption and Hunger

The relationship between corruption in executive branches and hunger can be examined in terms of how executive actions exacerbate food insecurity and deepen inequality (Njangang et al. 2024). Since corruption within executive bodies plays a central role in the allocation, implementation, and monitoring of food security policies, agricultural subsidies, and social protection programs, it can affect hunger more directly than other forms of corruption. In this sense, in developing economies

where institutional oversight is weak, corruption within executive structures can reduce policy effectiveness, distort the allocation of public resources, and weaken administrative coordination processes. Indeed, Sajjadi (2024) states that in environments with high levels of administrative or executive corruption, public trust and governance effectiveness systematically weaken. This situation may reduce the effectiveness of public resources, particularly those related to food aid and agricultural investments, which can increase the risk of hunger and malnutrition. This is because executive corruption allows elites to manipulate executive processes for their own interests. For example, Anser et al. (2021) found in their study on West Africa that government effectiveness and the fight against corruption increase food security. Similar results were also seen in the studies conducted by François and Méon (2021). Again, Meng et al. (2025), in their study based on the period 1973–2022, found that corruption in the executive branch weakened access to resources in Afghanistan, reduced per capita income, and created major difficulties in accessing food through the poverty channel. Similarly, Khan, Bojnec, et al. (2024) concluded in their study on Pakistan that household food security was negatively affected by corruption and instability. Njangang et al. (2024), who examined the impact of legislative, executive, and judicial corruption on hunger in 45 African countries, found strong evidence that executive corruption has the most devastating effect on hunger. Ngoc and Dang (2026) showed that improvements in governance quality reduce the negative effects of corruption and play an important role in combating poverty. Compared to legislative corruption, executive corruption can more directly affect the hunger problem through policy implementation, budget allocation, and the management of public resources related to food (Njangang et al. 2024). Therefore, it can be stated that executive corruption may weaken governance effectiveness by reducing the efficiency of public policies aimed at ensuring food security, thereby potentially increasing hunger. Consequently, we argue that executive corruption increases hunger by leading to the misuse of public resources and undermining policy effectiveness.

H3. *An increase in executive corruption has an effect that increases the level of hunger.*

3.4 | The Interconnection Between Public Sector Corruption and Hunger

Systematic corruption in the public sector of a country undermines public institutions, thereby undermining policies aimed at reducing hunger and ensuring food security. In this sense, corruption can negatively affect food security policies by causing a decline in public trust, poverty, and inefficiency in resource allocation, thereby further deepening socioeconomic problems such as hunger (Sambo and Sule 2021; Gebrihet et al. 2023). Therefore, efforts to prevent corruption in the public sector can ensure the effective distribution of resources allocated to food security programs by establishing transparency and accountability in public activities. In this regard, Smith and Haddad (2015), in their study using data from 1970 to 2012 for 116 developing countries, found that good governance reduces malnutrition. A similar study conducted by Ogunniyi et al. (2020) for Sub-Saharan African countries also concluded that the quality of governance is a critical factor in creating the necessary environment for national food security. Fokam et al. (2023), who examined the relationship between financial development and malnutrition in African countries, showed that financial development reduces malnutrition and that one of the transmission channels for this effect is the control of corruption.

Corruption in the public sector not only directly exacerbates problems such as hunger and malnutrition but can also indirectly influence issues like income inequality and poverty. For example, in their study examining the relationship between corruption and poverty in South Asian countries, Vinayagathasan and Ramesh (2022) found strong evidence that a decline in corruption reduces poverty in both the short and long term. For this reason, it highlights the argument that increasing poverty and income inequality in societies where corruption is widespread can be a cause of hunger (Policardo and Carrera 2018). Indeed, studies by Palma et al. (2009) and Eini-Zinab et al. (2020) empirically substantiated these arguments and showed that countries characterized by widespread poverty and high-income inequality are associated with higher levels of hunger. In another study, Wudil et al. (2022) identified gender inequality, high inflation, low crop productivity, and corruption as the biggest problems related to sustainable food security in Sub-Saharan Africa. The literature generally suggests that corruption in public institutions can worsen hunger through the inefficient allocation of resources, poverty, and weak social protection programs. For this reason, we argue that corruption in the public sector increases hunger by undermining resource allocation policies, exacerbating inequality, and deepening poverty.

H4. *An increase in corruption in the public sector has an effect that increases hunger levels.*

3.5 | The Interconnection Between Economic Growth and Hunger

Economic growth, commonly measured through GDP per capita, accepted as an indicator of economic prosperity, is an important indicator that directly and indirectly affects food availability, food accessibility, and consumption habits, which are the fundamental determinants of hunger. In this regard, some studies show that there is an inverse relationship between GDP per capita and hunger and that an increase in GDP plays an important role in reducing hunger (Leete and Bania 2010; Reuveni 2024). For example, Smith and Haddad (2015), in their study using data from 1970 to 2012 for 116 developing countries, found that income growth played a facilitating role in adequate nutrition among children. Similarly, in another study, Nzeh et al. (2024) examined the relationship between per capita income and the prevalence of hunger and malnutrition for the Economic Community of West African States. The study findings concluded that an increase in per capita income increased people's access to adequate and balanced food, thereby reducing hunger. Moreover, Mehmood et al. (2023) emphasize that institutional quality and governance effectiveness are key determinants of broader socioeconomic performance and argue that weak governance structures can also undermine policy effectiveness in areas related to poverty reduction. A comprehensive study by Njangang et al. (2024) also reached similar conclusions and found that per capita GDP is an important factor in reducing hunger.

On the other hand, there is also an alternative view in the existing literature that suggests corruption can positively impact economic growth by facilitating the decision-making procedures (Vinayagathasan and Ramesh 2022). This alternative view is based primarily on the idea that, in developing countries where institutional and legal frameworks are weak, corruption can remove barriers to investment and accelerate decision-making processes (Leff 1964; Lui 1985; Huntington 2006). However, findings in the literature generally indicate that economic growth can reduce hunger by improving income distribution, increasing purchasing power, and expanding access to food and nutrition services. Based on the findings in the literature, we argue that economic growth improves access to food through income growth and thereby reduces hunger.

H5. *Economic growth has a reducing effect on hunger levels.*

3.6 | The Interconnection Between Human Rights, Democracy, and Hunger

The protection of human rights and the quality of democracy are important institutional determinants in ensuring access to sufficient food and the effective implementation of policies to reduce hunger (Candel 2014; Elver 2023). The recognition of access to adequate food as a fundamental human right imposes a responsibility on states to protect this right. In this context, Domingo-Cabarrubias (2023) states that the right to food must be considered in conjunction with the principles of material equality and the prohibition of discrimination, particularly with regard to access to food for disadvantaged groups. In contrast, James (2024) emphasizes that prolonged hunger and food insecurity undermine human dignity and are directly linked to legal protection mechanisms. However, the legal recognition of the right to food does not guarantee that this right will be realized in practice. In this regard, Drèze (2004) notes that the right to food can be transformed into concrete public obligations through legal initiatives, democratic practices, and public pressure. Similarly, Hertel (2015) argues that the support of legal claims through social mobilization and pressure for political action is crucial for the realization of the right to food. In addition, Resnick and Deshpande (2023) claim that illiberal practices that restrict freedom of expression and association weaken the ability of civil society organizations active in the field of nutrition to access decision-makers and influence public policy.

Democratic institutions can influence food security by increasing governments' responsiveness to hunger, malnutrition, and food crises. Besley and Burgess (2002) found that in Indian states where newspaper circulation and electoral accountability were stronger, governments responded to declines in food production and agricultural disasters with more robust public interventions. On the other hand, Blaydes and Kayser (2011) have shown that democratic institutions facilitate the conversion of economic growth into calorie consumption for broader segments of society. These findings suggest that the relationship between democracy, human rights, and hunger may emerge through transmission channels such as government responsiveness, public oversight, redistribution, and the allocation of public resources to food policies.

Studies that examine the relationship between democracy and food security more directly have reached similar conclusions. After analyzing 106 low- and middle-income countries during the 1990–2012 period, Rossignoli and Balestri (2018) found that democratization processes were associated with a reduction in undernutrition and an improvement in food security. On the other hand, Gamso (2024) finds that democracy can mitigate the negative effects of sudden drops in food aid on food insecurity. Findings in the literature indicate that stronger protection of human rights can enhance equality in access to food, human dignity, and legal accountability, while improvements in the quality of democracy can increase political participation, government responsiveness, and the effectiveness of food policies. Therefore, we argue that the protection of human rights and improvements in the quality of democracy will reduce hunger levels.

H6. *Improvements in the protection of human rights and the quality of democracy reduces levels of hunger.*

3.7 | The Interconnection Between Population Growth and Hunger

In the literature, population growth is often discussed as one of the structural factors linked to food insecurity and hunger, particularly in developing countries with limited agricultural and institutional capacity. In environments where agricultural production and food supply systems cannot keep up with population growth, pressures on food availability and accessibility may intensify, which can increase the risks of hunger and malnutrition (Aiyedogbon et al. 2022). In this regard, the relation between population growth and hunger constitutes a key factor in the broader dynamics of food security (Ammar et al. 2023). Indeed, Oseghale et al. (2024) have emphasized that sustainable food production methods and techniques must adapt to population growth, highlighting the importance of increasing agricultural productivity in preventing hunger and malnutrition. This suggests that the pressure of population growth on hunger and malnutrition can be alleviated by increasing agricultural productivity. For example, studies by Peters (2015) and Owoo (2021) in the literature have found significant evidence that population growth is an indicator of food insecurity. Aiyedogbon et al. (2022), who examined the relationship between population growth and food security in Nigeria, obtained similar results. In essence, these results show that it is essential to balance food production with population growth in order to establish food security and combat hunger. In this context, according to the results of the study conducted by Molotoks et al. (2021), food security is higher in countries where population growth is expected to decline, while food security is weaker in countries where rapid population growth is expected.

The literature also shows that demographic pressure can lead to broader socioeconomic vulnerabilities, such as hunger and poverty. For example, Akinbode et al. (2022), in their analysis of Sub-Saharan African countries for the period 2007–2017, found that population growth significantly increased hunger levels. Literature findings indicate that population growth can exacerbate the risks of hunger and malnutrition, particularly in developing countries, by increasing pressure on agricultural production, food supply systems, and institutional capacity. Accordingly, we

assume that population growth exacerbates hunger and malnutrition by creating pressure on food security and agricultural production capacity.

H7. *Population growth increases hunger levels.*

3.8 | The Interconnection Between Greenhouse Gas Emissions and Hunger

The increase in greenhouse gas emissions, one of the main drivers of human-induced global warming, is further exacerbating climate change. This process can have direct and indirect negative effects on food production, access to food, and food security (Fanzo et al. 2025). These developments may limit food supply and drive up food prices, making it more difficult for low-income and food-insecure groups in particular to access adequate and balanced food. Indeed, Mirzabaev et al. (2023) note that temperature increases, droughts, floods, and rainfall irregularities associated with climate change can create persistent and widespread risks to food systems, thereby increasing food insecurity and malnutrition. Therefore, the impact of greenhouse gas emissions on hunger may manifest through the consequences of deteriorating climate conditions on agricultural production, food supply, prices, and economic access.

Empirical studies examining the impact of greenhouse gas emissions on agricultural production also support this transmission channel. Chandio et al. (2023), in a study of six South Asian countries, found that increases in temperature and CO_2 emissions reduced agricultural production in the long term. Similarly, Fagbemi et al. (2025) demonstrated that rising CO_2 emissions in Nigeria negatively affect food production and could lead to more severe food shortages. The study's identification of a bidirectional causal relationship between carbon emissions and food production indicates that unsustainable agricultural production can also increase emissions. Furthermore, these findings suggest that emissions can weaken agricultural production capacity by disrupting climatic and environmental conditions, thereby increasing the risk of hunger through a contraction in food supply.

Recent studies that examine the relationship between emissions and food insecurity, which can lead to hunger, more directly also largely reach similar conclusions. Gobezie and Boka (2023), by analyzing 22 Sub-Saharan African countries over the 2005–2018 period using the system GMM method, demonstrated that increases in greenhouse gas emissions negatively affect food security. Marwa et al. (2025), in a panel data analysis of 14 Asia-Pacific countries, determined that CO_2 emissions have a negative and statistically significant effect on food security. More recently, Hassan et al. (2026) examined 10 ASEAN countries over the 2000–2023 period and demonstrated that carbon emissions negatively affected food security under different estimation methods and alternative food security indicators. These findings indicate that an increase in greenhouse gas emissions could limit food supply by weakening agricultural production and the resilience of food systems, increase price pressures, and make it more difficult for vulnerable groups to access food. In line with the theoretical frameworks and empirical findings in the literature, we argue that rising greenhouse gas emissions will increase hunger levels by placing pressure on food production and accessibility.

H8. *The increase in greenhouse gas emissions is leading to rising levels of hunger.*

4 | Data Set, Material, and Methods

This study investigates the factors triggering hunger in the context of SDG 2, using annual data from 2002 to 2022 for Afghanistan, Bangladesh, North Korea, India, Pakistan, Papua New Guinea, and Timor-Leste, countries in Asia that suffer from serious hunger problems and are also among the most corrupt. Figure 1 specifically presents corruption indicators according to types of corruption (proposed by Coppedge et al. 2025) for selected countries. Thus, Bangladesh has the highest level of public sector corruption index (*an index closer to 1 indicates high corruption*, *and an index closer to 0 indicates low corruption*) among the selected countries. North Korea follows Bangladesh in second place, while Timor-Leste has the lowest level of public sector corruption. However, Timor-Leste, Papua New Guinea, and Bangladesh have the highest values in terms of judicial corruption index (*an index closer to 3 indicates low corruption, and an index closer to −3 indicates high corruption*) in recent years, while Afghanistan has experienced a radical increase, and Pakistan and Bangladesh have the lowest judicial corruption values. Accordingly, Timor-Leste, Papua New Guinea, and Bangladesh have a low corruption compared to the other selected countries. However Afghanistan, Pakistan and Bangladesh have a high corruption level in terms of judicial corruption. Conversely, North Korea and Timor-Leste have the highest share in legislative corruption index (*an index closer to 3 indicates low corruption, and an index closer to −3 indicates high corruption*), while Papua New Guinea, Pakistan, and Afghanistan have the lowest legislative corruption index. Therefore, North Korea and Timor-Leste have a low legislative corruption, whereas Papua New Guinea, Pakistan, and Afghanistan have a high legislative corruption. Finally, Papua New Guinea, North Korea, and Pakistan have the highest values in terms of executive corruption index (*an index closer to 1 indicates high corruption, and an index closer to 0 indicates low corruption*), while India, Afghanistan, and Timor-Leste have the lowest index values (see Appendix 1 for a detailed definition of the variables).

Table 1 reports the descriptive statistics of the variables and presents their statistical characteristics. Accordingly, no excessive standard deviation was detected in the general characteristics of the variables except for GDP. In parallel, the box diagram in Figure 2 also supports the descriptive statistics result. Therefore, the natural logarithm of the hunger, GDP, greenhouse gas emissions variables was employed in the econometric model to smooth out the standard deviation.

Figure 3 then reflects the regression relationship between the prevalence of undernourishment and the independent variables. Accordingly, it was observed that, excluding judicial corruption, increases in public sector corruption, and executive corruption significantly increased hunger for the selected countries. It has been observed that hunger increases when the legislative corruption index value increases, that is, when legislative corruption decreases. As expected, it has been observed that the increases in GDP significantly decreased hunger, while the increase in population growth boosts hunger. Moreover, it has been found that, in

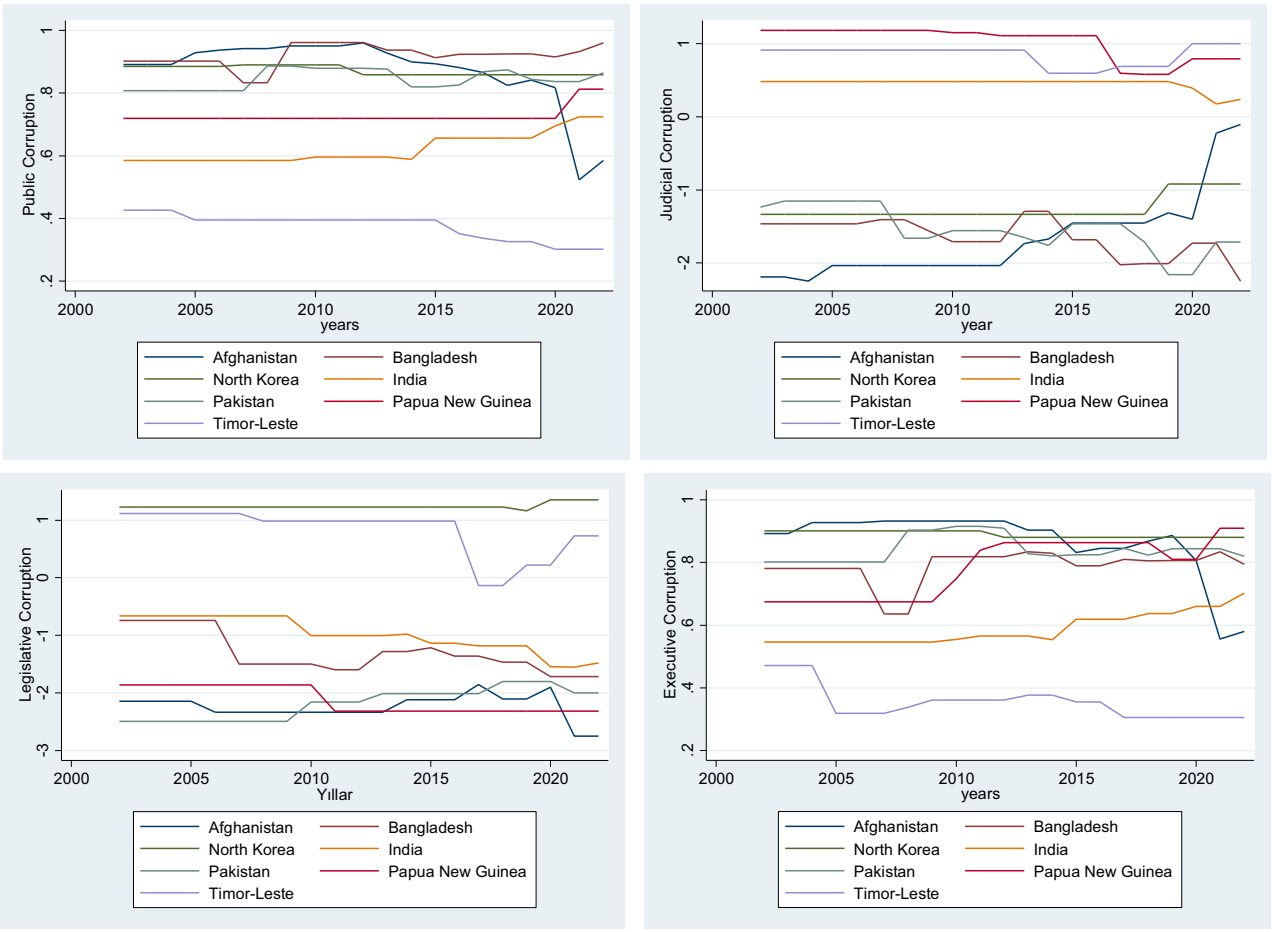

FIGURE 1 | Corruption level of countries. *Source:* Coppedge et al. (2025)/V-Dem.

TABLE 1 | Descriptive statistics of variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
Hunger	147	23.11	10.35	10.30	47.80
Public sector corruption	147	0.75	0.19	0.30	0.96
Legislative corruption	147	−0.93	1.38	−2.75	1.35
Judicial corruption	147	−0.54	1.20	−2.25	1.18
Executive corruption	147	0.73	0.19	0.31	0.93
GDP	147	1204.33	585.29	338.14	2584.89
Population growth rate	147	1.91	1.18	0.37	7.92
Human right index	147	0.548	0.27	0.01	0.88
Democracy	147	0.407	0.190	0.076	0.739
Greenhouse gas	147	5.28e+08	1.03e+09	3,966,795	3.87e+09

line with expectations, developments of human right and democracy led to decrease hunger, while, the increase in greenhouse gas emissions also trigger to raise hunger. It should not be forgotten that the relationships depicted in Figure 3 are essentially descriptive and preliminary in nature. For this reason, the study's main findings are based on robust panel estimation results presented in subsequent sections. These results suggest that robust tests and estimators that can provide unbiased and consistent results should be reviewed.

Another stage of the research focused on the results of the correlation analysis. When the statistically significant results presented in Figure 4 were evaluated, a positive relationship was observed between types of corruption and hunger, while a negative relationship was observed between GDP and hunger. In addition, it has been determined that there is a positive relationship between population growth and greenhouse gas emissions and hunger, while there is a negative relationship between human rights and democracy and hunger. Furthermore, a high degree

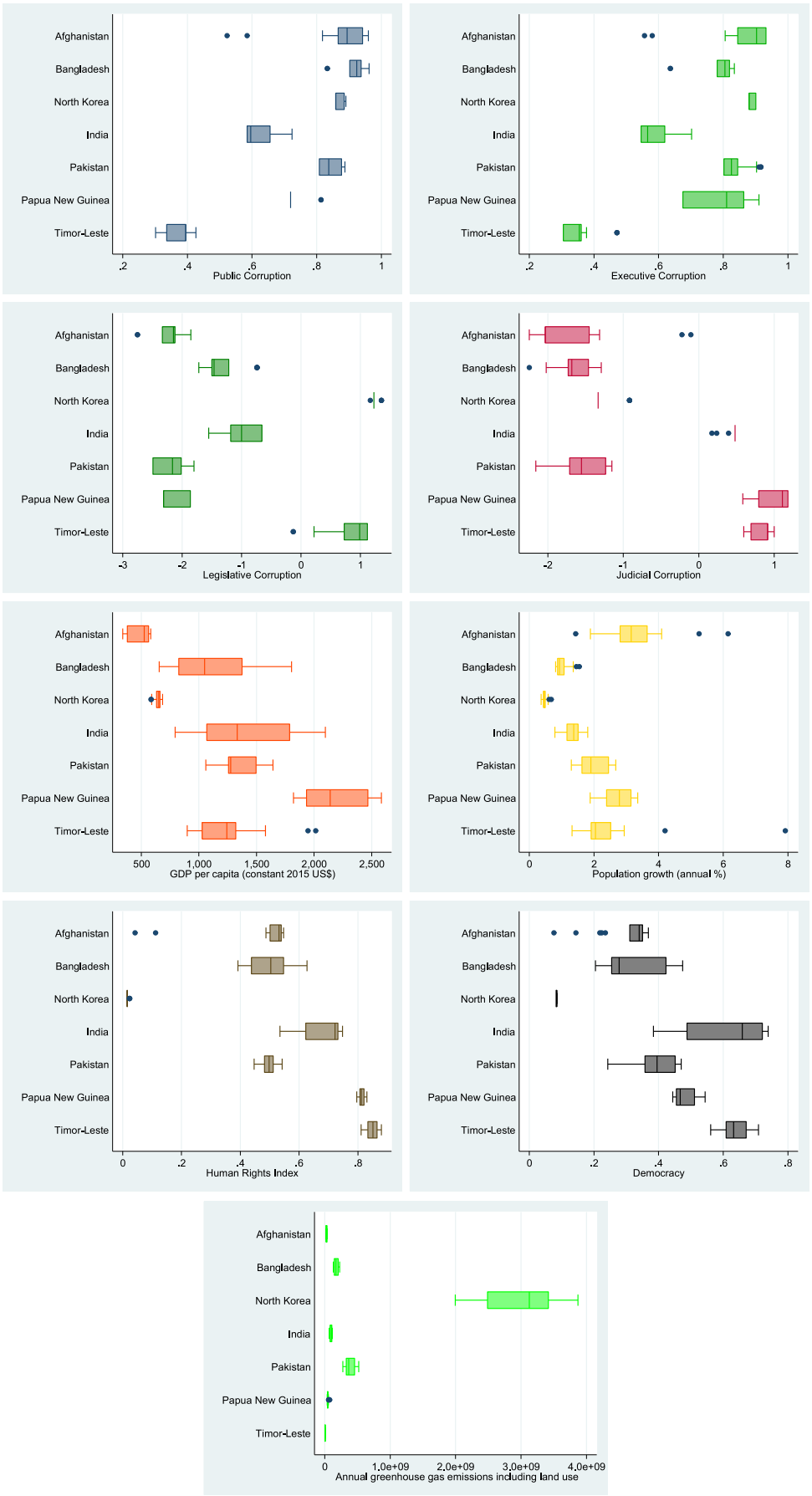

FIGURE 2 | Box plots of variables by country (median).

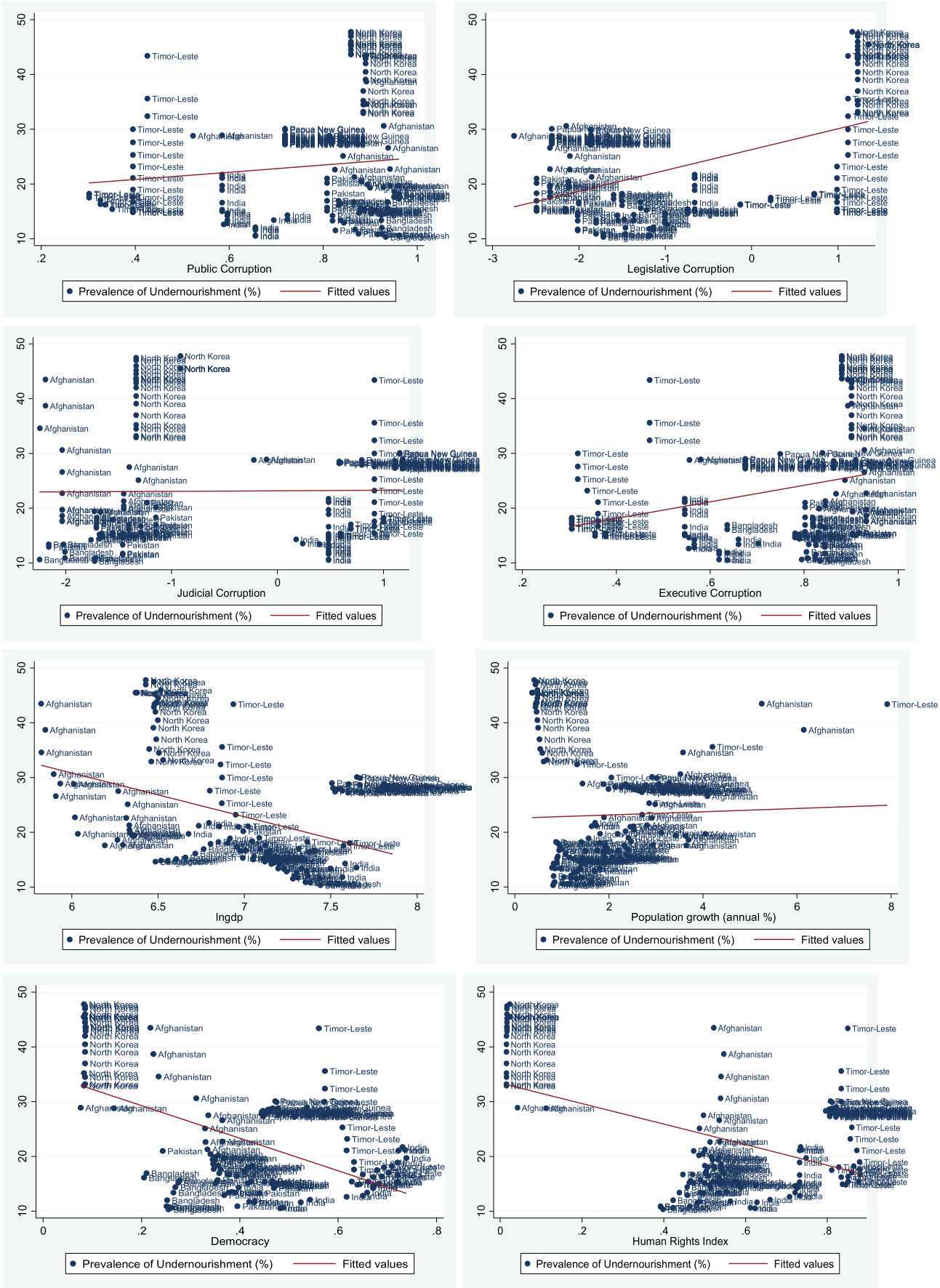

FIGURE 3 | Regression graphs of variables.

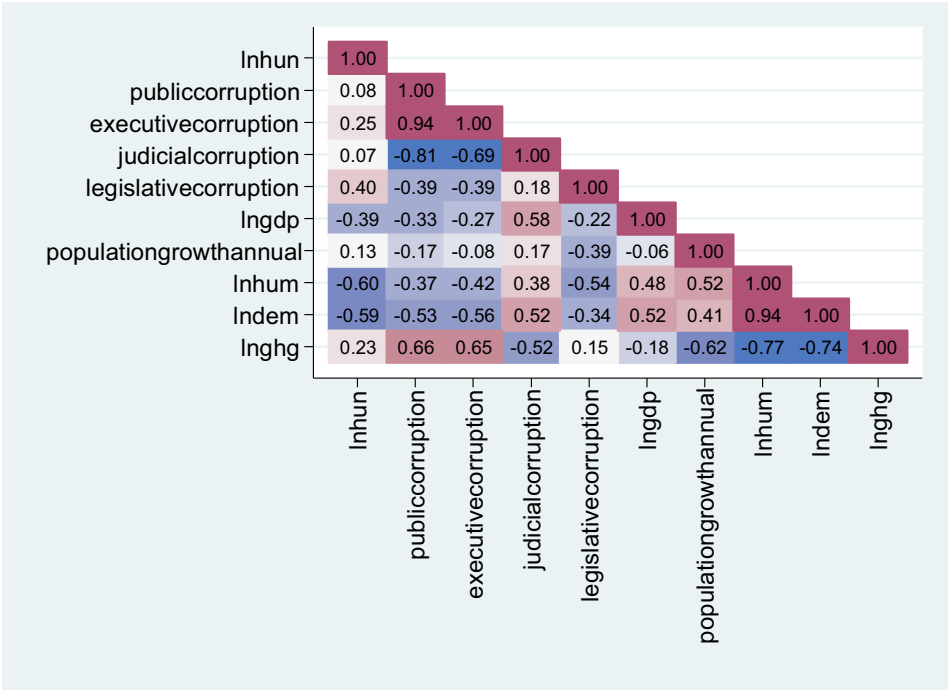

FIGURE 4 | Results of correlation analysis.

of correlation (0.94) was found between public sector corruption and executive corruption and human rights and democracy. To avoid the problem of multicollinearity between the relevant variables, these variables were utilized in different models and also applied ridge regression for robustness.

4.1 | Model Specification

This study investigates the factors affecting hunger in seven selected Asian countries using panel econometrics techniques for the period 2002–2022. Specifically, the effects of PC, EC, LC, and JC on hunger have been examined. Although the literature emphasizes that the impact of corruption on hunger is realized through different transmission channels, this study adopts a reductive empirical framework in order to evaluate the overall impact of these institutional mechanisms. The basic econometric model established to analyze these relationships is as follows:

$$\text{Hunger}_{it} = \alpha_0 + \alpha_1 \text{PC}_{it} + \alpha_2 \ln\text{GDP}_{it} + \alpha_3 \text{POP}_{it} + \alpha_4 Z_{it} + \varepsilon_{it} \quad (1)$$

$$\text{Hunger}_{it} = \beta_0 + \beta_1 \text{EC}_{it} + \beta_2 \ln\text{GDP}_{it} + \beta_3 \text{POP}_{it} + \beta_4 Z_{it} + e_{it} \quad (2)$$

$$\text{Hunger}_{it} = \varphi_0 + \varphi_1 \text{LC}_{it} + \varphi_2 \ln\text{GDP}_{it} + \varphi_3 \text{POP}_{it} + \varphi_4 Z_{it} + u_{it} \quad (3)$$

$$\text{Hunger}_{it} = \gamma_0 + \gamma_1 \text{JC}_{it} + \gamma_2 \ln\text{GDP}_{it} + \gamma_3 \text{POP}_{it} + \gamma_4 Z_{it} + \omega_{it} \quad (4)$$

Although it is theoretically predicted that corruption indicators have an effect on hunger levels, it is not possible to assume that the relationship between hunger and the quality of governance is entirely one-way. In fact, long-term hunger and food insecurity can weaken institutional capacity, the effectiveness of public services, and the quality of governance. Therefore, the empirical models developed in this study focus on identifying the long-term relationship between various aspects of corruption and hunger rather than proving a definitive causal relationship. Consequently, the coefficients should be understood within the context of long-term empirical relationships between variables rather than interpreted as definitive causal effects. Within this interpretive framework, in the models i states country dimension, while t means time dimension. In addition, $\alpha_1 \ldots \alpha_4$; $\beta_1 \ldots \beta_4$; $\varphi_1 \ldots \varphi_4$; $\gamma_1 \ldots \gamma_4$ reflect the slope coefficients, while α_0, β_0, φ_0 and γ_0 indicate the constant terms; ε_{it}, e_{it}, u_{it}, and ω_{it} states the error terms. Finally, Z displays other explanatory variables. Before moving on to the empirical findings, Figure 5 indicates the stages of the empirical analysis step by step.

5 | Empirical Findings

Table 2 presents the results of the one-way fixed effects model employing the robust estimator proposed by Driscoll and Kraay (1998). First, the impact of public sector corruption on hunger was investigated and reported in Table 2. F and Wald test statistics illustrated that the established models were statistically significant. Within this framework, an interesting finding was that an increase in public sector corruption reduced hunger. On the other hand, as expected, the robust fixed effects and random effects estimation results showed that developments in GDP contributed to a decrease in hunger for all models, while population growth triggered hunger. Another important finding was that positive developments in human rights and democracy contributed to a decrease in hunger, while conversely, an increase in greenhouse gas emissions deepened hunger.

Second, the impact of executive corruption on hunger was examined, and the findings are reported in Table 3. When interpreting the statistically significant models, it was observed that, in

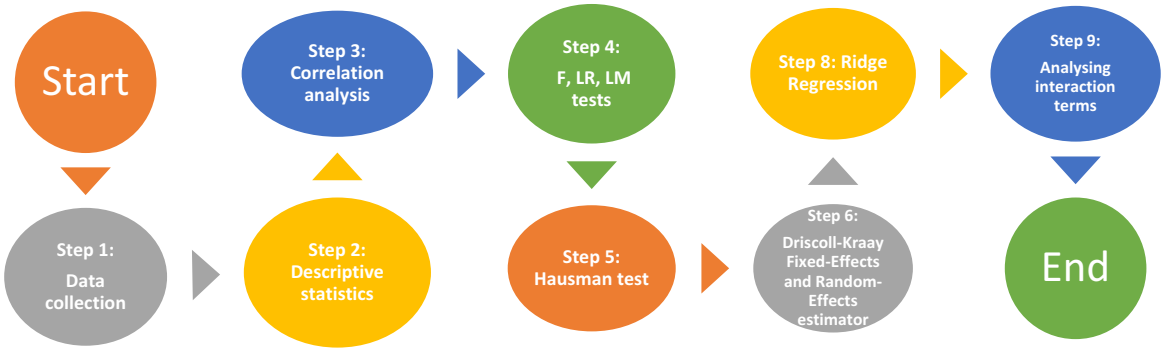

FIGURE 5 | The stages of the empirical analysis (created by authors).

TABLE 2 | Impact of public sector corruption on hunger.

Variable	(1) RE	(2) FE	(3) FE	(4) RE	(5) FE	(6) FE
Public sector corruption	−0.41**	−0.08	0.06	−0.33**	0.11	0.30
Gross domestic product	−0.50***	−0.54***	−0.60***	−0.53***	−0.59***	−0.68***
Population growth	0.09**	0.10***	0.08***	0.10**	0.09***	0.08***
Human rights	—	−0.11**	—	—	−0.12*	—
Democracy	—	—	−0.26***	—	—	−0.28**
Greenhouse gas emissions	—	—	—	0.11	0.14*	0.18*
Constant	6.69***	6.56***	6.77***	4.80***	4.06***	3.63**
F-statistic	—	29.97***	40.99***	—	33.70***	31.02***
Wald chi^2	153.75***	—	—	160.44	—	—
R^2	0.16	0.54	0.58	0.54	0.55	0.60
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	No	No	No	No	No	No
Hausman test	0.54 (0.91)	10.97 (0.02)	21.57 (0.00)	1.02 (0.90)	24.98 (0.00)	19.37 (0.00)
Bias-adjusted LM test	32.94**	33.30**	27.83	36.89**	30.06*	40.53***
Delta test (homogeneity)	8.98***	7.83***	7.12***	7.60***	6.17***	5.73***

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

TABLE 3 | Impact of executive corruption on hunger.

Variable	(1) RE	(2) FE	(3) FE	(4) RE	(5) FE	(6) FE
Executive corruption	0.16	0.51*	0.50*	0.31	0.69**	0.72**
Gross domestic product	−0.55***	−0.61***	−0.67***	−0.60***	−0.70***	−0.76***
Population growth	0.08**	0.09***	0.07***	0.08**	0.09***	0.07***
Human rights	—	−0.18***	—	—	−0.18***	—
Democracy	—	—	−0.30***	—	—	−0.03***
Greenhouse gas emissions	—	—	—	0.14*	0.21***	0.23***
Constant	6.63***	6.55***	6.86***	3.60***	3.07**	2.99***
F-statistic	—	52.41***	51.93***	—	106.18***	25.69***
Wald chi^2	463.38***	—	—	380.45***	—	—
R^2	0.17	0.56	0.60	0.21	0.58	0.64
Country effect (*F* test)	Yes	Yes	Yes	Yes	Yes	Yes
Time effect (*F* test)	No	No	No	No	No	No
Hausman test	0.78 (0.85)	14.53 (0.00)	23.00 (0.00)	2.07 (0.72)	43.58 (0.00)	23.03 (0.00)
Bias-adjusted LM test	35.85***	28.38	32.83**	41.78***	33.87**	39.95***
Delta test (homogeneity)	8.72***	7.22***	5.75***	7.27***	5.74***	4.87***

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

line with expectations, the increase in executive corruption triggered hunger. However, while developments in GDP were found to lead to a decrease in hunger, population growth was observed to contribute to an increase in hunger. Consistent with the previous estimation results, positive developments in human rights and democracy were found to trigger a decrease in hunger, while increases in greenhouse gas emissions were observed to cause an increase in hunger.

The third empirical estimation concerns the impact of legislative corruption on hunger presented by Table 4. It should be noted that no statistically significant link was found between legislative corruption and hunger. But, as with the previous findings, while developments in GDP were observed to positively influence the reduction of hunger, population growth was found to create the conditions for the emergence of hunger. The most striking result of the empirical analysis was that positive developments in human rights and democracy contributed to a decrease in hunger, while increases in greenhouse gas emissions triggered an increase in hunger.

The empirical analysis continues with Table 5, which presents the impact of judicial corruption on hunger. A significant finding is that an increase in judicial corruption index leads to an ascent in hunger. Interestingly, this finding implies that a decrease in judicial corruption increases hunger. However, in line with previous results and expectations, it was determined that developments in GDP positively contribute to a decrease in hunger, while population growth creates the conditions for the emergence of hunger. Other prominent findings of the empirical analysis indicate that positive developments in human rights and democracy contribute to a decrease in hunger, while conversely, an increase in greenhouse gas emissions leads to hunger.

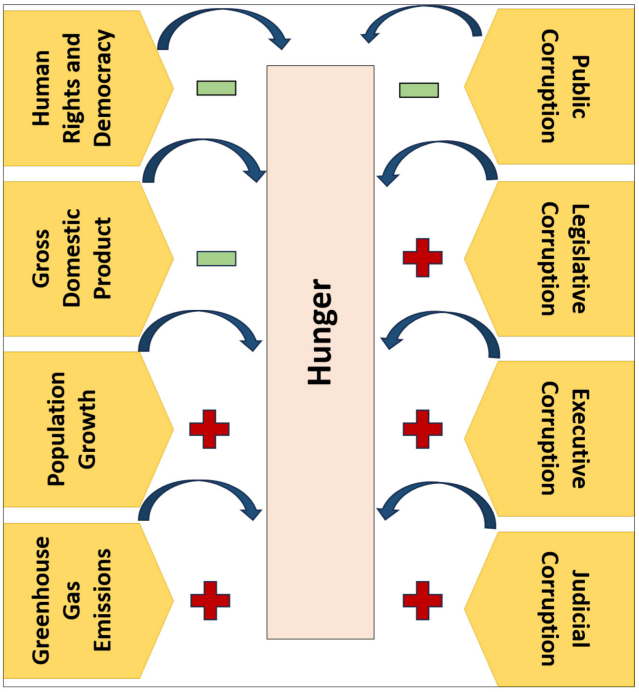

FIGURE 6 | Summary results of all estimators. The (+) symbol in the figure indicates that the coefficient is statistically significant and positive; the (−) symbol indicates that the coefficient is statistically significant and negative.

5.1 | Robustness Tests

In the continuation of the empirical analysis, the focus was on Ridge regression analysis, which is primarily applied to mitigate high correlation between independent variables as a robustness test. Hence, the Ridge regression results are reported in Table 6. The estimation results were proven to be consistent with the robust FE and RE estimation results. Accordingly, for the selected countries, increases in Legislative, Judicial, and Executive corruption play a decisive role in the rise of hunger. However, it was determined that increases in GDP and democracy positively affect the reduction of hunger, while population growth was observed to have a function that increases hunger.

Finally, Table 7 reports the effect of the interaction term on hunger. Here, quite remarkable findings were obtained, proving that increases in *Publiccorruption* × *Humanrights* and *Publiccorruption* × *Democracy* have a positive contribution to reducing hunger. A similar effect was found to be valid for increases in *Executivecorruption* × *Humanrights* and *Executivecorruption* × *Democracy*. In other words, even with executive corruption, advancements in human rights and democracy can play a vital role in reducing hunger. However, a similar result is not valid for *Legislativecorruption* × *Humanrights* and *Legislativecorruption* × *Democracy*. That is, theoretically, the consistent result reflects that legislative corruption renders the role of human rights and democracy in reducing hunger ineffective. However, the estimation results for *Judicialcorruption* × *Humanrights* and *Judicialcorruption* × *Democracy* were not interpreted as they were not statistically significant. Finally, the other results were observed to be consistent with previous estimation results (see Figure 6 for summary results of all estimators).

6 | Discussion

This study examined the relationship between hunger and various types of corruption in seven Asian countries facing serious hunger problems. Among the various types of corruption, corruption within the executive branch emerged as the most significant factor linked to rising hunger levels. This finding confirms previous studies that suggest corruption in executive branches weakens the effectiveness of governance, distorts the allocation of public resources, and undermines policies on food safety (Anser et al. 2021; Khan, Bojnec, et al. 2024; Meng et al. 2025; Njangang et al. 2024). Research findings indicate that corruption within the executive can limit the effectiveness of agricultural support systems, food aid programs, and larger social protection policies, thereby causing hunger to increase.

In contrast, the findings regarding corruption in the judiciary and the public sector paint a more complex picture. Although some model parameters indicate statistically significant relationships, not all estimators have consistently supported these findings. Similarly, in the basic models, no statistically significant relationship was found between legislative corruption and hunger. This result differs from the findings of studies such as that by Njangang

TABLE 4 | Impact of legislative corruption on hunger.

Variable	(1) RE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
Legislative corruption	−0.08	−0.06	−0.02	−0.12	0.01	−0.05
Gross domestic product	−0.58***	−0.57***	−0.62***	−0.64***	−0.59***	−0.67***
Population growth	0.09***	0.08***	0.07***	0.09***	0.10***	0.09***
Human rights	—	−0.13**	—	—	−0.10*	—
Democracy	—	—	−0.26**	—	—	−0.22**
Greenhouse gas emissions	—	—	—	0.22***	0.14**	0.18**
Constant	6.85***	6.69***	6.91***	3.17***	4.13**	3.94**
F-statistic	—	30.22***	26.09***	79.37***	91.04***	44.27***
Wald chi^2	122.06***	—	—	—	—	—
R^2	0.07	0.50	0.53	0.54	0.55	0.60
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	No	No	No	No	No	No
Hausman test	2.89 (0.40)	14.35 (0.00)	17.60 (0.00)	9.79 (0.04)	98.79 (0.00)	15.63 (0.00)
Bias-adjusted LM test	39.64***	24.27	26.86	39.89***	37.46**	43.99***
Delta test (homogeneity)	6.72***	7.34***	7.07***	6.27***	5.76***	5.70***

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

TABLE 5 | Impact of judicial corruption on hunger.

Variable	(1) RE	(2) FE	(3) FE	(4) RE	(5) FE	(6) FE
Judicial corruption	0.08*	0.03	0.01	0.08**	0.01	−0.01
Gross domestic product	−0.50***	−0.53***	−0.59***	−0.52***	−0.58***	−0.65***
Population growth	0.09***	0.10***	0.08***	0.10***	0.10***	0.09***
Human rights	—	−0.11*	—	—	−0.11*	—
Democracy	—	—	−0.25**	—	—	−0.03**
Greenhouse gas emissions	—	—	—	0.11	0.14**	0.16*
Constant	6.43***	6.48***	6.76***	4.50***	4.24***	4.09***
F-statistic	—	41.48***	43.96***	—	50.06***	38.07***
Wald chi^2	322.08***			317.18***	—	—
R^2	0.23	0.54	0.58	0.37	0.55	0.60
Country effect	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	No	No	No	No	No	No
Hausman test	0.65 (0.88)	14.91 (0.00)	75.85 (0.00)	2.93 (0.57)	10.87 (0.05)	83.96 (0.00)
Bias-adjusted LM test	43.38***	28.59	18.31	47.86***	27.44	41.79***
Delta test (homogeneity)	9.095***	6.58***	8.91***	7.99***	7.45***	5.75***

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

et al. (2024), which show that legislative corruption increases hunger. One possible reason for this is that the effects of corruption on hunger vary across institutional levels. The fact that the executive branch has a more direct influence on policy implementation processes and food assistance programs compared to the legislative bodies in question may explain this outcome. In addition, conflicting findings regarding corruption in the public sector can also be interpreted in light of the alternative "grease the wheels" assumption discussed in the literature. From this perspective, under certain conditions, corruption can accelerate decision-making processes and partially alleviate bureaucratic barriers in countries characterized by weak institutional and regulatory frameworks (Leff 1964; Lui 1985; Bardhan 1997; Huntington 2006; Persson et al. 2013; Vinayagathasan and Ramesh 2022). While our findings do not provide direct evidence supporting this argument, they do indicate that the relationship between corruption and hunger can be extremely complex and may vary depending on a country's institutional characteristics.

The findings of our study also highlight the importance of economic and institutional conditions in explaining hunger. Our findings that economic growth reduces hunger levels support the

TABLE 6 | Results of ridge regression.

Variable	Coef.	Std. Err.	*t*	*p* > *t*	[95% Conf. interval]	
Public sector corruption	−0.46	0.34	−1.36	0.18	−1.14	0.21
Legislative corruption	0.12***	0.02	5.46	0.00	0.08	0.17
Judicial corruption	0.28***	0.03	10.83	0.00	0.23	0.34
Executive corruption	1.68***	0.30	5.61	0.00	1.09	2.27
Gross domestic product	−0.29***	0.05	−5.59	0.00	−0.39	−0.19
Population growth	0.13***	0.02	6.53	0.00	0.09	0.17
Human rights	0.06	0.07	0.90	0.37	−0.08	0.20
Democracy	−0.41***	0.09	−4.36	0.00	−0.60	−0.22
Greenhouse gas emissions	0.02	0.02	0.66	0.51	−0.03	0.06
_cons	3.58***	0.37	9.59	0.00	2.84	4.31
R^2h=	0.85	R^2h Adj=	0.84	*F*-test	88.44	0.00
R^2v=	0.85	R^2h Adj=	0.84	*F*-test	85.17	0.00

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

TABLE 7 | Estimating interaction terms.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Publiccorruption × *Humanrights*	−0.16*	—	—	—	—	—	—	—
Publiccorruption × *Democracy*	—	−0.40**	—	—	—	—	—	—
Executivecorruption × *Humanrights*	—	—	−0.18**	—	—	—	—	—
Executivecorruption × *Democracy*	—	—	—	−0.50***	—	—	—	—
Legislativecorruption × *Humanrights*	—	—	—	—	0.05***	—	—	—
Legislativecorruption × *Democracy*	—	—	—	—	—	0.08***	—	—
Judicialcorruption × *Humanrights*	—	—	—	—	—	—	−0.03	—
Judicialcorruption × *Democracy*	—	—	—	—	—	—	—	0.01
Gross domestic product	−0.61***	−0.71***	−0.61***	−0.74***	−0.57***	−0.62***	−0.56***	−0.59***
Population growth	0.10***	0.08***	0.10***	0.08***	0.10***	0.10***	0.09**	0.09**
Greenhouse gas emissions	0.16***	0.20**	0.16***	0.21***	0.13***	0.16***	0.14**	0.16**
_cons	4.05***	3.88***	4.03***	3.75***	4.50***	4.12***	4.18***	4.09***
F test	26.93***	27.77***	34.51***	33.18***	76.56***	90.88***	76.20***	46.84***
R^2	0.54	0.6	0.55	0.63	0.56	0.59	0.53	0.53

Note: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$.

findings of studies in the literature that emphasize the role of income growth and purchasing power in ensuring food security and adequate nutrition (Smith and Haddad 2015; Reuveni 2024; Nzeh et al. 2024; Njangang et al. 2024). Furthermore, our findings show that improvements in human rights and democracy are consistently associated with reductions in hunger levels. These findings are consistent with studies by Drèze (2004), Rossignoli and Balestri (2018), and Gamso (2024), which explain that democratic accountability and the protection of fundamental rights strengthen the capacity to address difficulties related to hunger.

Our findings that population growth increases hunger are consistent with the results of studies in the literature that suggest demographic expansion may increase pressure on food systems and agricultural resources (Molotoks et al. 2021; Owoo 2021; Akinbode et al. 2022). Furthermore, findings indicating that greenhouse gas emissions are associated with higher levels of hunger support the literature highlighting the negative impacts of rising greenhouse gas emissions on agricultural productivity, food supply, climate change, soil degradation, and food security (Gobezie and Boka 2023; Marwa et al. 2025; Hassan et al. 2026). Thus, our findings provide significant evidence that hunger is shaped by demographic and environmental factors.

The findings based on the interaction terms in this study indicate that stronger human rights protections and the availability of democratic institutions can mitigate some of the negative effects that result from corruption in the executive authority. However, the positive coefficients derived from the interaction terms between corruption in the legislative branch and human rights and democracy show that corruption in the legislative branch may undermine the effectiveness of these institutional

arrangements. Overall, the findings reveal that progress toward SDG 2 depends not only on economic growth but also on better governance, democratic accountability, the protection of human rights, and sustainable environmental management.

7 | Conclusion, Policy Directions, and Limitations and Future Research

7.1 | Conclusion

Achieving Sustainable Development Goal 2 remains one of the greatest challenges facing global development today. In this context, this study examines the factors influencing hunger in seven Asian countries that faced serious hunger problems during the 2002–2022 period. The study placed particular emphasis on various types of corruption, as well as economic, demographic, institutional, and environmental factors.

The study's empirical findings indicate that executive corruption is the most consistent corruption-related factor associated with higher hunger levels. The results also show that economic growth, human rights, and democracy are associated with lower levels of hunger, whereas population growth and greenhouse gas emissions increase hunger. Although the findings regarding corruption in the public sector and the judiciary are not consistently supported across all model specifications, our results generally indicate that the quality of governance is an important factor in explaining the problem of hunger.

Interaction analyses present additional evidence that strong democratic institutions and effective protection of human rights contribute to minimizing the negative effects associated with specific forms of corruption. Consequently, these findings highlight that hunger should not be viewed simply as a consequence of economic and demographic conditions. The quality of institutions, the efficiency of governance, democratic transparency, and the protection of human rights also play an important role in long-term strategies to reduce hunger and achieve SDG 2. Overall, the findings indicate that the quality of governance, economic growth, demographic factors, democracy, and human rights are all significant determinants of hunger in the selected Asian countries. In this context, our study offers important and practical implications for future policy design.

7.2 | Policy Directions

The findings of this study offer various policy suggestions for countries that aim to decrease hunger and achieve SDG 2. In particular, it is understood that corruption within the executive branches undermines the implementation of food security policies and hinders the effective use of public resources allocated to social protection and agricultural support policies. In this context, strengthening transparency, accountability, and institutional oversight mechanisms can contribute to the more effective use of public resources and the implementation of food security policies. In particular, increasing accountability for public resources through open budget procedures and more regular oversight of food assistance and agricultural support programs can help reduce the misuse of resources. Similarly, reporting systems supported by legal protections and practices that promote access to public information can also serve to strengthen institutional accountability.

Second, policymakers and implementers should support sustainable economic growth. Since economic growth is consistently linked to a reduction in hunger levels, strategies that support employment opportunities, increase income, and contribute to inclusive economic development can improve access to food and enhance nutrition outcomes. The third finding highlights the importance of human rights protection and the strengthening of democracy. Policies aimed at reducing hunger and food insecurity can be made more effective by increasing political participation, improving institutional accountability, protecting individual freedoms, and building public oversight institutions. The findings on the term interaction also suggest that strong democratic institutions and protections of human rights can contribute to mitigating several negative effects associated with corruption.

The fourth point is that the pressures caused by population growth must be addressed as part of broader food security and development strategies. Our research findings, which show that population growth is creating pressure on food security, highlight the importance of establishing a balance between population dynamics and food supply capacity. For this reason, supporting production methods that increase agricultural productivity, improving rural infrastructure, strengthening the food supply chain, and developing sustainable production capacity can help alleviate the pressure that rapid population growth exerts on food systems in the medium and long term and reduce the risk of hunger. Last, given the findings that greenhouse gas emissions increase hunger, it is clear that environmental developments must be incorporated into food security policies. In this context, developing environmentally friendly measures, promoting sustainable agricultural production methods, and reducing environmental vulnerabilities can improve food security outcomes in the medium and long term.

However, it should not be overlooked that the feasibility of policy recommendations for combating hunger may vary depending on each country's institutional and governance structure. Particularly in countries where governance capacity is weak or institutional challenges are more deeply rooted, the ability to implement comprehensive reforms in the short term may be more limited. Therefore, policies to combat hunger that are shaped with due consideration for a country's institutional capacity, governance structure, and socioeconomic conditions can yield more realistic and sustainable results. Furthermore, given the limited direct applicability of institutional reforms in some countries, technical support and humanitarian aid mechanisms provided through international organizations and regional cooperation can also play a supplementary role.

7.3 | Limitations and Future Research

One of the most significant contributions of our study is its focus on Asian countries where corruption is widespread and hunger has reached severe levels, as well as its in-depth examination

of the effects of various types of corruption, along with demographic, economic, environmental, human rights, and democracy indicators, on hunger levels in these countries. In this context, while our study presents important findings, it also has certain limitations. First, our study is limited to a specific period (2002–2022) and covers only seven Asian countries where hunger has reached serious levels and corruption is widespread. Therefore, to enhance the generalizability of the results or to further discuss them, future studies could utilize broader datasets that include other regions such as Africa, the Caribbean, Latin America, and other Asian countries.

The corruption indicators used in this study are derived from perception and expert evaluations. While these indicators are commonly used in the literature, their measurement may be affected by error and they may not reflect all dimensions of corruption fully. Furthermore, data quality issues may be particularly significant for countries such as Afghanistan and North Korea, where institutional weakness, political instability, and limitations on data accessibility could impact the reliability of certain estimates.

This study, which examines the relationships between various dimensions of hunger and corruption, does not entirely disregard the potential for interaction among the variables or the possibility of reverse causality. Therefore, future studies could be designed to account for the possibility of reverse causality. Additionally, this study examined the direct effects of corruption types and selected socioeconomic indicators on hunger. In the future, researchers could also examine this relationship through intermediary mechanisms such as income inequality, public social spending, public education spending, agricultural subsidies, and agricultural investments.

Author Contributions

Ali Çelik: conceptualization, investigation, validation, writing – original draft, writing – review and editing, methodology, formal analysis, supervision. **Ahmet Köstekçi:** conceptualization, data curation, resources, writing – review and editing, writing – original draft, validation. **Ertuğrul Buğra Orhan:** validation, visualization, project administration. **Abdunnur Yıldız:** validation, investigation, conceptualization, resources.

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Appendix 1: Data, Description, and Source

Data	Description	Source
Prevalence of undernourishment (%) (PoU-Hunger)	The prevalence of undernutrition (PoU) is an estimated value of the proportion of the population whose habitual food consumption is insufficient to provide the energy levels necessary for a normal, active, and healthy life. It is expressed as a percentage. This indicator measures progress toward SDG Target 2.1. The rate ranges from 0 to 100. Values below 10 indicate low levels of hunger, 10–19.9 indicate moderate levels of hunger, 20–34.9 indicate serious levels of hunger, 35–49.9 indicate alarming levels of hunger, and scores above 50 indicate extremely alarming levels of hunger. The Global Hunger Index (GHI), developed by the International Food Policy Research Institute, is an indicator that has the advantage of reflecting the multidimensional nature of hunger and serves as a valuable tool for monitoring hunger at the global level. However, there are annual limitations to the Global Hunger Index data. Various sub-indicators are used to address these limitations. Therefore, in this study, we used the "Prevalence of Undernutrition" variable to measure hunger. The reason for this is that the Prevalence of Undernutrition (PoU) indicator is a key indicator widely accepted as a standard for measuring hunger and is commonly used in the literature (this indicator is widely used in the literature on un dernourishment and food security (Soriano and Garrido 2016; Mary et al. 2018; Njangang et al. 2024)).	FAO (2025)
Public sector corruption (PSC)	The point estimates of this index have been reversed so that they are the inverse of the directional input variables. That is, low scores indicate a better situation, while high scores indicate a worse situation. This scale takes values between 0 and 1. The index is estimated by taking the average of two indicators: bribery and theft in the public sector. The various corruption indicators used as independent variables in the study were obtained from the V-Dem dataset. These indicators, which measure institutional quality in a multidimensional approach based on expert assessments, are reliable indicators widely used in the literature.	Coppedge et al. (2025)/V-Dem (ourworldindata.org)
Legislative corruption (LC)	This indicator shows the extent to which members of the legislature abuse their positions to obtain financial gain, including accepting bribes or facilitating government contracts for businesses owned by members of the legislature or persons close to them. The Bayesian Item Response Theory (IRT) measurement paradigm was used to create this variable, which is a continuous (interval) indicator. Instead of using a 0–1 scale, values are displayed on a latent scale that roughly ranges from −3 to +3. Here, a low value indicates more legislative corruption, while a high value indicates less legislative corruption. This indicator is not an index, such as one for public sector corruption or executive corruption, but a score. As previously stated, the values for this indicator are not presented on a scale ranging from 0 to 1, but rather on a latent scale ranging from approximately −3 to +3 (Pemstein et al. 2025).	Coppedge et al. (2025)/V-Dem (ourworldindata.org)
Judicial corruption (JC)	This indicator reflects expert estimates of how often individuals or businesses make undocumented additional payments or bribes to obtain a favorable court ruling or to expedite or delay the judicial process. Higher scores indicate less corruption. The Bayesian Item Response Theory (IRT) measurement paradigm was used to create this variable, which is a continuous (interval) indicator. Instead of using a 0–1 scale, values are displayed on a latent scale that roughly ranges from −3 to +3. Here, a low value indicates more judicial corruption, while a high value indicates less judicial corruption. This indicator is not an index, such as one for public sector corruption or executive corruption, but a score. As previously stated, the values for this indicator are not presented on a scale ranging from 0 to 1, but rather on a latent scale ranging from approximately −3 to +3 (Pemstein et al. 2025).	Coppedge et al. (2025)/V-Dem (ourworldindata.org)

Data	Description	Source
Executive corruption (EC)	This indicator consists of expert estimates of the extent to which members of the executive branch, such as the head of government or ministers, are involved in bribery and theft activities. The index is calculated by taking the average of two indicators: executive branch bribery and executive branch embezzlement. This indicator takes values between 0 and 1. 0 represents the lowest level of executive corruption, while 1 represents the highest level of executive corruption.	Coppedge et al. (2025)/V-Dem (ourworldindata.org)
GDP per capita (constant 2015 US$) (GDPPC)	GDP per capita is calculated by dividing the gross domestic product by the mid-year population. GDP is the total gross value added by all resident producers in the economy, after adding product taxes and subtracting subsidies that are not included in the value of the products. This calculation is performed without any deductions for depreciation of manufacturing assets or depletion and degradation of natural resources. Data are in constant 2015 US dollars.	The World Bank (2025) and The United Nations (2025)
Population growth (annual %) (PG)	The annual population growth rate for year t is the exponential growth rate, expressed as a percentage, of the mid-year population from year $t-1$ to t. Population is based on the actual population definition, which counts all residents regardless of legal status or citizenship.	The World Bank (2025)
Human Rights Index	People are free from government torture, political killings, and forced labor, have property rights, and enjoy the freedoms of movement, religion, expression, and association. The index ranges from 0 to 1 (most rights).	Data by V-Dem. https://ourworldindata.org/grapher/human-rights-index-vdem
Electoral Democracy Index	Political leaders are elected under comprehensive voting rights in free and fair elections, and freedoms of association and expression are guaranteed. The index ranges from 0 to 1 (most democratic).	Data by V-Dem. https://ourworldindata.org/grapher/electoral-democracy-index
Greenhouse gas emissions	Greenhouse gas emissions include carbon dioxide, methane and nitrous oxide from all sources, including land-use change. They are measured in tonnes of carbon dioxide-equivalents over a 100-year timescale.	https://ourworldindata.org/greenhouse-gas-emissions