Corruption and Food Security Status:
An Exploratory Study on Perceived Corruption and Access to Adequate Food on a Global Scale

Gabrielle Du Perron Helal

School of Dietetics and Human Nutrition; McGill University, Montreal

Submitted April 2016

A thesis proposal submitted to McGill University in partial fulfillment of the requirements of the degree of Master of Science

ABSTRACT

Food insecurity is a global problem that has yet to be properly addressed. Its determinants are part of a greater scheme of food security governance and overall governance. Presence of corruption occurs when there are failures in governance. There are currently no studies exploring corruption and food security, on a global scale, with internationally validated tools. This study aimed to fill this gap in the literature. The main objective was to explore the relation between corruption and food insecurity status on a global scale.

Data from Gallup World Poll, Transparency International and the World Bank were analyzed. The sample included 118 countries and 115,379 individuals**.** Food security status, the dependant variable, was assessed using the Food and Agriculture Organization's Food Insecurity Experience Scale. Corruption, the independent variable, was measured using Transparency International's Corruption Perception Index score (CS). Data was analyzed on an individual and country level. Several statistical analyses including cross-tabulations, model II regression, cumulative logit modelling (CLM) and non-metric multidimensional scaling (NMDS) were conducted to evaluate the relationship between socio-demographic characteristics, country characteristics and corruption on food insecurity.

On a global scale, bivariate analyses demonstrated a strong significant association between corruption and food insecurity. Increasing corruption, demonstrated by a decreasing CS, increases food insecurity, $r_s(118)=-0.715$, $p=0.000$. CLM analyses demonstrated that decreasing corruption, represented by a unit increase in the CS, was associated with a reduction in food insecurity ($\beta= -0.24$, $p=0.001$). Furthermore, being female, being older, having less education and income, and being unemployed were statistically significantly associated with an increase in food insecurity. An increase in gross-domestic product per capita was associated with a reduction in food insecurity ($\beta= -0.25$, $p=0.001$) whereas an increase of the Gini index, signifying an increase in inequality, was associated with an increase in food insecurity ($\beta= 0.30$, $p=0.001$).

Also, there were 7 groups of countries established by NMDS, which were analyzed with CLM. Groups 2 ($\beta= -0.44$), 5 ($\beta= -0.23$), and 7 ($\beta= -0.36$), found that a reduction in corruption, represented by a unit increase in CS, was associated with a reduction of food insecurity ($p=0.001$). These findings suggest that amongst diverse population socio-demographic and country characteristics, corruption has a negative impact on food security.

The results of this novel study will help inform policy makers and stakeholders in regards to the impact of corruption on food security, which will help address this issue within interventions. Furthermore, they will contribute knowledge to the emerging field of food security governance. Overall they will help work towards the development of new approaches to tackle world hunger.

RÉSUMÉ

L'insécurité alimentaire est un problème mondial de haute complexité. Ses déterminants font partie d'un système de gouvernance générale, ainsi que d'un système de gouvernance spécifique à la sécurité alimentaire. Lorsque les systèmes de gouvernance ne fonctionnent pas efficacement, ceci laisse place à la corruption. Présentement, il n'existe aucune étude qui explore la corruption et l'insécurité alimentaire, utilisant des outils validés à l'échelle internationale. Cette étude a visé à combler cette lacune dans la littérature. L'objectif principal était d'explorer la relation entre la corruption et l'insécurité alimentaire à l'échelle mondiale.

Les données du *Gallup World Poll*, *Transparency International* et la Banque Mondiale ont été analysées. L'échantillon comprenait 118 pays et 115 379 individus. L'insécurité alimentaire, la variable dépendante, a été évaluée à l'aide du *Food Insecurity Experience Scale* crée par l'Organisation des Nations Unies pour l'alimentation et l'agriculture. La corruption, la variable indépendante, a été mesurée à l'aide du *Corruption Perception Index Score* de *Transparency International* (CS). Les données ont été analysées au niveau individuel et national. Plusieurs analyses statistiques, y compris des analyses croisées, des régressions linéaires (modèle II), de la modélisation logit cumulative (CLM) et des analyses multidimensionnelle non métrique (NMDS) ont été utilisées pour évaluer la relation entre l'insécurité alimentaire et la corruption, les profils sociodémographiques des populations ainsi que les caractéristiques des pays.

À l'échelle mondiale, les analyses bivariées ont démontré une association significative entre la corruption et l'insécurité alimentaire. L'augmentation de la corruption, démontré par une diminution du CS, a augmenté l'insécurité alimentaire, r_s (118)=-0.715, p=0.000. Les analyses de CLM ont démontré qu'une diminution de la corruption, représentée par une augmentation d'une unité du CS, était associée à une réduction de l'insécurité alimentaire (β=-0.24, p=0.001). De plus, être une femme, être plus âgé, avoir moins d'éducation et moins de revenu, ainsi qu'être au chômage étaient tous des caractéristiques ayant une association significative à l'insécurité alimentaire. De plus, une augmentation du produit intérieur brut par habitant, ajusté pour la parité du pouvoir d'achat, était associée à une réduction de l'insécurité alimentaire (β=-0.25, p= 0.001) alors qu'une augmentation du coefficient de Gini, représentant une augmentation de l'inégalité, était associée à une augmentation de l'insécurité alimentaire (β=0.30, p=0.001).

Il y avait 7 groupes de pays établis à partir des statistiques NMDS. Ces groupes ont été analysés à partir de statistiques CLM. Groupes 2 (β=-0.44), 5 (β=-0.23) et 7 (β=-0.36) ont démontré qu'une réduction de la corruption, représentée par une augmentation d'une unité du CS, était associée à une réduction de l'insécurité alimentaire (p=0.001). Ces résultats démontrent que, même lorsqu'elle est contrôlée pour les caractéristiques sociodémographiques et caractéristiques des pays, la corruption a un impact défavorable sur l'insécurité alimentaire.

Les résultats de cette étude aideront à informer les décideurs politiques et les parties prenantes par rapport à l'impact de la corruption sur la sécurité alimentaire, ce qui permettra d'adresser ce problème dans un cadre d'interventions. De plus, cette recherche contribuera des connaissances au nouveau domaine de la gouvernance de la sécurité alimentaire. En somme, ces résultats aideront à développer de nouvelles approches pour lutter contre la faim dans le monde.

ACKNOWLEDGMENTS

The creation of this thesis has been an intensive learning process that would not have been possible without the assistance of numerous colleagues, having each provided help and support throughout this research.

I would first like to thank my supervisor, Dr. Hugo Melgar-Quiñonez. His knowledge and passion for his chosen field have provided me with inspiration and confidence throughout this project. His support throughout all stages of this research has played an essential role in the success of this thesis.

I would also like to extend my gratitude to my committee member, Dr. Nicolas Kosoy. His original ideas and expertise have helped me create a unique thesis, using statistical analyses that provide a different insight on the topic at hand. Without his innovative ideas, support and confidence in my abilities, the completion of this thesis would not have been possible.

Furthermore, I would like to thank Timothy Schwinghamer, Julien Malard, Diana Dallmann and Davod Ahmadigheidari, which have gone above and beyond by providing everyday assistance with statistics and conceptualization for this research project. This project would not have been possible without their extensive knowledge and experience within their respective fields. Their patience, positivity and encouragement have provided me the necessary support to complete this project.

Finally, thanks are due to the McGill Global Institute for Global Food Security's research group. Their support and feedback during the various stages of this thesis has been very valuable. The sharing and collaborative environment provided by this group has enhanced the quality of this research.

CONTRIBUTION OF AUTHORS

The authors listed in the manuscript of this thesis all contributed to various stages of this research project. As a first author, I created the research question, reviewed the literature, analyzed the data, interpreted the statistical findings and provided insight on the practical implications of the findings of this research. Dr. Hugo Melgar-Quiñonez supervised the entire process of this research project, contributing his knowledge during the conceptualization and literature review. He also provided assistance with the interpretation and presentation of statistical findings, as well as a review of the overall project. Dr. Nicolas Kosoy also helped guide the process of this research project. He provided assistance during the conceptualization of the statistical analyses. Furthermore, he contributed towards the interpretation of statistical findings, and provided overall support and guidance throughout this study. Diana Dallmann, Julien Malard and Timothy Schwinghamer offered assistance throughout the phases of statistical analyses for this project. Diana Dallmann contributed her knowledge and expertise on complex survey analysis, the FIES and the Gallup World Poll surveys. She also helped with the interpretation and the presentation of statistical findings. Timothy Schwinghamer was of assistance during regression and multidimensional scaling analyses as well as the interpretation of findings of these statistical tests. Julien Malard contributed his knowledge on cumulative logit modelling analyses and the interpretation of findings of these analyses. Finally, Davod Ahmadigheidari provided assistance with the theoretical framework of this study, helped prepare the data for analysis and gave support for preliminary and descriptive statistics.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

CLM	–	Cumulative Logit Modelling
CPI	–	Corruption Perception Index
CS	–	Corruption Perception Index Score
EBFSS	–	Experienced Based Food Security Scale
ELCSA	–	Latin American and Caribbean Food Security Scale
FAO	–	Food and Agriculture Organization
FIES	–	Food Insecurity Experience Scale
FIES-SM	–	Food Insecurity Experience Scale Survey Module
GDP	–	Gross Domestic Product
GDP PC PPP	–	Gross Domestic Product Per Capita Obtained by Purchasing Power Parity
GWP	–	Gallup World Poll
IRT	–	Item Response Theory
NMDS	–	Non Metric Multidimensional Scaling
OECD	–	Organization for Economic Co-operation and Development
TI	–	Transparency International
US HFSSM	–	United States Household Food Security Survey Module
VOH	–	Voices of the Hungry
WB	–	World Bank

CHAPTER 1: GENERAL OVERVIEW

1.1 INTRODUCTION

In 2014, there were 805 million hungry people worldwide (Food and Agriculture Organization, International Fund for Agricultural, & World Food Programme, 2014). These people are undernourished, which is defined by the Food and Agriculture Organization (FAO) as living in a chronic state of inability to acquire sufficient food to meet dietary energy requirements (Food and Agriculture Organization, 2015). More specifically, the regions facing the highest rates of undernourishment are Sub-Saharan Africa and Asia. Although the past decades have shown positive trends in reducing the prevalence of hunger, these numbers remain unacceptably high (Food and Agriculture Organization et al., 2014). These high levels of hunger breach the *Right to Food*, which was deemed a human right in 1948 (Food and Agriculture Organization, n.d.). Furthermore, increasing industrialization has left regions like Oceania with a double-burden of malnutrition, referring to the high rates of overweight, obesity and undernourishment within their population (Food and Agriculture Organization et al., 2014).

Numerous efforts have aimed to better understand the multidimensionality and complexity of hunger, leading to its conceptualization as food security (Radimer, Olson, & Campbell, 1990; Radimer, Olson, Greene, Campbell, & Habicht, 1992). Food insecurity exists when one of four pillars, which are availability, accessibility, utilization and stability of food, is not respected (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008). Presence of food insecurity impedes on the overall health of a population (Maletta, 2014; Weaver & Hadley, 2009), and has negative effect on human development (Conceição, Fuentes-Nieva, Horn-Phathanothai, & Ngororano, 2011; Pritchard, Rammohan, & Sekher, 2013).

Determinants of food security are part of a greater scheme of food security governance and overall governance (Candel, 2014). The presence of corruption, which is

a failure in governance, has detrimental effects on countries' growth (Mauro, 1995), income distribution (Gupta, Davoodi, & Alonso-Terme, 2002; Li, Xu, & Zou, 2000), gross-domestic product (GDP) investments (Delavallade, 2006), distribution of aid from social programs (Mehta & Jha, 2012) and land ownership (Hardoon & Heinrich, 2013; Oldenburg & Neef, 2014). Overall, corruption has a negative impact on a country's development. Interestingly enough, the same outcomes of corruption are also determinants of food security (Ben-Davies, Kinlaw, Estrada Del Campo, Bentley, & Siega-Riz, 2013; Liefert, 2004; Mehta & Jha, 2012; Rammohan & Pritchard, 2014). Despite these striking similarities, limited studies have aimed to explore the relation between food security and corruption.

1.2 STUDY RATIONALE

Although there are numerous efforts aiming to eliminate global hunger, initiatives have failed to halve the amount of hungry people in the world by 2015 emphasizing the complexity of this issue (Food and Agriculture Organization, International Fund for Agricultural, & World Food Programme, 2015). Thus, to continue positive trends in hunger eradication, it is important to broaden current food security knowledge. A potential determinant of food insecurity, that has yet to be thoroughly researched, is corruption. Despite often being suggested as a cause of food insecurity, little evidence supports this matter. Therefore, an important step towards broadening the scale of intervention is to explore the association between food security and corruption. Generating knowledge on this matter is essential to achieve the Sustainable Development Goal of ending world hunger and achieving food security (United Nations, 2015b).

1.3 OVERALL STUDY AIM

The overall aim of this study is to *explore* the relation between corruption and food security, on a global scale, in order to gain a better understanding of their interaction.

1.4 STUDY OBJECTIVES

The first objective of this study is to assess if food insecurity and corruption are associated, on a global scale. The second objective of this study is to assess how corruption interacts with food security within subgroups of countries.

CHAPTER 2: LITERATURE REVIEW

2.1 FOOD SECURITY

In the past decade, there have been positive trends in hunger reduction. However, there are still approximately one in nine people worldwide that do not have enough food (Food and Agriculture Organization et al., 2014). Although food insecurity has proven to be a challenge in both the industrialized (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015; Rosier, 2011) and developing countries, the majority of individuals living in hunger are from the developing world (Food and Agriculture Organization et al., 2014). There have been positive global trends achieving food security within developing countries, but progress has not been consistent within and among regions. Sub-Saharan Africa, and South and Western Asia are examples of a region that did not meet hunger reduction objectives established in the Millennium Development Goals. They failed to meet the target of halving the proportion of undernourished people by 2015 (Food and Agriculture Organization et al., 2015; United Nations, 2015a). Thus, despite progress in reducing world hunger, a goal of achieving food security for all remains a global priority and a key component of the United Nations Sustainable Development Goals for 2030 (United Nations, 2015b). In order to achieve this target, it is first important to properly define food security.

2.2 DEFINING FOOD SECURITY

In 1996, at the World Food Summit meeting, food security was defined as a state where "-all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization, 1996). It consists of four dimensions which are 1) availability, 2) access, 3) utilization and 4) stability of food (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008).

Availability refers to the physical availability of diverse, sufficient and quality foods. This refers to the food that is produced, provided through trades or stocked within a region (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008).

Accessibility refers to the physical and economic access to food. Despite food being available on a national or international level, it is not always accessible to individuals because of physical or financial constraints. Poor road infrastructures, limited availability of railways, and more will compromise physical access to food. Furthermore, food prices and income may impact financial access to food (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008).

Utilization addresses the nutrient content and safety of food items, in reference to diet diversity and the interactions of our diets with disease, water and sanitation. Feeding practices, food preparation, and household food distribution will alter the nutrient content and safety of foods that people consume (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008).

Finally, *stability* refers to changes in food security status through time. This is affected by weather conditions, political stability, and economic factors. If an individual is at risk of having compromised access, availability, and utilization on a periodical basis, this affects the stability of their food security (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008).

Food insecurity occurs when one of these pillars is not respected. More specifically, it exists when the "availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain" (Anderson, 1990). This term has often been used synonymously to hunger, despite having some differences in meaning. The definition of hunger has shifted from being a subjective feeling of desiring to eat (Maletta, 2014). It can also be defined as a lack of food to meet energy requirements, leading to a shortage of nutrients required for growth

and maintenance of health, also known as malnutrition. However, malnutrition also exists when there is sufficient food to meet energy requirements, taking form as both under- and overnutrition (Maletta, 2014; World Food Programme, 2016). Despite meeting and surpassing energy requirements, overnutrition can exist with micronutrient deficiencies, often referred to as hidden hunger (von Grember et al., 2014; World Food Programme, 2016). Radimer et al. (1990) have also found hunger to go beyond the scope malnutrition, incorporating experiences and behaviours specific to the severity of food insecurity. Thus, food security has helped conceptualize hunger, incorporating the emotional, behavioural and nutritional components of the phenomenon (Radimer et al., 1990).

The severity of food insecurity relates to a distinct sequence of experiences of hunger. Radimer et al. (1992) developed a construct, describing the severity of food insecurity based on these experiences. This construct is described as having three domains: 1) anxiety about food, 2) inadequate quality of food and 3) inadequate quantity of food. These are exhibited in a sequential order, from 1 to 3, as food insecurity becomes more severe (Radimer et al., 1992). Based on this construct, it is possible to classify food insecurity in four categories: 1) food secure, 2) mildly food insecure, 3) moderately food insecure, 4) severely food insecure (Ballard et al., 2013; Hamilton et al., 1995). This construct was found to be true across various cultures (Coates et al., 2006).

Food insecurity can also be classified as transitory, chronic and cyclical, based on the duration of the phenomenon. *Transitory* or temporary food insecurity refers to the short-term inability to meet food requirements, related to sporadic crises. On the other hand, *chronic* food insecurity refers to the long-term inability to meet food requirements, lasting six months or more. Finally, *cyclical* refers to typical seasonal variations in food insecurity and depending on its duration, it can be categorized as *transitory* or *chronic* (World Food Programme, 2009).

All of theses classifications and definitions contribute towards our understanding of food insecurity and its multiple dimensions. Furthermore, it is also essential to identify

causes and consequences of food insecurity, and vulnerable populations, to fully grasp the complexity of this topic.

2.2.1 CAUSES AND CONSEQUENCES OF FOOD INSECURITY

Food insecurity is triggered by numerous interrelated factors and cannot be traced to a single cause. These include political instability (Deaton & Lipka, 2015), market price volatility and poverty (Dávila, 2010; The World Bank, 1987; World Food Programme, 2013), climate change (Wossen & Berger, 2015), and food waste (Food and Agriculture Organization, 2014b). Overall, these can be summarized in two general categories, which are an insufficient availability of food on the national level and inadequate access to food on the household and/or individual level (Smith, Obeid, & Jensen, 2000).

Some individuals are more vulnerable to food insecurity because of their gender (Ivers & Cullen, 2011; Matheson & McIntyre, 2014), low education status (De Muro & Burchi, 2007), region of living (Usfar, Fahmida, & Februhartanty, 2007; Walsh & van Rooyen, 2015), unemployment (Food and Agriculture Organization, 2012), low income (Furness, Simon, Wold, & Asarian-Anderson, 2004; Maitra & Rao, 2015), and more. These vulnerabilities put them at higher risk of food insecurity and its consequences.

Food insecurity negatively impacts individuals' physical and mental development and health (Cook & Frank, 2008; Humphries, Dearden, Crookston, Fernald, & Stein, 2015; Ke & Ford-Jones, 2015). However, food insecurity does not only affect individuals but also has repercussion on a national level by hampering human development (Conceição et al., 2011; Pritchard et al., 2013). To prevent these detrimental effects, interventions must properly address the causes of food insecurity, and give adequate support to vulnerable populations.

2.2.2 MEASURING FOOD SECURITY

In order to prioritize and monitor interventions that address food insecurity, a suitable measurement tool is essential (Løvendal, Knowles, & Horii, 2004; Scaramozzino, 2006). Multiple methods have been proposed to measure food security, however, there is

currently no gold standard (Pérez-Escamilla & Segall-Correa, 2008). This relates to the fact that food security is a latent trait, which is unobservable. Therefore, there is no objective benchmark to which we can compare the findings of each tool (Ballard, Kepple, & Cafiero, 2013). The five main measures used to assess food security, in national surveys, are (1) the FAO estimates of the prevalence of undernourishment, (2) household income and expenditures, (3) individuals dietary intake, (4) anthropometry, and (5) experienced-based food security scales (EBFSS). Despite an abundance of available tools, there is variability in their *validity* and *reliability,* which compromises the quality of their findings (Cafiero, Melgar-Quinonez, Ballard, & Kepple, 2014; Pérez-Escamilla & Segall-Correa, 2008).

Cafiero et al. (2014) state that validity exists when the interpretation of a measure, produced by a tool, can be supported by both evidence and theory. On the other hand, reliability exists when a measurement tool continually produces results that are accurate and precise (Cafiero et al., 2014). Amongst the five tools used to assess food insecurity in national surveys, EBFSS have proven to be valid and reliable measures, that are inexpensive and time-efficient to use. They also capture the psychological and emotional aspects of food insecurity, whereas the other scales do not. Since food insecurity has multiple dimensions and no tool is a perfect measure, it would be favourable to use a combination of all tools. However, this is not always possible, making EBFSS an ideal choice (Cafiero et al., 2014; Pérez-Escamilla & Segall-Correa, 2008).

2.2.3 EXPERIENCED-BASED FOOD SECURITY SCALES

Radimer, Olsen and Campbell (1990) and Radimer et al. (1992) initiated steps towards conceptualizing hunger and were the first to propose a construct for food security, regarding the severity of its experience (Radimer et al., 1990, 1992). Findings from these studies inspired the United States Household Food Security Survey Module (US HFSSM), which used this construct. This scale was applied annually, since 1995, to measure food security in the United States (Hamilton et al., 1995). After being heavily analyzed, it proved to be a valid and reliable measure (Ballard et al., 2013).

The US HFSSM led to the creation of numerous scales in Latin America, including the Latin American and Caribbean Food Security Scale (ELCSA), which combined concepts from various EBFSS such as the FANTA-Food Insecurity Access Scale, the Brazilian Food Insecurity Scale and a similar scale administered in Colombia. Over a ten-year timespan, ELCSA was successfully administered in various Latin American and Caribbean countries, as well as a few countries in different continents. Its proven effectiveness amongst diverse cultures led to the creation of the Food and Agriculture Organization's (FAO) Food Insecurity Experience Scale (FIES) (Ballard et al., 2013).

The FIES was launched as part of the Voices of the Hungry (VOH) project, aiming to create a universally applicable tool to measure the experience of food insecurity. In 2014, the FIES was administered in 140 countries and proved to be a valid and reliable measure of food insecurity worldwide (Cafiero et al., 2015).

Suitable tools, such as the FIES, are of great importance when aiming to comprehend and respond to the causes of food insecurity and to identify vulnerable populations. Furthermore, such tools are useful when measuring and monitoring food security governance (Pérez-Escamilla, 2012).

2.3 GOVERNANCE AND FOOD SECURITY

2.3.1 GOVERNANCE

In order to tackle food insecurity, it is important to understand its various determinants, which are all part of a greater scheme of food security governance. However, to understand food security governance, it is first important to comprehend what consists of overall governance. Multiple definitions of governance have been presented in the literature (June, Chowdhury, Heller, & Werve, 2008; Weiss, 2000), which can be summarized as "the management functions of societies – formal and informal – that are generally focused or coordinated around the state or government institutions but include

diverse actors, including civil society and the private sector" (Duncan, 2015). It is important to note that governance goes beyond the activities of the government, by mobilizing multiple actors from governmental and non-governmental fields, to work together and address problems that concern various states and regions. It can be achieved through four main key components: *accountability*, *participation, transparency* and *respect of the rule of law*. Furthermore, it requires an environment that has *political stability*, absence of *violence* and control of *corruption* (Azmat & Coghill, 2005; Grindle, 2006). Food security has often been viewed as a problem related to economics, ignoring political governance despite its important role in the equation (Aziz, 2001).

2.3.2 FOOD SECURITY GOVERNANCE

Food security governance is an emerging concept that has yet to be properly defined. Candel (2014) explains food security governance as "the formal and informal interactions across scales between public and/or private entities ultimately aiming at the realization of food availability, food access, and food utilization, and their stability over time" (Candel, 2014). Food security governance exists on global, national and subnational levels, and includes various types of institutions. Governance and food security governance share the same key components that were previously stated (Candel, 2014; Food and Agriculture Organization, 2011; McKeon, 2015). Food security is better addressed by achieving a committed, organized and politically active governing body (Food and Agriculture Organization, 2011). An illustrative example of food security governance includes Bauer's (as cited in Boyd, 2011) comparison of North and South Korea. Bauer describes how both countries have similar natural conditions, yet varying levels of food security. These differences are related to a different quality of governance, emphasizing how governance can be both a challenge and a solution to food security (Boyd & Wang, 2011). Furthermore, these differences go farther than food security governance and can be traced back to systems of overall governance (Candel, 2014).

2.4 CORRUPTION

Although governance refers to a broad array of activities, control of corruption is an important component (June et al., 2008). Corruption is usually thought to be a failure of multiple institutions in relation to improper management, or bad governance (Bertok,

1999). Good governance addresses and reduces the opportunities for corruption to a minimum, through transparent government activities that are exerted with integrity and in a trustworthy manner. On the other hand, failures in governance will allow corruption to flourish (Kaufmann, Kraay, & Zoido-Lobatón, 2002; World Bank, 1992).

Corruption can affect both overall governance and food security governance, thus impeding on food security (as presented in Figure 1). Presence of corruption disrupts food security governance, directly impacting food security. Secondly, corruption can reduce the quality of overall governance, which will impede on food security governance, thus indirectly impacting food security (Candel, 2014). There is currently a lack of empirical evidence supporting this association. However, there is a strong reason to believe that corruption will have adverse effects on food security. In order to explore this relationship, it is necessary to properly define corruption.

2.4.1 DEFINING CORRUPTION

Corruption is "*the abuse of entrusted power for private gain"* (Transparency International, 2015c). There are two distinct categories of corruption: 1) grand corruption or political corruption, 2) petty corruption or bureaucratic corruption (Tanzi & Davoodi, 1998; Tanzi, 1998).

High-level, grand or political corruption refers to widespread corruption through the highest levels of government, relating to election laws, financing for campaigns and rules that are a conflict of interest. It consists of manipulating policies, institutions and rules in regards to the allocation of resources and financing. This form of corruption will lead to the gradual destruction of the rule of law, economic stability and trust in governance (United Nations, 2004a). Furthermore, high-level corruption encourages petty corruption (Riley, 1999). Low-level, petty or bureaucratic corruption refers to activities such as exchanges of small amounts of money, granting minor favours and employment of friends and family for minor positions (United Nations, 2004a). This refers to abuse of entrusted power by public officials when interacting with ordinary citizens that are trying to access public services, on an everyday basis (Riley, 1999).

Corruption can take many forms such as bribery, nepotism, fraud (Hardoon & Heinrich, 2013; Sampford, Shacklock, Connors, & Galtung, 2006; United Nations, 2004b), and sexual extortion (Hossain, Musembi, & Hughes, 2010). Most variations of corruption usually involve a corrupter and a corrupted participant (Kaufmann et al., 2002). The corrupter usually participates in *active* bribery, which refers to paying or offering the bribe, and the corrupted usually participates in *passive bribery*, referring to receiving the bribe (Sampford et al., 2006). The corrupter is usually a citizen or a private firm, and the corrupted usually refers to a public official or politician (Kaufmann et al., 2002).

Traditionally, corruption was considered as an illegal act. However, in recent years, the concept of legal corruption has emerged. Legal corruption, or institutional corruption, can be defined as "political gains in the form of campaign contributions or endorsements by a government official, in exchange for providing specific benefits to private individuals or groups, be it by explicit or implicit understanding" (Dincer & Johnston, 2015). In other words, legal corruption refers to a strategic influence that is currently legal, weakening the ability of institutions to achieve their main purpose (Lessig, 2013). Illegal corruption usually occurs when there are very low-quality of legislations and there is a failure of implementation of laws within public institutions (Bertok, 1999). On the other hand, legal corruption usually occurs when there are very strict and narrow regulations, allowing for people to find loopholes and thus engage in legal corruption (Kaufmann, 2004). Illegal corruption is mostly associated with high inequalities and low incomes, whereas legal corruption is usually associated with lack of political accountability. Although illegal forms of corruption, such as bribery, are more prominent in the developing world, some areas of the industrialized world are still affected by alternate forms of corruption, such as legal corruption, whereas other industrialized countries have no significant problems (Kaufmann & Vicente, 2011). Countries with more wealth usually have more sophisticated legal systems and public officials which, in theory, would limit bribery (Fan, Lin, & Treisman, 2009). However, this does not shelter them from the legal alternative.

Overall, corruption is a complex and multidimensional concept, that can be interpreted various ways. When creating interventions to improve governance, we must first quantify corruption. This assessment can be done with various tools, each reflecting different facets of corruption.

2.4.2 MEASURING CORRUPTION

Since corruption is an unobservable concept, all indicators are *proxy measures*. These measures can be classified by three characteristics: (1) experience-based or perception-based measures, (2) input or output measures, and (3) composite or individual measures. Perception-based indicators refer to an individual or an experts' opinion on the presence of corruption. Experienced-based indicators refer to an actual engagement in corrupt activities, such as giving or being solicited for a bribe. Input measures assess the presence and quality of anti-corruption/governance institutions, whereas output measures refer to the outcomes of these institutions. Finally, indicators of a single or individual source of data are usually data that the organization has collected itself, whereas, composite data is a compilation of a variety of third-party data (June et al., 2008).

Perception-based indicators are commonly used when aiming to assess levels of corruption. These tools have been criticized for measuring the perception of corruption, which is not corruption per say. If individuals lack appropriate knowledge regarding corruption, or have varying interpretations of its meaning, results can be biased. However, a perception-based indicator can reduce the error associated with individuals' reluctance to admit that they have given bribes (June et al., 2008; Treisman, 2007), and inaccuracy of memory (Treisman, 2007). Overall, it remains the most frequently used measure of corruption because of a lack of alternatives (Treisman, 2007). It is important to note that corruption is a variable term. Therefore, there exists no single tool that can provide a perfect measurement. What is important is to choose the most appropriate tool for the purpose a study or intervention, rather than attempting to find the best tool to assess corruption (June et al., 2008). Thus, with an appropriate tool, is then possible to explore how corruption relates to other issues, such as food security.

2.5 CORRUPTION AND FOOD SECURITY

2.5.1 INDIRECT ASSOCIATION

The presence of corruption has detrimental effects on society by having a negative impact on both a country's growth (Mauro, 1995; Salinas-Jiménez & Salinas-Jiménez, 2007) and income distribution (Gupta et al., 2002). Furthermore, corruption will distort GDP investments (Delavallade, 2006), and land ownership (Hardoon & Heinrich, 2013). Interestingly, the same outcomes of corruption are also determinants of food security.

2.5.2 GROWTH AND INCOME INEQUALITY

Corruption has been found to disrupt a country's growth and division of incomes (Gupta et al., 2002; Mauro, 1995). A study by Mauro (1995) found that one standard deviation decrease in corruption, leads to 2.9 percent increase in investment from GDP, i.e. growth (Mauro, 1995). Furthermore, Salinas-Jiménez, M. & Salinas-Jiménez, J. (2007) have found that countries with lower levels of corruption have higher levels of productivity growth ($p<0.05$). These findings suggest that corruption will not only impact the investments associated growth of a country, but it will also negatively impact productivity growth (Salinas-Jiménez & Salinas-Jiménez, 2007).

Some studies have also found corruption to have a negative impact income inequality. A study by Gupta et al. (2002) is a perfect example of this association. In this study, a country's corruption is assessed by an index of 0 to 10, where 10 is the most corrupt. They found that an increase in the corruption index of 2.52 points is associated with an 11-point increase in the Gini coefficient ($p<0.01$). This signifies that an increase in corruption is associated with an increase in income inequality. This increase in inequality is significant if we consider that an average Gini coefficient is 39. Overall, corrupt government have difficulty stabilizing the economy and redistributing income, which will negatively impact the population (Gupta et al., 2002).

Inferior GDP and income inequalities relate to poverty, which enables food insecurity (Maitra & Rao, 2015; Lietfert, 2004). Liefert (2004) studied Russia during the transition period where GDP had decreased and unequal distribution of income had increased. Increased poverty affected the population's ability to access food, thus increasing food insecurity (Liefert, 2004). Timmer (2000) found similar trends in Asia where food insecurity was tackled by improving each country's economic growth and stabilizing food prices. This approach reduced poverty and thus increased access to food (Timmer, 2000). In addition to affecting a country's GDP and Gini index, corruption may also impact food security in other ways, such as distorting GDP investments (Delavallade, 2006; Tanzi & Davoodi, 1998).

2.5.3 DISTORTION OF GDP INVESTMENTS

Corruption deviates public spending towards activities that generate more bribes for public officials. When a government is corrupt, public expenditures will favour military, fuel and energy, public services, and capital projects while reducing spending on education, health and social protection (Delavallade, 2006; Tanzi & Davoodi, 1998). By increasing spending in these sectors, this increases public officials' ability to extract bribes and make profit (Delavallade, 2006). It has been found that a reduction in corruption from the high levels in Indonesia, to the lower levels in Korea, could help improve the percentage points of literacy from 15-25 percent (Kaufmann, Kraay, & Zoido-Lobatón, 2000). Tanzi & Davoodi (1998) highlight that governments can ask for bribes from capital projects, since the enterprises are willing to pay them to land specific contracts. On the other hand, enterprises attempt to recover from such bribes by reducing the quality of the work and materials used for a project. This can explain why we see high rates of newly built roads, within developing countries, that need to be fixed soon after construction. Also, shifted public investments may reduce money available to address structural issues. This alteration in public spending has a negative impact of a country's growth, by reducing the quality of public spending. Furthermore, the deterioration of infrastructures delay growth more than the investment in new infrastructures would improve it (Tanzi & Davoodi, 1998).

By shifting GDP investments away from services such as education, health, and social protection programs, corruption may affect food security. Ben-Davies et al. (2013) conducted a study in Honduras, which highlighted the importance of education for food security. In this study, they found that mothers that were mildly food insecure or food secure had a higher prevalence of completed education beyond primary school (24%) than mothers with moderate food insecurity (11%) or severe food insecurity (8%) (Ben-Davies et al., 2013).

Also, corruption may be a determinant of food insecurity by deviating public spending from capital projects, leading to poor road infrastructures. Tanga et al. (2014) highlight that the absence of roads infrastructures and their maintenance, in the third world, hinders the population's access to various public services and impacts their food security. Their study in Lesotho aimed to analyze the impact of the Transport Sector Program on food security within the communities. They found that improving road infrastructure and maintenance enhanced the villagers' access to schools, clinics, markets and police services. The increased ability to reach markets helped improve access to fertilizers and seeds, which helped with agricultural yields. Furthermore, the ability to reach access to police services helped reduce livestock theft. Overall the improved maintenance of roads increased community and household food security (Tanga et al., 2014). Overall, decreased investments in maintenance of road infrastructures may be another pathway through which corruption affects food security.

2.5.4 LAND-OWNERSHIP

Another pathway through which corruption may be detrimental to food security is by distorting land ownership. Countries such as Afghanistan, Cambodia, Iraq, Liberia, Pakistan and Sierra Leone, have demonstrated high rates of bribery for these services, ranging from 39 to 75 percent (Hardoon & Heinrich, 2013). For example, in Cambodia, poor governance of land ownership has led to 20-30% of the lands belonging to 1% of the population, which negatively impacts the poor and marginalized (Oldenburg & Neef, 2014).

Rammohan & Pritchard (2014) found that, in Myanmar, households that did not own land were food insecure. Households that owned over 10 acres of land had 10.2% lower probability of being food insecure than those who did not. On the other hand, 75% of reported hunger was from landless people (Rammohan & Pritchard, 2014). Although land ownership does not always lead to food security, it is associated with a higher prevalence, revealing the potential impact that corruption may have on hunger.

2.6 CORRUPTION AND FOOD SECURITY: DIRECT ASSOCIATION

Despite the commonalities between outcomes of corrupt systems and determinants of food security, there are few studies that explore this topic. Some have attempted to explore corruption on a micro level, such as within food aid distribution programs and corruption at the farm level.

A study by Mehta & Jha (2012) assessed a food subsidy program within the Philippines. It was estimated that out of 14.16kg/person of allocated rice, within the frame of a food subsidy program, only 7.26kg were distributed. This signifies that only 48.5% of food aid was distributed to the population. Thus corruption affected the ability of this social program to adequately distribute goods to the community (Mehta & Jha, 2012). A study by Camacho & Conover (2011) found that, in Colombia, distribution of food aid, within social welfare programs, was also disrupted by corruption. They suggested that politicians used food subsidy programs, close to election time, to help gain votes. Because of this, there was a misrepresentation of 3 million individuals as the poorest segment, within a population of 40 million. Consequently, corruption distorted the allocation of food aid that was intended for vulnerable populations (Camacho & Conover, 2011). Furthermore, Menkhaus (2012) found that officials running relief camps for drought victims, in Somalia, unequally distributed the goods in accordance to each individual's lineage. Distribution of food was associated with social rankings. Therefore, those from a weak lineage had less social capital to access food aid (Menkhaus, 2012). These findings further illustrated how corruption impacts social program aid distribution.

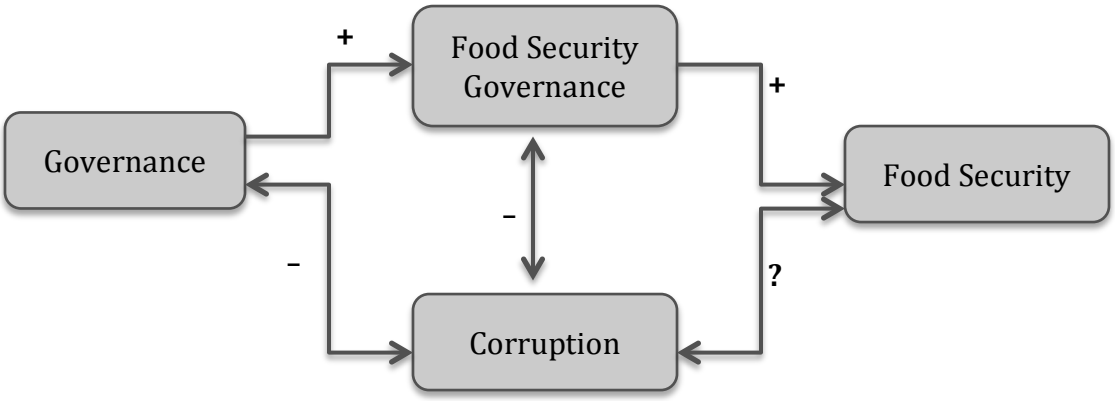
Anik, Manjunatah & Bauer (2013) aimed to assess the impact of farm level corruption on food security of households in Bangladesh. In this study, they found that cost of corruption had a negative effect on caloric intake ($p<0.05$). Findings suggested that an increase in cost of corruption resulted in fewer calories consumed within a household (Anik, Manjunatha, & Bauer, 2013).

On the global scale, there is currently only one study that exists aiming to explore the association between food security and corruption. Uchendu & Abolarin (2015) found that a reduction in corruption, represented by an increase in the corruption perception index, was associated to an increase in food security within least corrupt countries ($r=0.65$, $p<0.05$). However, results were not significant when looking at most corrupt countries (Uchendu & Abolarin, 2015). It is important to note that this study was not conducted with a validated measure of food insecurity. Therefore, despite positive findings, there has yet to be a study assessing the interaction between food security and corruption internationally with a valid and reliable tool.

2.7 CONCLUSION FROM THE LITERATURE

There are currently numerous efforts working towards hunger eradication by generating studies and interventions in the field of food security. However, despite growing literature linking food security to governance systems, few studies have aimed to assess the role of corruption within this equation. Corruption is a form of bad governance, which is important to consider when aiming address food security from a governance angle. Thus, to complement the current advances in hunger eradication and to encourage proper governance of food security, it is important to start exploring the relation between these two concepts and generate knowledge that can fuel interventions. Overall, the aim of this study is to explore the association between food security and corruption.

Figure 1. Interactions Between Governance, Corruption and Food Security.



CHAPTER 3: GENERAL METHODOLOGY

3.1 RESEARCH DESIGN

This study consists of quantitative research, using a cross-sectional survey design. Food security status is assessed, on an individual and country level, in relation to each country's level of corruption.

3.2 RESEARCH CONTEXT

This research is conducted within the frame of collaboration between the McGill Institute for Global Food Security and the FAO. In 2013, the FAO launched the VOH, aiming to create a global standard to monitor worldwide hunger. This project revolved around a new EBFSS named the FIES (Ballard et al., 2013). In 2014, the FIES was incorporated into the Gallup World Poll (GWP) survey, to generate nationally representative data on food security.

3.3 MEASUREMENTS

3.3.1 GALLUP WORLD POLL – FOOD INSECURITY EXPERIENCE SCALE

The GWP conducts annual surveys in 150 countries, which represents approximately 98% of the world's population. Most of the questions are dichotomous. Furthermore, the survey is comprised of core questions that are asked worldwide, and other questions that are asked in select countries. All of the core questions are organized into the different indices of the GWP. Questions are translated into the main conversation languages used within each country (Gallup Incorporated, 2014).

The FIES was incorporated in the GWP survey in 2014. For the purpose of this study, the data generated for that year is used to assess food security status. This tool is a universal EBFSS that measures the food insecurity of individuals. The FIES measures the severity of food insecurity, in regards to the access dimension. It uses a twelve-month

reference, which allows for a better comparison between countries and accounts for the seasonal effects that may modify results (Ballard et al., 2013). It includes eight questions that can be found in the individually referenced Food Insecurity Experience Scale Survey Module (FIES-SM) (see Appendix A) (Food and Agriculture Organization, 2015a). These assess the severity of food insecurity in regards to the pre-established construct, going from mildly to severely food insecure (Ballard et al., 2013; Radimer et al., 1992). Questions are answered through dichotomous yes/no responses that are associated with a specific severity of food insecurity (Ballard et al., 2013).

The FIES was constructed and validated through Rasch Modelling and Item-Response Theory (IRT). The IRT model assumes that it is possible to measure an unobservable construct based on yes/no answers for a series of questions. It theorizes that a question that generates more positive responses is associated to a less severe state of food insecurity. Conversely, a question that generates higher negative responses is more rare, therefore it is associated to a state of food insecurity that is more severe. When applying these concepts, participants' response patterns do not always follow the theory. To assess the pairing of each question to a specific level of severity, individual responses are measured as raw scores. The Rasch Model then assesses the probability of each question to generate a positive response. Based on these probabilities, it is then possible to assess the level of food insecurity associated with each question. It is important to note that severity of each question is measured independently from one and other (Ballard et al., 2013; Nord, 2014). This method helped establish that positive responses to FIES questions 1 through 3 reflect mild food insecurity, 4 through 6 reflect moderate food insecurity, and 7 and 8 reflect severe food insecurity (Ballard et al., 2013).

The FIES has been validated through IRT and Rasch Modelling, as well as through other EBFSS scales (Cafiero et al., 2014). It uses concepts that are socio-economically and culturally common across the globe, which justifies its use worldwide (Coates et al., 2006). Furthermore, the 2014 findings have proven to be valid measures of food insecurity in most countries included in the GWP surveys (Food and Agriculture

Organization et al., 2015). These unique characteristics, absent in other measures of food security, justify the use of this tool within the frame of this research.

3.3.2 TRANSPARENCY INTERNATIONAL – CORRUPTION INDEX

For this study, the 2014 Transparency International's (TI) Corruption Perception Index (CPI) score was used to measure corruption. This is a composite indicator that assembles 12 sources of data to generate indices for each country. These sources measure experts' perception of corruption in the public sector of various countries (Transparency International, 2015a). There is a four-step process involved in creating this index. First, data are selected based on the source's credibility, ability to measure perceived corruption in the public sector, inter-country comparability, and ability to provide data for multiple years. Secondly, once sources are selected, data are standardized to allow comparability and aggregation of the various scales. All data are standardized to a z-score and converted to a scale of 0 to 100. The z-scores are calculated using the mean and standard deviations of imputed 2012 scores. They are rescaled to fit the CPI scale, and any data that exceeds the scale, of 0 to 100, is capped. Thirdly, standardized data are aggregated to a single corruption perception index score (CS), which is an average of all available scores for each country. Countries are only given a CS if there are three data sources that can provide corruption indices. Finally, once the data are aggregated, standard errors and confidence intervals are reported. This score ranges from 0 – 100, were countries country that score closer to 0 have higher corruption and those that score closer to a 100 have lower corruption (Transparency International, 2015b). Through this score, it is possible to assess and compare levels of corruption between countries.

The CS is restricted by its ability to only measure corruption within the public sector, dismissing corruption within the private sector. Moreover, it does not consider the public's perception and experience of corruption. It focuses on experts' opinions, which can sometimes overestimate a country's level of corruption and bias results (Razafindrakoto & Roubaud, 2005). However, its use of experts' opinions is also valuable. Using expert versus public perception reduces errors associated with

individuals' being reluctant to admit they have given bribes (June et al., 2008). Additionally, the composite nature of this indicator is beneficial because it reduces the possibility of errors during measurement, which is a higher risk when using data from an individual source. Although there is currently no gold standard to measure corruption, the CPI remains the most broadly used to assess corruption (Transparency International, 2015b). Thus, because of its desirable characteristics, and due to a lack of alternatives, the CPI was used as a measure of corruption for this study (Johnson & Mason, 2013; Treisman, 2007).

3.3.3 WORLD BANK – CONTROL VARIABLES

The World Bank (WB) is a platform that offers international data provided by member countries (The World Bank Group, 2016a). This study incorporated control variables, provided by the WB, within its statistical model. These variables are each country's income Gini coefficient and GDP.

The Gini coefficient measures to which extent a country's income are equally distributed amongst the population. To assess this, a Lorenz curve plot is created, which plots the income received (cumulative percentage) to the amount of recipients of said income. This plot is then compared to a hypothetical line, which represents absolute equality. The Gini index measures the area between the lines (in percentages), where 0 equals perfect equality and 100 equals perfect inequality (The World Bank Group, 2016c).

This study also used the Gross-domestic product per capita (Purchasing Power Parity) or GDP PC PPP. The GDP at purchaser's price refers to the value that is added by both producers and by product taxes to a country's economy. The GDP PC PPPs used for this study are adjusted to an international dollar. This adjustment is done through price power parity rates. All GDP per capita are converted, based on their purchasing power, to the equivalent purchasing power of 1 US $ in the United States. Data are converted to US$ dollar based on the 2011 International Comparison Program (The World Bank Group, 2016b).

Both of these variables were considered during statistical analyses because of their interaction with food security and corruption. Thus, they were incorporated to better understand possible nuances in statistical findings.

3.4 SAMPLING AND RECRUITEMENT

Among the databases used for this study, GWP is the only one that provides single source data collected directly from participants. The GWP surveys random nationally representative samples of individuals within each country. The questionnaires are conducted via telephone and face-to-face interviews (Gallup Incorporated, 2014).

In regards to face-to-face interviews, sampling was conducted in three stages. The *first* stage consisted of establishing clusters of households that are referred to as sampling units. During this phase, approximately 100 to 135 ultimate clusters were selected based on stratifications that considered both the country's population size and its geography. If the information was available, the sampling was based on the proportionality to the population's size. However, if not available, the sampling was conducted via simple random sampling methods. The *second* stage of sampling consisted of using the random routes procedure to select households. Three attempts were made to get in contact with the members of the household, at different times of the day. In the event that a house could not be contacted, simple substitution methods were applied such as selecting a household to the right or left of the house in question. The *third* stage of sampling consisted of participant selection within the household. This is a random selection process that uses the *Kish grid* (method), used after all eligible household members have been identified and dates of birth have been established. Face-to-face interviews were not conducted in all countries surveyed by Gallup. In countries where 80% of the population could be reached via telephone, participants were surveyed by telephone interviews (Gallup Incorporated, 2014).

In countries where telephone surveys were used, participants were selected by Random-Digit Dial method or a list of phone numbers that is nationally representative.

Additionally, in countries that have a high use of cellular phones, a dual-sample frame method was used. Similar to face-to-face interviews, three attempts were made to contact households, using alternate days and times. Participants were selected based on *Kish grid* (method) or by latest birthdate within the household (Gallup Incorporated, 2014).

3.5 SAMPLE SIZE

This study includes data from 118 countries, which were selected based on specified inclusion and exclusion criteria. Within each country, the selected sample sizes of participants are meant to be representative of the population class of age 15 and older. The most common sample size is 1000 participants per country (as presented in Table 1). Sample selection is probability based. Some countries have smaller and larger samples to ensure proper representation (Gallup Incorporated, 2014)**.** In total, there were 120,417 individuals included for statistical analyses.

Table 1. Sample Size of Individuals Surveyed per Country.

Country	n	Country	n	Country	n	Country	n
1.00 United States	1027	41.00 Uganda	1000	82.00 Costa Rica	1000	140.00 Liberia	1000
2.00 Egypt	1000	42.00 Benin	1000	83.00 Albania	999	143.00 Lithuania	1000
6.00 Jordan	1000	43.00 Madagascar	1008	88.00 Armenia	1000	144.00 Luxembourg	1000
8.00 Turkey	1001	44.00 Malawi	1000	89.00 Austria	1000	145.00 Macedonia	1000
9.00 Pakistan	1000	45.00 South Africa	1000	96.00 Bolivia	1000	146.00 Malaysia	1008
10.00 Indonesia	1000	46.00 Canada	1021	97.00 Bosnia and Herzegovina	1001	150.00 Mauritius	1000
11.00 Bangladesh	1000	47.00 Australia	1000	99.00 Bulgaria	1000	153.00 Mongolia	1000
12.00 United Kingdom	1000	48.00 Philippines	1000	100.00 Burundi	1000	154.00 Montenegro	1000
13.00 France	1000	49.00 Sri Lanka	1062	103.00 Chad	1000	155.00 Namibia	1000
14.00 Germany	1002	50.00 Vietnam	1000	104.00 Chile	1032	157.00 Nepal	1050
15.00 Netherlands	1000	51.00 Thailand	1000	105.00 Colombia	1000	158.00 Nicaragua	1000
16.00 Belgium	1000	52.00 Cambodia	1000	107.00 Congo (Kinshasa)	1000	160.00 Norway	1000
18.00 Italy	1000	57.00 Botswana	1000	108.00 Congo Brazzaville	1000	163.00 Panama	1000
19.00 Poland	1000	60.00 Ethiopia	1004	109.00 Croatia	1000	164.00 Paraguay	1000
20.00 Hungary	1003	61.00 Mali	1000	111.00 Cyprus	1000	165.00 Peru	1000
21.00 Czech Republic	1008	62.00 Mauritania	1000	114.00 Dominican Republic	1000	166.00 Portugal	1007
22.00 Romania	998	64.00 Niger	1008	115.00 Ecuador	1000	173.00 Serbia	1000
23.00 Sweden	1000	65.00 Rwanda	1000	116.00 El Salvador	1000	175.00 Slovakia	1000
24.00 Greece	1000	66.00 Senegal	1000	119.00 Estonia	1000	176.00 Slovenia	1017
25.00 Denmark	1000	67.00 Zambia	1000	121.00 Finland	1000	181.00 Sudan	1000
26.00 Iran	1005	71.00 Belarus	1036	122.00 Gabon	1008	184.00 Switzerland	1002
29.00 Japan	1000	72.00 Georgia	1000	124.00 Guatemala	1000	185.00 Tajikistan	1000
31.00 India	3000	73.00 Kazakhstan	1000	125.00 Guinea	1000	187.00 Togo	1000
33.00 Brazil	1007	74.00 Kyrgyzstan	1000	128.00 Haiti	504	190.00 Tunisia	1056
34.00 Mexico	1017	75.00 Moldova	1000	129.00 Honduras	1000	194.00 Uruguay	1000
35.00 Nigeria	1000	76.00 Russia	2000	131.00 Iraq	1003	195.00 Uzbekistan	1056
36.00 Kenya	1000	77.00 Ukraine	1000	132.00 Ireland	1000	198.00 Kosovo	1001
37.00 Tanzania	1008	78.00 Burkina Faso	1000	134.00 Ivory Coast	1000		
38.00 Israel	1000	79.00 Cameroon	1000	135.00 Jamaica	504		
40.00 Ghana	1000	80.00 Sierra Leone	1008	138.00 Latvia	1002		
Total	**120417**						

Note: *n* represents the sample size
Source: Gallup survey, August 2014.

3.5.1 SAMPLE INCLUSION

For this study, 2014 data was used for the GWP survey, Transparency International CPI and WB's GDP PC PPP. This selection was based on the fact that the 2014 database was complete and that FIES data collected in 2014 had been validated, by the FAO, as an accurate measure of food security (Cafiero et al., 2015). In regards to the WB Gini index, this study used data collected between 2000 and 2013. This range of years was selected because of missing data for 2014, and small variability of Gini indices from year to year. The Gini indices used for this study were selected if they were the most recent data available between 2000 to 2013. Sample inclusion, regarding participants surveyed by GWP consisted of any adult aged 15 years or over. Participants were both men and women, living in rural and urban areas. Ultimately, the samples were intended to represent the entire civilian population of each country (Gallup Incorporated, 2014).

3.5.2 SAMPLE EXCLUSION

For the purpose of this study, all countries that did not have data for CS, FIES, and WB Gini and GDP PC PPP, were not included. The following countries were not considered during statistical analyses: Palestine, Belize, Northern Cyprus, Venezuela, Myanmar, New Zealand, Angola, Taiwan, Argentina, Malta, Puerto Rico, Somalia, Yemen, Lebanon, Saudi Arabia, Hong Kong, Singapore, South Korea, Algeria, Afghanistan, South Sudan, Zimbabwe, Bahrain, Kuwait, Turkmenistan, United Arab Emirates. It is important to note that GWP did not survey countries where interviewers safety would potentially be at risk or areas that can only be reached by boat, animal or foot (Gallup Incorporated, 2014). Furthermore, it has been found that the FIES was not a good measure of food security within the following countries: China, Bhutan and Azerbaijan. These countries were removed for statistical analyses (Cafiero et al., 2015).

3.6 STATISTICAL ANALYSIS

This study was conducted using IBM ® SPSS ® version 23 (complex samples module), SAS ® University Edition and RStudio ® version 0.99.491. Complex samples module

allowed to conduct statistical analyses that consider sampling design. Data was analyzed on both individual and country levels. Statistical significance for all analyses was set at $p \leq 0.05$.

3.6.1 VARIABLES CREATED

The predictor and outcome variables used in this study were characterized as being categorical (nominal and ordinal) or continuous (interval and ratio). For statistical analyses, variables were adapted and transformed accordingly.

Food insecurity was the outcome variable for this study. It was calculated in 3 different ways. The first measure of food insecurity was dichotomous. It was computed from the raw score into two categories (0 = food secure and 1-8 = food insecure). This variable was categorical. The second measure of food insecurity was the prevalence on a national level. Using the raw score, this variable was calculated by establishing the weighted percentage of individuals identified as food insecure (0 = food secure and 1-8 = food insecure) within a country. This variable was continuous. The final measure of food insecurity, also a categorical variable, highlighted the different levels of insecurity based on severity. As suggested by Ballard et al. (2013), the raw scores were divided into four categories, being food secure, mildly food insecure, moderately food insecure and severely food insecure (0 = food secure, 1-3 = mildly food insecure, 4-6 = moderately food insecure and 7-8 = severely food insecure) (Ballard et al., 2013).

The predictor variables used in this study were on both an country and individual level. Those measured on a country level included the CS, the GDP PC PPP, and the Gini index. All three were continuous variables.

The predictor variables measured on an individual level included gender, education, employment, age and household income per capita. Gender was a categorical variable, where participants were either a) female or b) male. Education was categorized into three levels, either a) having completed elementary education or less (up to 8 years of basic education), b) having completed secondary education and some education beyond, or c) having completed four years of education beyond high school. This

variable was categorical. Employment, which was also a categorical variable, was sorted into 4 levels, either a) unemployed, b) part-time employed, c) full-time employed or d) out of the workforce. Age was calculated two ways, depending on the statistical analyses. For some analyses, age was used as a continuous variable. However, age was also transformed into a categorical variable, by being divided into the following categories: a) 15 to 17 y.o, b) 16 to 64 y.o, and c) 65 and over. Similarly, income was kept as a continuous variable for some tests, whereas for others, it was transformed into a categorical variable. It was divided into five categories from its original continuous form. The five categories were the following: a) 0$ - 4,999$, b) 5,000$ - 9,999$, c) 10,000$ - 14,999$, d) 15,000$ to 19,999$ and e) 20,000$ and more.

3.6.2 WEIGHTS

Data from the GWP was weighted to account for the sampling design. Two weights were used depending on the analysis. When participants were analyzed per country, data was weighted to consider the stratification process used during sampling. These weights ensured that individuals' answers were representative of their assigned population size and geographical region. On the other hand, statistics that pooled individuals from all countries used an additional weight that accounted for the population size of each country. This ensured a proper representation of each individual's responses on the global scale. Population sizes were established using the WB Total Population data (The World Bank Group, 2016d). Weights were not used for Cumulative Logit Modelling (CLM) analyses. It has been argued that using sampling weights in a regression will fit the line to characteristics that differ from the original population. Thus, using sampling weights will reduce the precision of findings, which is why they were not used for these analyses (Lumley, 2010).

3.6.3 DATA ANALYSIS

Descriptive statistics were conducted to explore the distribution of food insecurity amongst the population. A cross-tabulation compared socio-demographic characteristics in regards to food insecurity. This analysis used the dichotomous food insecurity variable.

This variable was weighted for sampling design and population size. Frequency distributions, demonstrated by percentage means and standard errors, were calculated for categorical variables (gender, age, education, employment and income).

Bivariate analyses were conducted using Spearman's Rank correlation and type II Linear Regression with Slope of Major Axis. These analyses assessed the relationship between the prevalence of food insecurity and CS, on a country level. Both variables were continuous. Spearman's rank correlation was used because the assumptions for a Pearson's correlation were not met. A type II linear regression was deemed the most appropriate for analyses because both variables were subject to natural variation and measurement error. Variables used for this model were ranked to adjust for non-normal distribution. The Slope of Major Axis was determined, rather than the Standard Major Axis, because both variables were in the same unit of measurement. A Loess Curve was used, on unranked data, to assess if the relationship between both variables was non-linear.

Multivariate analyses were conducted using CLM to assess corruption's ability to predict food insecurity, on a global scale. The food insecurity variable, grouped according to severity, was used for this analysis. CLM was selected because of the ordinal nature of the outcome variable. Both country and individual level variables were included, as controls, in this model. These were continuous (GDP PC PPP, Gini index, age, and income) and categorical (gender, education, employment). The CS, GDP PC PPP, and the Gini index were scaled and transformed (lg10) for this analysis. Furthermore, the income variable was also transformed for statistical analyses (lg10 + 1). Interactions were calculated and controlled for CS, Gini index and GDP PC PPP.

To further assess the association between food insecurity and corruption, data was disaggregated into groups, established by non-metric multidimensional scaling (NMDS) analysis. NMDS was used to group countries based on their prevalence of food insecurity, CS, GDP PC PPP and Gini index, all continuous variables. Euclidean distances were used to assess dissimilarity between the ranks of the variables for each country. As suggested by Clarke and Warwick (2001), groups of countries that were

formed on the NMDS plot graph were confirmed by a separate clustering analysis (Clark & Warwick, 2001). Disjoint cluster analysis was conducted using Euclidean distances and a k-means model. Once groups of countries were established, descriptive statistics were conducted for each continuous variable (Food Insecurity Prevalence, CS, GDP PC PPP and Gini index) and groups were described as having low, moderate or high values for each. After groups were established, each group was analyzed using the same CLM model applied on the global level. Because groups were too small, interactions were not calculated.

3.7 ETHICAL CONSIDERATIONS

Food insecurity data and population demographic variables used for this study were collected as part of the GWP surveys. Gallup has "been committed to the principle that accurately collecting and disseminating the opinions and aspirations of people around the globe is vital to understanding our world". Gallup has set a mission of providing objective, reliable, and scientifically grounded data. Furthermore, it is important to note that the GWP is not affiliated with any political or advocacy group, allowing for unbiased results. The GWP is not discriminatory in the sense that all data is available for all individuals, institutions or governments. Furthermore, Gallup has committed to keeping all identities of survey respondents confidential. The survey is translated into the major conversation languages of each country (Gallup Incorporated, 2014). This allows for each participant to complete the survey with ease. Finally, participants may be distressed while answering survey questions that may reflect upon situations or topics that bring them discomfort.

TI collected the corruption data used for this study. Ethical guidelines and codes of conducts were put in place for their staff and partners, ensuring ethical behaviour regarding data collection, processing and publication. TI works with all types of organizations, such as profit and non-profit, as well as all individuals and groups. The organization is committed to providing unbiased information, conduct their work with integrity and collaborate with parties that are non-corrupt. They only accept funding from donors that will not compromise the objectivity of their data, and their ability to speak

freely on the topic of corruption. Finally, TI provides data, and access to methodology, for all individuals and organizations (Transparency International, 2011).

For this study, the GDP PC PPP and income Gini index variables were provided by the WB. Numerous policies and protocols have been put in place to maintain the confidentiality of information. There are some restrictions in place, regarding the sharing of information with the media, to prevent unapproved disclosure of information. Furthermore, there are precautions in place to prevent that the data provided by member governments and partners is inaccurate. These are established to preserve the integrity of the WB data (The World Bank Group, 2013).

CHAPTER 4: MANUSCRIPT

Exploring the Relationship Between Corruption and Food Insecurity on a Global Scale

Gabrielle Du Perron Helal[1], Timothy Schwinghamer[2], Julien Malard[3], Diana Dallmann[1], Davod Ahmadigheidari[1], Nicolas Kosoy[4], Hugo Melgar-Quiñonez[1]

McGill University, Sainte-Anne de Bellevue, Qc, Canada. 1 The School of Dieteics and Human Nutrition; Institute for Global Food Security. 2 Plant Science; Applied Statistics Laboratory. 3 Bioresource Engineering. 4 Natural Resource Sciences.

To be submitted to *Food Policy*.

4.1 ABSTRACT

Food insecurity is a global problem that has yet to be properly addressed. Its determinants are part of a greater scheme of food security governance and overall governance. Presence of corruption occurs when there are failures in governance. There are currently no studies exploring corruption and food security, on a global scale, with internationally validated tools. This study aimed to fill this gap in the literature. The main objective was to explore the relation between corruption and food insecurity status on a global scale. Data from Gallup World Poll, TI and the WB were analyzed. The sample included 118 countries and 115,379 individuals**.** Food security status, the dependant variable, was assessed using the Food and Agriculture Organization's Food Insecurity Experience Scale. Corruption, the independent variable, was measured using TI's Corruption Perception Index score (CS). Data was analyzed on an individual and country level. Several statistical analyses including cross-tabulations, model II regression, cumulative logit modelling (CLM) and non-metric multidimensional scaling (NMDS) were conducted to evaluate the relationship between socio-demographic characteristics, country characteristics and corruption on food insecurity. On a global scale, bivariate analyses demonstrated a strong significant association between corruption and food insecurity. Increasing corruption, demonstrated by a decreasing CS, increases food insecurity, $r_s(118)=-0.715$, $p=0.000$. CLM analyses demonstrated that decreasing corruption, represented by a unit increase in the CS, was associated with a reduction in food insecurity ($\beta= -0.24$, $p=0.001$). Furthermore, being female, being older, having less education and income, and being unemployed were statistically significantly associated with an increase in food insecurity. An increase in gross-domestic product per capita was associated with a reduction in food insecurity ($\beta= -0.25$, $p=0.001$) whereas an increase of the Gini index, signifying an increase in inequality, was associated with an increase in food insecurity ($\beta= 0.30$, $p=0.001$). Also, there were 7 groups of countries established by NMDS, which were analyzed with CLM. Groups 2 ($\beta= -0.44$), 5 ($\beta= -0.23$), and 7 ($\beta= -0.36$), found that a reduction in corruption, represented by a unit increase in CS, was associated with a reduction of food insecurity ($p=0.001$). These findings suggest that amongst diverse population socio-demographic and country characteristics, corruption has a negative impact on food security. The results of this novel study will promote governmental accountability in regards to corruption, and will contribute to emerging research in the field of food security governance. Overall they will help the development of new approaches to tackle world hunger.

4.2 INTRODUCTION

In 2014, there were 805 million hungry people worldwide. Although the past decades have shown positive trends in reducing the prevalence of hunger, these numbers remain unacceptably high (Food and Agriculture Organization et al., 2014). Food insecurity affects all regions of the world and impedes on both the physical health, in regards to inadequate nutrition (Maletta, 2014), and mental health (Weaver & Hadley, 2009). It has yet to be eradicated, which may be attributed to the complexity of the problem. This warrants the need for research to develop a more comprehensive understanding of the causes of food insecurity.

In 1996, at the World Food Summit meeting, food security was defined as a state where "-all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization, 1996). It consists of four dimensions which are 1) availability, 2) access, 3) utilization and 4) stability of food (Food and Agriculture Organization et al., 2014; Food and Agriculture Organization, 2008). Food insecurity is a state achieved when one of these dimensions is not respected. It varies in severity, in increasing order, in relation to a distinct sequence of experiences of hunger which are described as 1) anxiety about food, 2) inadequate quality of food and 3) inadequate quantity of food (Radimer et al., 1992). This construct was found to be true across various cultures (Coates et al., 2006).

Determinants of food insecurity are all part of a greater scheme of food security governance. Overall governance can be summarized as "the management functions of societies – formal and informal – that are focused or coordinated around the state or government institutions but include diverse actors, including civil society and the private sector" (Duncan, 2015). Good governance requires an environment that has *political stability*, absence of *violence* and control of *corruption* (Azmat & Coghill, 2005; Grindle, 2006). Food security governance can be defined as "the formal and informal interactions

across scales between public and/or private entities ultimately aiming at the realization of food availability, food access, and food utilization, and their stability over time" (Candel, 2014). It exists on global, national and subnational levels, and includes various types of institutions (Candel, 2014; McKeon, 2015). Failures in food security governance can often be traced back to failures in systems of overall governance (Candel, 2014).

Good governance refers to a broad array of activities, including the control of corruption (June et al., 2008; Kaufmann, 2004). Corruption is defined as "*the abuse of entrusted power for private gain"* (Transparency International, 2015c). There are two distinct categories of corruption: 1) grand corruption or political corruption, 2) petty corruption or bureaucratic corruption (Tanzi & Davoodi, 1998; Tanzi, 1998). High-level, grand or political corruption refers to widespread corruption through the highest levels of government (United Nations, 2004a). This form of corruption also encourages petty corruption (Riley, 1999), such as exchanges of small amounts of money, granting minor favours and employment of friends and family for minor positions (United Nations, 2004a).

Corruption is usually thought to be a failure of multiple institutions in relation to improper management, or bad governance (Bertok, 1999). Good governance addresses and reduces the opportunities for corruption to a minimum, through transparent government activities that are exerted with integrity and in a trustworthy manner (Kaufmaan, Kraay, Zoido-Lobatón, 2002; World Bank, 1992). Corruption can affect both overall governance and food security governance, two pathways through which it could potentially affect food security.

The presence of corruption has been found to have detrimental effects on society by negatively impacting both a country's growth (Mauro, 1995; Salinas-Jiménez & Salinas-Jiménez, 2007) and income distribution (Gupta et al., 2002). Corruption has been shown to shift GDP investments towards activities that generate more bribes for public officials,

reducing spending on education, health and social protection (Delavallade, 2006). Also, it has been shown to impact land ownership (Hardoon & Heinrich, 2013). Interestingly, the same outcomes of corruption have also been found to be determinants of food security. Poor growth and income inequality are associated with poverty, which enables food insecurity (Food and Agriculture Organization, 2014a; Liefert, 2004; Timmer, 2000). Furthermore, studies have shown that education (Ben-Davies et al., 2013), road infrastructures (Tanga et al., 2014), and land-ownership (Rammohan & Pritchard, 2014) are all determinants of food security status, and are services from which corruption deviates spending (Delavallade, 2006). Despite their common grounds, few studies have attempted to research food security and corruption.

Some have explored corruption on a micro level, regarding food aid distribution and on the farm level. Each found corruption to have a negative impact on food security (Anik, Manjuanatha, & Siegfried, 2013; Mehta & Jha, 2012). Additionally, there is only one study available assessing food security and corruption on a global scale. Uchendu & Abolarin (2015) found that there was a positive association between corruption and food security ($r=0.65$, $p<0.05$), however, this was only within least corrupt countries (Uchendu & Abolarin, 2015).

Overall, there is a reason to believe that corruption, presented as a failure in governance, may be a determinant of food security status. The aim of this study is to *explore* the relation between corruption and food security, on a global scale, to gain a better understanding of their interaction.

4.2.1 OBJECTIVE

The first objective of this study is to assess if food insecurity and corruption are associated, on a global scale. The second objective of this study is to assess how corruption interacts with food security within subgroups of countries.

4.3 METHODOLOGY

4.3.1 RESEARCH DESIGN AND CONTEXT

This study consists of quantitative research, using a cross-sectional survey design. Food security status is assessed, on an individual and country level, in association to each country's corruption score. This research is conducted within the frame of collaboration between the McGill Institute for Global Food Security and the Food and Agriculture Organization.

4.3.2 MEASUREMENTS

This study used four different sources of data. Food Insecurity Experience Scale (FIES) and socio-demographic characteristics were obtained from the 2014 Gallup World Poll (GWP) survey. Transparency International (TI) provided the 2014 Corruption Perception Score (CS). Finally, the World Bank (WB) provided data for the Gross-domestic product per capita (Purchasing Power Parity) in current international $ (GDP PC PPP), for 2014, and the Gini coefficient for 2000-2013.

The GWP conducts annual surveys in 150 countries, representing approximately 98% of the world's population. Questions are translated into the main conversation languages of each country (Gallup Incorporated, 2014). The FIES was incorporated in the GWP survey in 2014. This tool is a universal experienced-based food security scale measuring the access dimension of individual food security. It uses a twelve-month reference and includes eight questions, which can be answered by dichotomous yes/no responses (Ballard et al., 2013; Food and Agriculture Organization, 2015a). Each question is associated with a specific level of food insecurity that was established and validated by the Rasch Model and Item Response Theory (IRT) (Ballard et al., 2013; Nord, 2014). Therefore, each question is associated to either being food secure or mildly, moderately or severely food insecure (Ballard et al., 2013). The FIES uses concepts that are socio-economically and culturally common across the globe, which justifies its use worldwide (Coates et al., 2006). Furthermore, the 2014 findings have proven to be valid

measures of food insecurity in most countries included in the Gallup World Poll Survey (Food and Agriculture Organization et al., 2015).

For this study, the 2014 CS was used to measure corruption. This is a composite indicator that assembles 12 sources of data, measuring experts' perception of corruption in the public sector (Transparency International, 2015a). The index is created in a four step process, that consists of the following: (1) selection of data sources (2) standardization of data to a z-score and conversion to a scale of 0 to 100, and (3) aggregation of data to an average CS for each country. Countries are only given a CS if there are three data sources that can provide corruption indices. The highest level of corruption is a CS that is equal to 0, and the lowest level of corruption is a score of 100. The composite nature of this indicator is beneficial because it reduces the possibility of errors during measurement. Although there is currently no gold standard to measure corruption, the CS remains the most broadly used measure of corruption (Transparency International, 2015b).

This study incorporated control variables, provided by the WB, within its statistical model. These are each country's Gini coefficient and GDP PC PPP. The Gini coefficient measures to which extent a country's income is equally distributed amongst the population, by creating a Lorenz curve plot. This plot is then compared to a hypothetical line, which represents absolute equality. The Gini index measures the maximal percentage area between the lines, where 0 equals perfect equality and 100 equals perfect inequality (The World Bank Group, 2016c). This study also used the GDP PC PPP. The GDP at purchaser's price refers to the gross value added by producers and product taxes to the economy. The GDP used for this study were adjusted to an international dollar, converting each GDP PC PPP's purchasing power to the equivalent in United States dollars (The World Bank Group, 2016b). Both of these variables were considered during statistical analyses because of their interaction with both food security and corruption.

4.3.3 SAMPLING AND RECRUITEMENT

Among the databases used for this study, GWP is the only one providing single source data, collected directly from recruited participants. The GWP surveys random nationally representative samples of individuals within each country. The questionnaires were conducted via telephone and face-to-face interviews. Telephone surveys were used in countries where 80% of the population can be reached via telephone. These participants were selected by Random-Digit Dial method or a list of phone numbers that is nationally representative. Additionally, in countries that have a high use of cellular phones, a dual-sample frame method was used. Three attempts were made to contact households, using alternate days and times. Participants were selected based on *Kish grid* (method) or by latest birthdate within the household. In regards to face-to-face interviews, three stages of sampling were used. First, approximately 100 to 135 clusters of household were established. These were based on stratifications that considered both the country's population size and its geography. If information was available, the sampling was based on the proportionality to the population's size, however, if not available, the sampling was conducted via simple random sampling methods. Secondly, the random routes procedure was used to select households. Three attempts were made to contact members of each household. If unsuccessful, simple substitution methods were applied. Thirdly, participants were selected within households using the *Kish grid* method (Gallup Incorporated, 2014).

4.3.3.1 SAMPLE SIZE

This study includes data from 118 countries, which were selected based on specified inclusion and exclusion criteria. The average sample size surveyed by the GWP is 1000 individuals per country. Individuals are selected by a probability-based approach, and are intended to be representative of the population aged 15 years and older. Some countries have smaller and larger samples, which are adjusted to ensure adequate representation (Gallup Incorporated, 2014)**.** In total, there were 120,417 individuals included for statistical analyses.

4.3.3.2 SAMPLE INCLUSION

The data selected from the GWP, CS and WB's GDP PC PPP was collected in 2014 (Cafiero et al., 2015). However, the WB Gini indices were collected from 2000 and 2013, due to missing data for 2014. The Gini index was selected if it was the most recent data available between 2000 to 2013. GWP's inclusion criteria consisted of adults aged 15 years and older, both men and women, living in rural and urban areas (Gallup Incorporated, 2014).

4.3.3.3 SAMPLE EXCLUSION

All countries with missing data for CS, FIES, Gini and GDP PC PPP were not included: Palestine, Belize, Northern Cyprus, Venezuela, Myanmar, New Zealand, Angola, Taiwan, Argentina, Malta, Puerto Rico, Somalia, Yemen, Lebanon, Saudi Arabia, Hong Kong, Singapore, South Korea, Algeria, Afghanistan, South Sudan, Zimbabwe, Bahrain, Kuwait, Turkmenistan, United Arab Emirates. The GWP did not survey countries where interviewers safety was at risk or areas that were difficult to access (Gallup Incorporated, 2014). Furthermore, the inability of the FIES to provide a valid measure of food insecurity for China, Bhutan and Azerbaijan, supported their removal from statistical analyses (Cafiero et al., 2015).

4.3.4 STATISTICAL ANALYSIS

This study was conducted using IBM ® SPSS ® version 23 (complex samples module), SAS ® University Edition and RStudio ® version 0.99.491. Data was analyzed on both individual and country levels. Statistical significance for all analyses was set at $p \leq 0.05$. Data are weighed, for all analyses except Cumulative Logit Modelling (CLM).

4.3.4.1 VARIABLES CREATED

Food insecurity was the outcome variable for this study. It was calculated in 3 different ways. First, food insecurity was transformed into a dichotomous variable from the raw score (0 = food secure and 1-8 = food insecure), creating a categorical variable. Secondly, food insecurity was measured as prevalence, on a country level. This continuous variable was calculated from the weighted percentage of individuals identified as food insecure (0 = food secure and 1-8 = food insecure). Thirdly, food insecurity was transformed into a categorical variable, creating 4 levels of food insecurity from the raw score (0 = food secure, 1-3 = mildly food insecure, 4-6 = moderately food insecure and 7-8 = severely food insecure) (Ballard et al., 2013). The predictor variables used in this study were on a country level (CS, GDP PC PPP and Gini index) and individual scale (gender, education, employment, age and household income per capita).

4.3.5 DATA ANALYSIS

Descriptive statistics were conducted, using cross-tabulation, to explore food insecurity in regards to various socio-demographic characteristics. This analysis used the dichotomous food insecurity variable, which was weighted. Frequency distributions, demonstrated by percentage means and standard errors, were calculated for categorical variables (gender, age, education, employment and income).

Bivariate analyses were conducted using Spearman's Rank correlation and type II Linear Regression with Slope of Major Axis. These used the prevalence of food insecurity and CS on a country level. Both, continuous variables, were ranked to adjust for non-normal distribution. A Loess Curve was created, using unranked data, to assess if the relationship between both variables was non-linear.

Multivariate analyses were conducted using CLM. The food insecurity grouped in four levels of severity was used for analysis. Both country and individual level variables were included, as controls, in the model. These were continuous (GDP PC PPP, Gini index, age, and income) and categorical (gender, education, employment). The CS, GDP PC PPP, and the Gini index were scaled and transformed (lg10). The income variable was

also transformed for this statistical analysis (lg10 + 1). Interactions were calculated for CS, Gini index and GDP PC PPP.

Data are disaggregated into groups, using non-metric multidimensional scaling (NMDS). This grouped countries, by similarity, regarding their prevalence of food insecurity, CS, GDP PC PPP and Gini index (all continuous variables). Variables were scaled and Euclidean distances were used to assess dissimilarity between ranks. The groups of countries formed by NMDS plot graph were confirmed by a disjoint cluster analysis, using Euclidean distances and a k-means model. Once groups of countries were established, descriptive statistics were conducted for each continuous variable (Food Insecurity Prevalence, CS, GDP PC PPP and Gini index) and groups were described as having low, moderate or high values for each. After groups were established, each group was analyzed using the same CLM model applied at the global level. Because groups were too small, interactions were not calculated.

4.4 ETHICAL CONSIDERATIONS

The GWP surveys have "been committed to the principle that accurately collecting and disseminating the opinions and aspirations of people around the globe is vital to understanding our world". Gallup has set a mission of providing objective, reliable, and scientifically grounded data. It provides non-discriminatory data that is available to all. GWP is not affiliated with any political or advocacy group, reducing bias, and has committed to keeping all identities of survey respondents confidential. The survey is translated into the major conversation languages of each country, allowing a comfortable survey experience for all respondents (Gallup Incorporated, 2014). TI has put in place ethical guidelines and codes of conducts for staff and partners, ensuring ethical behaviour regarding data collection, processing and publication. The organization is committed to providing unbiased information, conduct their work with integrity and collaborate with parties that are non-corrupt. Funding from donors is only accepted if it will not comprise the objectivity of the data, and their ability to speak freely on the topic of corruption. TI provides data, and access to methodology, to all individuals and organizations (Transparency International, 2011). Finally, the WB has numerous policies and protocols

in place to maintain confidentiality of information, and has precautionary measures in place to prevent the dissemination of inaccurate data (The World Bank Group, 2013).

4.5 RESULTS

4.5.1 DESCRIPTIVE ANALYSES

Within 118 countries included for statistical analyses, there were 120,415 surveyed individuals out of which 3,361 did not respond to one of eight FIES questions. After removing non-respondents for various socio-demographic characteristics, the sample size used for analyses was 115,379 individuals. Within the weighted prevalence, 47.1% reported being food insecure. Amongst these individuals, 40.9% were mildly food insecure, 28.1% were moderately food insecure and 30.1% were severely food insecure. Food insecurity was found to be higher amongst women and individuals of 18 to 64 years of age, as well as people that were unemployed, had low income and were less education (p<0.001) (findings present in Table 2).

4.5.2 BIVARIATE ANALYSES

Bivariate analyses were conducted to assess data on a country level. A Spearman's Rank correlation was used to investigate the relationship between the prevalence of food insecurity and the score of corruption within countries. Initial analyses confirmed that the association between both variables was monotonic. Findings demonstrated a strong negative correlation between corruption scores and prevalence of food insecurity, $r_s(118)=0.715$, $p=0.000$. The association between both variables was presented in a model II regression for ranked data, with a slope of the major axis, presented in Figure 2. The model demonstrated that a reduction in food insecurity is associated to a reduction in corruption, represented by an increase in CS. The linearity of this model is supported by a Loess Curve nonparametric regression, that produced a curve similar to a line (as presented in Figure 3).

4.5.3 MULTIVARIATE ANALYSES

4.5.3.1 CUMULATIVE LOGIT MODELLING – GLOBAL SCALE

To further evaluate the variables, CLM was used to assess the predictability of corruption on food security status, when controlling for individuals' socio-demographic characteristics and country characteristics. This analysis included data from both an country and individual level. Findings from the CLM demonstrated that decreasing corruption, represented by a unit increase in the corruption score, is associated with a reduction in food insecurity (β= -0.24, p=0.001). Furthermore, being female, being older, having less education and income, and being unemployed were statistically significantly associated with an increase in food insecurity. In regards to country characteristics, an increase in GDP PC PPP was associated with a reduction in food insecurity (β= -0.25, p=0.001) whereas an increase of the Gini index, signifying an increase in inequality, was associated to an increase in food insecurity (β= 0.30, p=0.001). Interactions between Gini index, GDP PC PPP and CS were statistically significant, however, a visual inspection of scatterplots did not support strong interaction between variables (results shown in Table 3).

4.5.3.2 NON-METRIC MULTIDIMENSIONAL SCALING

NMDS was used to create groups of countries based on Gini, GDP PC PPP, CS and prevalence of food insecurity, that were later assessed with CLM. The NMDS model demonstrated a good-fit with a Badness of Fit Criterion of 0.07. Visual inspection of the NMDS plot graph allowed the identification of 7 groups of countries (listed in Table 4). Cluster analysis, demonstrated on the NMDS plot as the colouring of each country, highlighted these groups (presented in Figure 4).

When assessing the NMDS plot, the countries with higher food insecurity, higher corruption and lower GDP PC PPP were found on the left of the graph, whereas opposite characteristics were found to the right. The first dimension described most of the variability of the data. An exception to this trend was the Gini index. In the first

dimension, countries with a higher inequality, were located on the left of the plot graph, whereas countries with a low Gini index were on the right. Furthermore, countries with high inequality were in the bottom half of the plot graph whereas countries with high equality where located in the top half. It is important to note that the second dimension provides more explanation for the Gini index than for other variables. Group 4 and 5 were on opposite ends (180°) of the plot graph, signifying a correlation of -1 between groups. Thus, group 4 and 5 were counterparts. Table 5 describes the characteristics of groups formed by NMDS. Based on established categorization, Group 4 was described as having the most favourable characteristics, demonstrating low food insecurity, low corruption, high GDP PC PPP and moderate inequality. In contrast, group 5 was described the least favourable characteristics by having high food insecurity, high corruption, high GDP PC PPP and high inequality. A trend was apparent amongst all groups, where those with higher food insecurity, also had higher corruption and lower GDP PC PPP. However, the Gini index did not follow this pattern. Figure 5 confirmed these trends through box plots, where similar group patterning was seen for CS, prevalence of FI and GDP PC PPP, with the Gini index as an exception.

4.5.3.3 CUMULATIVE LOGIT MODELLING – GROUPS

Groups generated from the NMDS were analyzed with CLM (presented in Table 6). Groups 2 (β= -0.44), 5 (β= -0.23), and 7 (β= -0.36), found that a reduction in corruption, represented by a unit increase in CS, was associated with a reduction of food insecurity (p=0.001). There were no statistically significant findings, regarding food security and corruption, in groups 1, 3, 4 and 6. The Gini index demonstrated a similar impact of food insecurity across country groups. A unit increase in the Gini index, or an increase in inequality, was linked to an increase in food insecurity amongst all groups (p=0.001). GDP PC PPP had varying impacts on food insecurity amongst country groups. In Groups 4, 5 and 7, a unit increase in GDP PC PPP was associated with a reduction in food insecurity (p=0.001). In contrast, a unit increase of the GDP PC PPP, in Groups 2 and 6, was related to a statistically significant increase in food insecurity. Interactions were not calculated for this analysis because of the small amount of data available per country group.

4.6 DISCUSSION

4.6.1 FOOD INSECURITY AND CORRUPTION ON A GLOBAL SCALE

In this study, we explored the association between food insecurity and corruption. Our results showed that an increase in corruption was significantly associated with an increase in food insecurity, even when controlled for various socio-demographic and country characteristics. These results are in-line with those of Anik, Manjunatah & Siegfried (2013) that found farm level corruption to have a negative impact on food security (Anik et al., 2013). These findings confirm our expectations, suggesting that corruption hinders food security governance and overall governance, leading to an increase in food insecurity. Overall, this study provides scientific evidence supporting the association between food insecurity and corruption, allowing a better understanding of a topic that had yet to be thoroughly explored.

Also, we found that increases in GDP PC PPP were associated with decreasing food insecurity whereas increases in income inequality were associated with increasing food insecurity. These results confirm our expectations since the literature has shown that low GDP and high income inequality, both related to poverty, may strain economic access to food (Maitra & Rao, 2015; Lietfert, 2004). These findings may also be providing insight on a pathway through which corruption increases hunger. Previous studies describe how corruption negatively impacts growth and equality (Gupta et al., 2002; Mauro, 1995), which would increase poverty, consequently increasing food insecurity (Maitra & Rao, 2015; Lietfert, 2004). However, this study is of cross-sectional nature. Therefore, it cannot determine if corruption *causes* lower GDP PC PPP and higher inequality.

Our results also showed that food insecurity was associated with various socio-demographic characteristics. Specifically, it was found that being a female, being unemployed, having low income and having lower education were all significantly associated with higher levels of food insecurity. These results are in-line with the literature, which validates the quality of the statistical model used for analysis in this

study (De Muro & Burchi, 2007; Food and Agriculture Organization, 2012; Ivers & Cullen, 2011; Maitra & Rao, 2015).

4.6.2 CHARACTERISTICS OF SUBDIVIDED GROUPS OF COUNTRIES

Since countries vary in contextual, cultural and environmental features, subgroups were created to provide a better understanding of food insecurity and corruption within different settings. Several groups were identified using ordination and cluster analyses, pairing countries by similarity. Based on these resemblances, each group was described, compared, and labelled by its characteristics.

Group 4 or the ***"Righteous"*** group, was described as having the most favourable characteristics, which were low food insecurity, low corruption, high GDP PC PPP and moderate inequality. This group contains numerous advanced economies and countries from emerging and developing Europe, as classified by the Global Competitiveness Report (Schwab, 2015). Furthermore, according to the United Nations (2013), all are considered to be developed countries (United Nations, 2013). Interestingly, most member countries of the Organization for Economic Co-operation and Development (OECD) are found within this group (Organization for Economic Co-operation and Development, 2016b). The OECD is a collaboration of countries aiming to adopt standards and principles to fight poverty and prosper (Organization for Economic Co-operation and Development, 2016a). This organization gives continuous support to its member by providing guidelines and monitoring systems for countries to achieve good governance (Bertok, 1999). Therefore, this organization encourages countries to thrive and achieve the favourable characteristics that were previously highlighted. Overall, a combination of ideal features inspired this group's name.

Group 1, entitled ***"Nearly Righteous"*** was the only other group with low food insecurity. It was also described as having moderate corruption, moderate GDP PC PPP and high inequality. Contrary to the *Righteous* group, countries do not seem to be from similar geographic locations or member organizations. The description of this group is

limited to the common characteristics amongst its countries. Therefore, its name derived from its suboptimal features when compared to the *Righteous* group.

Group 3, labelled ***"Satisfactory Socialists"*** was described as having moderate levels of food insecurity, corruption and GDP PC PPP, whereas inequality was relatively low. This group includes various European countries, both Southern and Eastern, and countries from all over Asia. Except Jordan, all states in this group were previously socialist (BenYishay & Grosjean, 2014; Sneath, 2006). Therefore, its title derived from its political history and mediocre characteristics.

Group 6 named the ***"Select Superiors"*** was characterized by moderate levels of food insecurity, corruption, GDP PC PPP, and high inequality. Its description is almost identical to the *Satisfactory Socialists*; however, both groups differ considerably regarding levels of equality. This group is composed of numerous South American countries and bordering Central American countries. Furthermore, it contains the only two South African countries of our sample, as well as two emerging and developing Asian countries (United Nations, 2013). The majority of these countries have high economic performances when compared to others in their region (The World Bank Group, 2016b). Therefore, this group's name aimed to reflect the strong performance of its members.

Group 2 or the ***"Disappointing Socialists"*** was described as having moderate levels of food insecurity, high corruption, low GDP PC PPP and low inequality. Despite being described with similar levels of food insecurity as the *Satisfactory Socialists* and *Select Superiors*, its levels of corruption and GDP PC PPP are worse off. This group is mostly comprised of previously socialist Eastern European countries and Middle Eastern countries (BenYishay & Grosjean, 2014; Florian & Zidas, 2003; United Nations, 2013). Many of these post-socialist countries (Moldova, Ukraine, Albania) were found to have a poor progression of economic reforms, calculated by governance and other indicators during their post-socialist era (BenYishay & Grosjean, 2014). These weak reforms may

explain why this group's characteristics are worse off than the *Satisfactory Socialists*, from which derived its name.

Group 7, also known as the ***"Nearly Unrighteous"***, was characterized by a high prevalence of food insecurity, high corruption, low GDP PC PPP and moderate inequality, which are mostly unfavourable characteristics. It consists of a series of Sub-Saharan African countries and Asian countries (United Nations, 2013). Both are regions that are identified as having the highest prevalence and number of undernourishment respectively, which is reflected by a high prevalence of food insecurity within this group (Food and Agriculture Organization et al., 2014). Thus, its name represents its undesirable characteristics, which are slightly superior to those of the final group.

Group 5 named ***"Unrighteous"*** was described as having the least favourable characteristics. This group was characterized by a high prevalence of food insecurity, high corruption, low GDP PC PPP and high inequality. Its characteristics are similar to those of the *Nearly Unrighteous*; however, the *Unrighteous* group has higher inequality. It contains numerous African, Central American and a few Asian (the Philippines, Vietnam, Uzbekistan) countries, which are all regions presenting high rates of undernourishment (Food and Agriculture Organization et al., 2014; United Nations, 2013). Furthermore, it contains two South American (Bolivia and Paraguay) countries that have the lowest economic performance of their region (The World Bank Group, 2016b; United Nations, 2013). This group's name aims to reflect its characteristics, which are the least desirable from this sample.

All of these groups are presented in the NMDS graph. When examining the plot graph there is a clear polarization between the *Righteous* and *Unrighteous* countries, demonstrating opposite characteristics found within these groups. Furthermore, all other groups are plotted between both of these extremes. This demonstrates a transition of these groups towards being *Righteous* or *Unrighteous*. These findings confirm expectations since industrialized countries, found within the *Righteous* group, have more sophisticated legal systems that limit opportunities for corruption (Bertok, 1999; Fan, Lin, & Treisman,

2009). In contrast, countries from the developing world, present in the *Unrighteous* group, usually have higher inequalities and lower incomes, which are conducive to corruption (Kaufmann & Vincente, 2011). Since corruption is evaluated by the way it is defined, this model finds *Righteous* countries to be grouped, because of lower levels of corruption, whereas the *Unrighteous* countries are grouped because they are in-line with the definition of corruption. However, corruption can be defined numerous ways, and this concept is still evolving. Therefore, this model may not be reflecting all types of corruption. Despite being limited to the mainstream definition of corruption, the findings generated from the NMDS contribute a valid grouping of countries that preserves their unique characteristics.

4.6.3 FOOD INSECURITY AND CORRUPTION WITHIN SUBDIVIDED GROUPS OF COUNTRIES

For each group, regression analyses were conducted to assess if the global trend were the same within subgroups. When controlling for socio-demographic and country characteristics, corruption was only a significant determinant of food insecurity within the *Disappointing Socialists, Nearly Unrighteous* and *Unrighteous* countries. This creates a diagonal division of the NMDS graph, from the bottom left to the top right of the plot. Interestingly, these were the only three groups characterized as having high levels of corruption. On the other hand, the association between corruption and food insecurity was insignificant, or unknown, for the *Righteous, Nearly Righteous, Satisfactory Socialists* and *Select Superiors* groups.

These findings suggest that corruption may be a significant predictor of food insecurity when it is widespread within countries. However, when levels of corruption are less pronounced, it's possible that other socio-demographic and country characteristics are better predictors of food insecurity. Also, it is possible that lower corruption corresponds to fewer aspects of overall governance being compromised. Thus, food security governance, which is a component of overall governance, might be unaffected in groups that have less corruption.

Furthermore, these findings may be reflecting different types of corruption. As previously stated, developing countries have higher rates of illegal corruption from which higher income countries are usually sheltered. The sophisticated legal systems in place in the industrialized world limits illegal corruption but does not eliminate the possibility of legal corruption (Bertok, 1999; Fan et al., 2009; Kaufmann & Vincente, 2011). Therefore, it's possible that these reflect the interaction between legal corruption and food insecurity within groups with low to moderate corruption, and that this association is insignificant. However, this study is unable to differentiate the types of corruption in countries, which would provide support to this theory.

Finally, insignificant findings may be attributed to the role that corruption plays in these countries. Although corruption has often taken a negative connotation, it's very cultural and contextual practice. Therefore, in countries where corruption was not a significant predictor of food insecurity, it's possible that this practice is a way of conducting business rather than a hindrance to society. Thus, despite some limitations, these results provide new insight on the association between corruption and food insecurity.

The findings of this research conflict with a previous study where corruption was only associated with food insecurity within least corrupt countries (Uchendu & Abolarin, 2015). However, these inconsistencies may be attributed to the different research model used for each study. Since both designs used the same measure of corruption, the conflicting results are most likely produced by the use of different measures of food security and grouping of countries. Uchendu & Abolarin (2015) measured food insecurity at a national level, using a composite indicator. This tool may lead to imprecise data, due to loss of information. In contrast, our study used an individual indicator to assess food insecurity which preserves the depth of analysis (Jackson, Best, & Richardson, 2006). Furthermore, the FIES has been validated worldwide and is an accurate measure of the access dimension of food security (Cafiero et al., 2015). It captures physical and psychological aspects of food insecurity and can identify the level of severity (Ballard et al., 2013; Cafiero et al., 2014). In contrast, it is unclear which dimensions or aspects of

food insecurity are measured in the previous study because their tool is of composite indicator that combines a variety of food security measures, provided by numerous data sources. Therefore, it's possible that these tools gave different appreciations of food security status, which may explain the conflicting findings. Furthermore, Uchendu & Abolarin (2015) imposed groups to their countries, categorizing them as either 1) Least Corrupt or 2) Most Corrupt (Uchendu & Abolarin, 2015). In contrast, our study allowed 7 groups to from organically, which were described with three levels of corruption. Therefore, the different number of groups and categorization of corruption within both studies may explain the different findings. Overall, these variations may explain why the previous study did not detect significance for Most Corrupt Countries. However, due to the novelty of this topic, there are currently no other studies that can be used for comparison. Nevertheless, our study uses a measure of food insecurity supported by the United Nations, and uses country groups that were formed naturally providing validity and strong support for our findings.

In addition to being the only groups with high corruption, the *Disappointing Socialists, Nearly Unrighteous* and *Unrighteous* countries were also the only groups categorized as having low GDP PC PPP. These results suggest that lower income countries may be more vulnerable to corruption, which explains why corruption was significantly associated to food insecurity. Interestingly, lower income countries have a reduced availability of social protection programs. Such programs help provide monetary assistance, health services, and education to vulnerable populations, which are all determinants of food security (Ginneken, 2003). Therefore, these programs may serve as a buffer to the effects of corruption on food security. However, the absence of such programs in low-income countries may increase the vulnerability of their populations to food insecurity. Previous studies have also shown that corruption has a negative impact on a country's growth (Mauro, 1995). Thus, it may partly be responsible for these countries' low GDP PC PPP and therefore increase food insecurity. However, causality cannot be determined because this study is cross-sectional.

Also, amongst *Disappointing Socialists, Nearly Unrighteous* and *Unrighteous*, regression analyses demonstrated that groups described with higher inequality had a smaller association between corruption and food insecurity. *Disappointing Socialists* had the largest regression estimate for food insecurity and corruption, and were described with the lowest inequality. In contrast, the *Unrighteous* countries had the lowest regression estimate for food insecurity and corruption, and were described with the highest inequality. These findings suggest that in countries with low inequality, corruption will have a greater impact on food insecurity. In countries with high inequality, the unequal distribution of incomes may be a greater determinant of food insecurity than corruption. However, the literature has shown corruption to be a determinant of inequality within countries (Gupta et al., 2002). Therefore, the effect of higher inequality on food insecurity may be partly attributed to the presence of corruption.

Regression analyses also found the Gini coefficient to be a significant determinant of food insecurity throughout all groups. However, GDP PC PPP was only a significant determinant for the *Righteous, Select Superiors, Disappointing Socialists,* and *Unrighteous* countries. Some groups revealed that an increase in GDP PC PPP improved food insecurity whereas others proved the opposite. More specifically, for the *Select Superiors* and *Disappointing Socialists*, increases in GDP PC PPP were significantly associated with increases in food insecurity. When investigating these groups' characteristics, *Disappointing Socialists* had the highest average GDP of the all the groups described as having low GDP PC PPP. *Select Superiors* had the lowest average GDP of all the groups described as having moderate GDP PC PPP. It is possible that when a country has a GDP within these ranges, that its interactions with corruption, socio-demographic and country characteristics has an unfavourable effect on food insecurity. However, due to the limitations of this study, further investigations will be required to understand this phenomenon.

In summary, corruption has been found to increase food insecurity in highly corrupt and low-income countries. These findings provide a unique insight on this topic

and are initial steps in the exploratory process of understanding how food insecurity and corruption interact. Overall, these emphasize the need to better understand and address corruption within the frame of food insecurity interventions. Therefore, these results can be used as a fuel for future research and will inform our approaches when tackling world hunger.

4.6.4 LIMITATION

This study is subject to some limitations, including the tool used to measure corruption. Corruption is a growing and changing concept, for which there is no gold standard measure. This study uses a corruption perception index, which is a tool that has previously been criticized for a lack of credibility. Since there are differences between perception and reality, this tool may wrongfully depict levels of corruption (June et al., 2008).

Also, the perception index used in this study does not differentiate types of corruption. Industrialized countries have been found to engage in legal corruption, as well as illegal corruption within other countries (Kaufmann & Vincente, 2011; Kaufmann, 2004). However, it is unclear if this index captures these forms of corruption. This limits our ability to determine if variations in corruption have different association with food insecurity. Also, this tool focuses on corruption within the public sector. Therefore, it does not investigate how corruption within the private sector interacts with food insecurity.

Furthermore, the tool used to assess corruption only measures the output of a governance system. These findings are less actionable because they do not measure inputs, making it impossible to identify and therefore rectify specific failures in the governance system (June et al., 2008).

Finally, this is a cross-sectional study making it impossible to establish causation. Therefore, we cannot make inferences from these findings, which reduce the depth of analysis of this phenomenon.

4.6.5 CONCLUSION

This study sought to explore the association between food insecurity and corruption. Our findings demonstrate that an increase in corruption is found to be a significant predictor of food insecurity on a global scale. More specifically, corruption increases food insecurity within highly corrupt and low-income countries. These results are supported by a strong research model, which uses nationally representative samples and internationally validated tools. Overall, our findings provide information on an unexplored topic. This enhances our understanding of food security governance and overall governance, and promotes accountability within countries. Corruption is a contextual and cultural practice for which there is no silver bullet. Therefore, to tackle food insecurity, it is important to understand how it interacts with corruption within different contexts. This will help create suitable policies and interventions, which aim to achieve the sustainable development goal for food security. For future studies, it is recommended to measure corruption using input measures rather than outputs of governance systems. This will provide findings that are more actionable. Also, it is recommended that types of corruption be differentiated, which will enhance our understanding of the topic at hand. Despite limitations, this study highlights the importance of addressing corruption when creating an intervention to tackle food insecurity**.** These findings open the door for future research on this topic and will generate new approaches to address food insecurity in the global fight against hunger.

4.7 TABLES

Table 2. Socio-Demographic Characteristics of the Population and their Prevalence of Food Insecurity (n=115 379)

	Food insecure (%)
Socio-demographic characteristics	
Gender* **	
Female	47.3±0.9
Male	41.7 ±0.9
Age* **	
15 to 17 y.o.	39.4±2.4
18 to 64 y.o.	45.8±0.7
65 and older	36.3±2.0
Highest level of education attained* **	
Completed elementary education or less (up to 8 years of basic education)	59.4±1.0
Completed secondary education and beyond	32.2±0.8
Employment Status * **	
Unemployed	60.2±2.6
Part-time employed	47.7±1.6
Full-time employed	42.4±1.0
Out of workforce	43.7±1.0
Household Income Per Capita* **	
$ 0 – $ 4,999	49.5±0.7
$ 5,000 – $ 9,999	22.8±0.8
$ 10,000 – $14,999	18.4±1.3
$ 15,000 – $19,999	11.9±1.3
$ 20,000 or more	14.9±1.2

Chi-square *= p<0.05; **= p<0.01; ***= p<0.001; N.S: not-significant.

Source: Weighted data analysis of the Gallup survey, August 2014.

Figure 2. Model II Regression, with Slope of Major Axis, for Ranked Food Insecurity Prevalence and Ranked Perceived Corruption Score (n=118 countries)

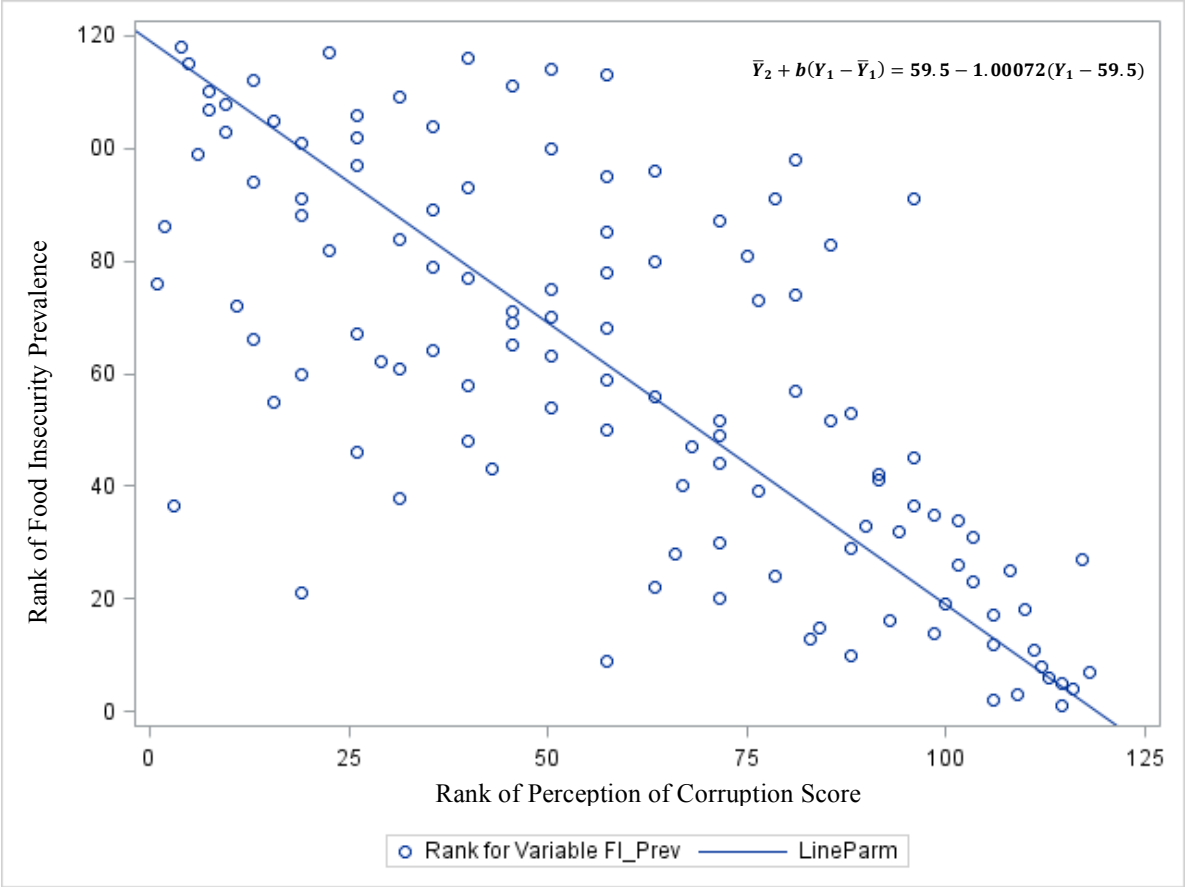


Figure 3. Nonparametric Regression: Loess Curve for Food Insecurity Prevalence and Corruption Perception Score (n=118 countries)

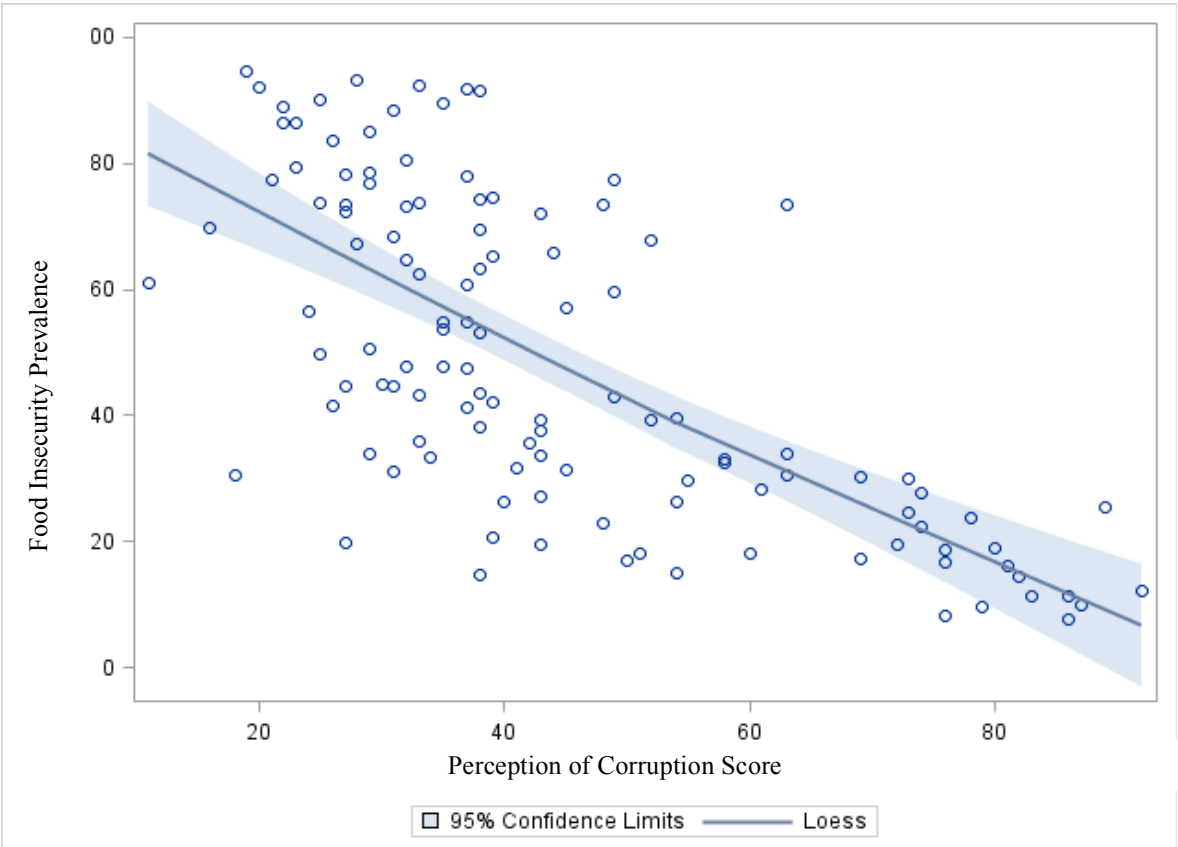
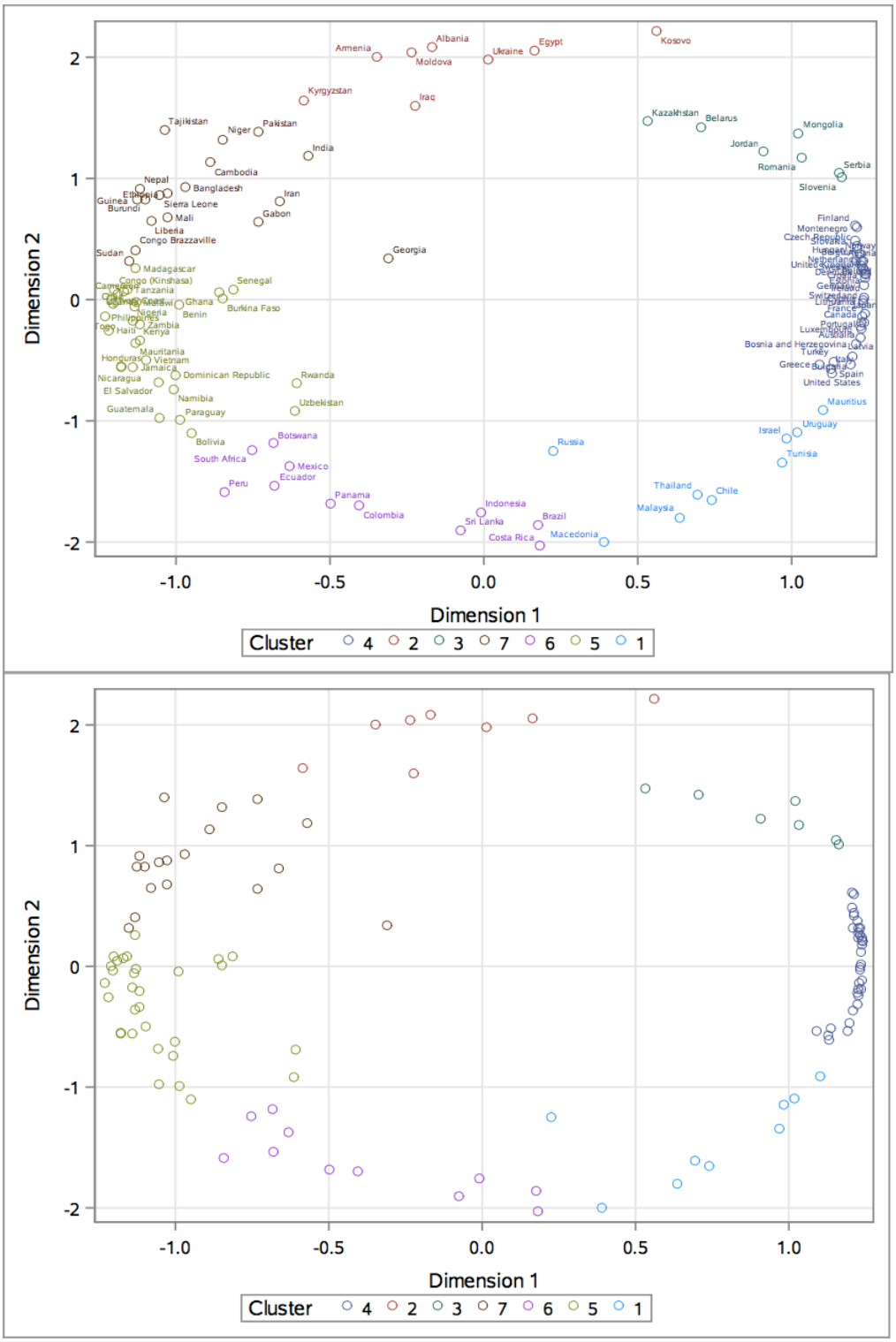


Table 3. Cumulative Logit Model for the Probability of Food Insecurity on a Global Scale (n=115 379)

Coefficients		Estimate (β)	
Corruption Score		-0.24	***
GDP PC PPP		-0.25	***
Gini		0.30	***
Gender			
	Female	0.08	***
	Male (Reference)		
Age		0.05	***
Employment			
	Unemployed	0.67	***
	Part-Time Employed	0.20	***
	Out of Work Force	0.01	
	Full-Time Employed (Reference)		
Income		-0.32	***
Education			
	Elementary	1.00	***
	Secondary	0.52	***
	University (Reference)		
Interactions			
	GDP:Gini	-0.11	***
	GDP:Corruption	0.11	***
	Gini:Corruption	0.07	***

Significance:*= p<0.05; **= p<0.01; ***= p<0.001; N.S: not-significant.
Note: The estimate is the coefficient in log-odds form. Abbreviated terms include: Gross-Domestic Product per Capita on Purchasing Price Parity (GDP PC PPP). Variables that were transformed include Age (scaled), Income (lg10), GDP PC PPP (lg10 and scaled), Gini (lg10 and scaled) and CS (lg10 and scaled). Dependant variable (0 food secure, 1 mildly food insecure, 2 moderately food insecure, 3 severely food insecure).
Source: Gallup survey, August 2014; World Bank (GDP), 2014; World Bank (Gini), 2000 – 2013; Transparency International, 2014.

Figure 4. Non-Metric Multidimensional Scaling of Variables on a Country Level (n=118 countries)



Legend	
Group 4	*Righteous*
Group 1	*Nearly Righteous*
Group 3	*Satisfactory Socialists*
Group 6	*Select Superiors*
Group 2	*Disappointing Socialis*
Group 7	*Nearly Unrighteous*
Group 5	*Unrighteous*

Note: Data included in this model are Food Insecurity Prevalence, GDP PC PPP, Gini Index and CS**.** Group names are described in the discussion. The points plotted on this 2-dimensional graph express the similarity/dissimilarity between entities. Both dimensions are similar to geographical locations (ex: South and West), where the distances between points represent their dissimilarity.
Source: Gallup survey, August 2014; World Bank (GDP), 2014; World Bank (Gini), 2010 – 2013; Transparency

Table 4. Groups of Countries Generated by Non-Metric Multidimensional Scaling

Group 4	Group 1	Group 3	Group 6	Group 2	Group 7	Group 5
Righteous	**Nearly Righteous**	**Satisfactory Socialists**	**Select Superiors**	**Disappointing Socialists**	**Nearly Unrighteous**	**Unrighteous**
(n=34)	**(n=9)**	**(n=7)**	**(n=11)**	**(n=8)**	**(n=18)**	**(n=31)**
Australia	Chile	Belarus	Botswana	Albania	Bangladesh	Benin
Austria	Israel	Jordan	Brazil	Armenia	Burundi	Bolivia
Belgium	Macedonia	Kazakhstan	Colombia	Egypt	Cambodia	Burkina Faso
Bosnia and Herzegovina	Malaysia	Mongolia	Costa Rica	Iraq	Congo Brazzaville	Cameroon
Bulgaria	Mauritius	Romania	Ecuador	Kosovo	Ethiopia	Chad
Canada	Russia	Serbia	Indonesia	Kyrgyzstan	Gabon	Congo (Kinshasa)
Croatia	Thailand	Slovenia	Mexico	Moldova	Georgia	Dominican Republic
Cyprus	Tunisia		Panama	Ukraine	Guinea	El Salvador
Czech Republic	Uruguay		Peru		India	Ghana
Denmark			South Africa		Iran	Guatemala
Estonia			Sri Lanka		Liberia	Haiti
Finland					Mali	Honduras
France					Nepal	Ivory Coast
Germany					Niger	Jamaica
Greece					Pakistan	Kenya
Hungary					Sierra Leone	Madagascar
Ireland					Sudan	Malawi
Italy					Tajikistan	Mauritania
Japan						Namibia
Latvia						Nicaragua
Lithuania						Nigeria
Luxembourg						Paraguay
Montenegro						Philippines
Netherlands						Rwanda
Norway						Senegal
Poland						Tanzania
Portugal						Togo
Slovakia						Uganda
Spain						Uzbekistan
Sweden						Vietnam
Switzerland						Zambia
Turkey						
United Kingdom						
United States						

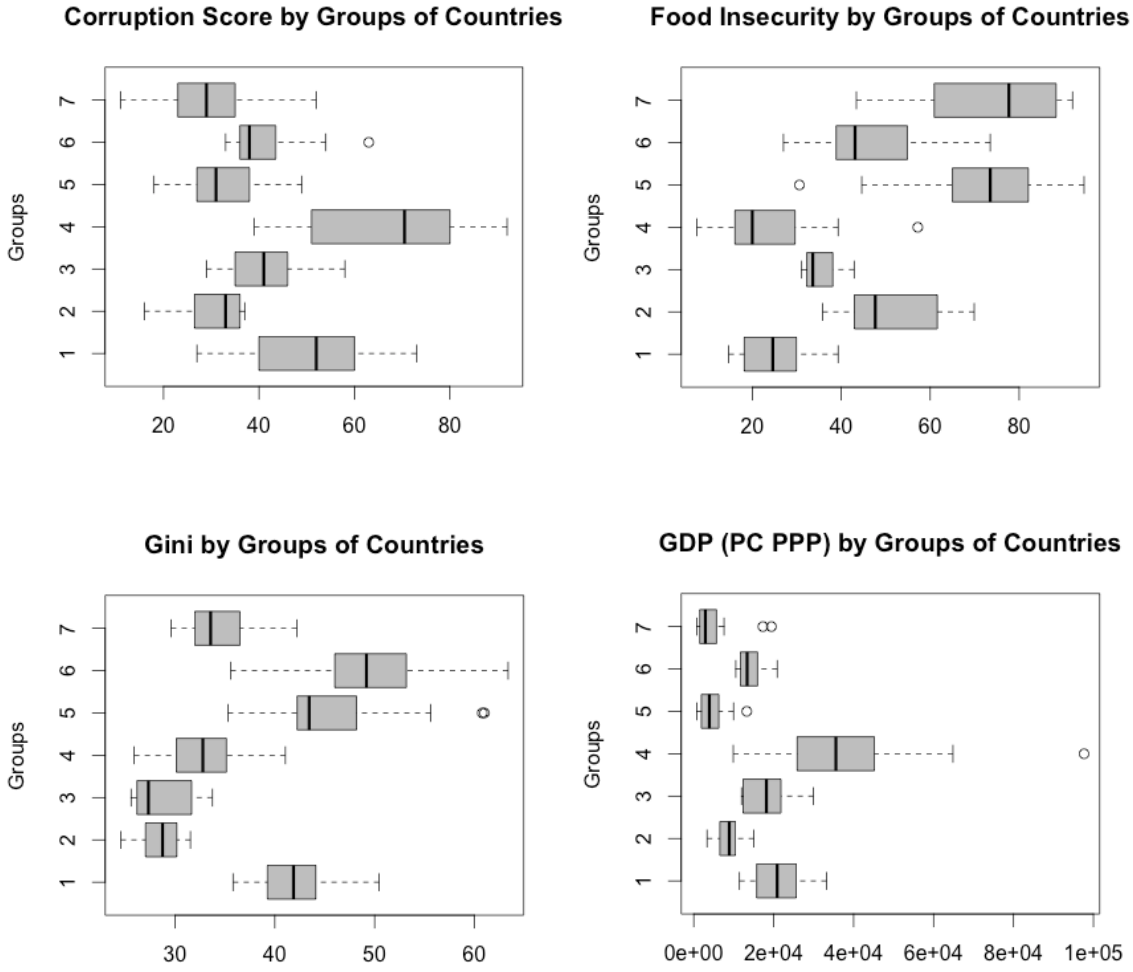
Note: Group names are described in the discussion.

Table 5. Description Table of Groups Formed by Non-Metric Multidimensional Scaling (n=118 countries)

	Food Insecurity		Corruption		GDP PC PPP		Gini	
Multidimensional scaling cluster groups								
Group 4 – *Righteous*	Low	22.62±1.83	Low	66.68±2.78	High	36,969.65±2,862.09	Mod	32.45±0.65
Group 1 – *Nearly Righteous*	Low	24.36±2.74	Mod	51.33±5.22	Mod	20,736.98±2,298.98	High	42.00±1.58
Group 3 – *Satisfactory Socialists*	Mod	35.47±1.87	Mod	41.43±3.79	Mod	18,347.49±2,598.62	Low	28.91±1.34
Group 6 – *Select Superiors*	Mod	47.67±4.24	Mod	41.45±2.80	Mod	14,210.93±942.37	High	49.58±2.50
Group 2 – *Disappointing Socialists*	Mod	51.26±4.16	High	30.50±2.53	Low	8,755.68±1,265.06	Low	28.50±0.80
Group 7 – *Nearly Unrighteous*	High	73.17±3.85	High	29.33±2.12	Low	4,474.66±1,260.11	Mod	34.45±0.83
Group 5 – *Unrighteous*	High	71.99±2.72	High	32.23±1.48	Low	4,475.25±557.58	High	45.47±1.12

Table Values: Mean (±SE)
Note: Means were classified as low, moderate or high values. Colouring represents favourable characteristics (light grey – most favourable to dark grey – least favourable). Group names are described in the discussion.
Source: Gallup survey, August 2014; World Bank (GDP), 2014; World Bank (Gini), 2010 – 2013; Transparency International, 2014.

Figure 5. Box Plot Description of Groups formed by Non-Metric Multidimensional Scaling (n=118 countries)



Source: Gallup survey, August 2014; World Bank (GDP), 2014; World Bank (Gini), 2010 – 2013; Transparency International, 2014.

Table 6. Cumulative Logit Modelling for the Probability of Food Insecurity within Groups (n= 115 379)

	Estimate (β)													
Coefficients	**Group 4**		**Group 1**		**Group 3**		**Group 6**		**Group 2**		**Group 7**		**Group 5**	
	Righteous		**Nearly Righteous**		**Satisfactory Socialists**		**Select Superiors**		**Disappointing Socialists**		**Nearly Unrighteous**		**Unrighteous**	
	(n=32 081)		**(n=9 774)**		**(n=6 626)**		**(n=10 744)**		**(n=7 662)**		**(n=19 208)**		**(n=29 284)**	
Corruption Score	0.02		-0.04		-0.04		0.03		-0.44	***	-0.36	***	-0.23	***
GDP PC PPP	-0.28	***	-0.13		0.38		0.30	*	0.19	**	-0.46	***	-0.29	***
GINI	0.48	***	0.68	***	0.41	**	0.57	***	0.48	***	1.47	***	0.83	***
Gender														
Female	0.16	***	0.07		0.23	***	0.07		0.32	***	0.03		0.07	***
Male (Ref)	-		-		-		-		-		-		-	
Age	-0.08	***	0.01		0.12	***	0.01		0.29	***	0.11	***	0.10	***
Employment														
Unemployed	1.07	***	0.87	***	0.55	***	0.63	***	0.61	***	0.35	***	0.44	***
Part-Time Employed	0.16	***	0.12		0.00		0.38	***	0.07		0.20	***	0.08	**
Out of Work Force	0.16	***	0.02		0.11		-0.04		-0.54	***	-0.05		-0.14	***
Full-Time Employed (Ref)	-		-		-		-		-		-		-	
Income	-0.35	***	-0.29	***	-0.45	***	-0.43	***	-0.51	***	-0.31	***	-0.27	***
Education														
Elementary	0.96	***	0.82	***	0.92	***	1.22	***	0.96	***	1.27	***	1.05	***
Secondary	0.54	***	0.38	***	0.48	***	0.72	***	0.50	***	0.70	***	0.57	***
University (Ref)	-		-		-		-		-		-		-	

Significance:*= p<0.05; **= p<0.01; ***= p<0.001; N.S: not-significant.
Note: The estimate is the coefficient in log-odds form. Abbreviated terms include: Gross-Domestic Product per Capita on Purchasing Price Parity (GDP PC PPP), Reference (Ref). Variables that were transformed include Age (scaled), Income (lg10), GDP PC PPP (lg10 and scaled), Gini (lg10 and scaled) and CS (lg10 and scaled). Dependant variable (0 food secure, 1 mildly food insecure, 2 moderately food insecure, 3 severely food insecure). Group names are described in the discussion.
Source: Gallup survey, August 2014; World Bank (GDP), 2014; World Bank (Gini), 2000 – 2013; Transparency International, 2014.

CHAPTER 5: FINAL CONCLUSIONS

This study sought to explore the association between food insecurity and corruption. Although corruption, or bad governance, has been suggested to increase food insecurity, there was previously an absence of reliable evidence proving this interaction on a global scale. Therefore, this study was essential in providing support for this relationship.

Overall, we found that an increase in corruption is found to be a significant predictor of food insecurity on a global scale. More specifically, corruption increases food insecurity within highly corrupt and low-income countries. Furthermore, these findings were supported by a strong research model, which used an internationally validated measure of food insecurity, a sample that is representative of the world's population, and assessed information on an individual level. This combination of favourable characteristics allows these findings to be generalized to the global scale.

Furthermore, since the theoretical background on this topic was previously missing empirical evidence, these findings contribute new information that furthers our understanding of food security governance and overall governance. This can influence policies by promoting accountability within countries, in regards to poor governance and food security. It is important to highlight that there is no silver bullet for corruption. It is a contextual and cultural practice. Therefore, when addressing food insecurity, it is important to understand how it interacts with corruption within different contexts to create suitable policies and interventions. With these new findings, we can inform and tailor future policies, and work towards reaching the sustainable development goal of achieving food security on a global scale.

For future studies, it is recommended that corruption be assessed through input measures rather than outputs of systems of governance. By using input measures, it will be possible to identify specific failures in governance that are impeding on food security. This type of information is more actionable and could be used to establish interventions

and policies. Also, it is recommended that types of corruption, such as legal and illegal, and public and private, be differentiated. This will provide another layer of information, enhancing our understanding of food security and corruption.

Overall, this study highlights the importance of considering corruption when creating interventions to tackle food insecurity. By addressing corruption within interventions, this will enhance food security governance and overall governance, thus helping to reduce hunger. Food security is often placed on the international agenda; however, there is a failure to address corruption within both the Millennium Development Goals and Sustainable Development Goals. To mobilize international efforts to eradicate hunger, we need to start looking at national and international system issues that may impact food security. Thus, we need to start placing corruption, a problem that is of global proportion, as an international priority. These findings will potentially open the door for future research on this topic and help address food security in the global fight against hunger.

APPENDICES

6.1 APPENDIX A – FOOD INSECURITY EXPERIENCE SCALE

GLOBAL FOOD INSECURITY EXPERIENCE SCALE ***Individually Referenced***	
Now I would like to ask you some questions about food. During the last 12 MONTHS, was there a time when:	
Q1. You were worried you would not have enough food to eat because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused
Q2. Still thinking about the last 12 MONTHS, was there a time when you were unable to eat healthy and nutritious food because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused
Q3. You ate only a few kinds of foods because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused
Q4. You had to skip a meal because there was not enough money or other resources to get food?	0 No 1 Yes 98 Don't Know 99 Refused
Q5. Still thinking about the last 12 MONTHS, was there a time when you ate less than you thought you should because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused
Q6. Your household ran out of food because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused
Q7. You were hungry but did not eat because there was not enough money or other resources for food?	0 No 1 Yes 98 Don't Know 99 Refused
Q8. You went without eating for a whole day because of a lack of money or other resources?	0 No 1 Yes 98 Don't Know 99 Refused

(Ballard et al., 2013)

BIBLIOGRAPHY

Anderson, S. A. (1990). Core indicators of nutritional state for difficult-to-sample populations. *The Journal of Nutrition*, *120*(11), 1559–1600.

Anik, A. R., Manjunatha, A. V., & Bauer, S. (2013). Impact of farm level corruption on the food security of households in Bangladesh. *Food Security*, *5*, 565–574. doi:10.1007/s12571-013-0282-8

Aziz, T. A. (2001, August). Governance and Food Security: Acting in the Public Interest? - The Impact of Corruption on Food Security. *Panel discussion conducted at the Sustainable Food Security for All by 2020 Conference*. Bonn, Germany.

Azmat, F., & Coghill, K. (2005). Good governance and market-based reforms: a study of Bangladesh. *International Review of Administrative Sciences*, *71*(4), 625–638. doi:10.1177/0020852305059602

Ballard, T. J., Kepple, A. W., & Cafiero, C. (2013). *The Food Insecurity Experience Scale Development of a Global Standard for Monitoring Hunger Worldwide* (pp. 1–61). Rome.

Ben-Davies, M. E., Kinlaw, A., Estrada Del Campo, Y., Bentley, M. E., & Siega-Riz, A. M. (2013). Risk factors associated with the presence and severity of food insecurity in rural Honduras. *Public Health Nutrition*, *17*(1), 5–13. doi:10.1017/S1368980013002048

BenYishay, A., & Grosjean, P. (2014). Initial endowments and economic reform in 27 post-socialist countries. *Journal of Comparative Economics*, *42*(4), 892–906. doi:10.1016/j.jce.2014.04.008

Bertok, J. (1999). OECD Supports the Creation of Sound Ethics Infrastructure: OECD Targets Both the "Supply Side" and the "Demand Side" of Corruption. *Public Personnel Management*, *28*(4), 673–687.

Boyd, M., & Wang, H. H. (2011). The role of public policy and agricultural risk management in food security Public policy: implications for food security. *China Agricultural Economic Review*, *3*(4), 1–7. doi:10.1108/caer.2011.40603daa.001

Cafiero, C., Melgar-Quinonez, H. R., Ballard, T. J., & Kepple, A. W. (2014). Validity and reliability of food security measures. *Annals of the New York Academy of Sciences*, *1331*(2014), 230–248. doi:10.1111/nyas.12594

Cafiero, C., Nord, M., Viviani, S., del Grossi, M. E., Ballard, T., Kepple, A., Miller, M., Nwosu, C. (2015). *Methods for estimating comparable prevalence rates of food insecurity experienced by adults in 147 countries.* (pp. 1–60). Rome.

Camacho, A., & Conover, E. (2011). Manipulation of Social Program Eligibility. *American Economic Journal: Economic Policy*, *3*(2), 41–65. doi:10.1257/pol/3.2.41

Candel, J. J. L. (2014). Food security governance: a systematic literature review. *Food Security*, *6*, 585–601. doi:10.1007/s12571-014-0364-2

Clark, K. R., & Warwick, R. M. (2001). *Change in Marine Communities: An Approach to Statistical Analysis and Interpretation* (pp. 1–176). Plymouth: PRIMER-E.

Coates, J., Frongillo, E. A., Rogers, B. L., Webb, P., Wilde, P. E., & Houser, R. (2006). Commonalities in the experience of household food insecurity across cultures: what are measures missing? *The Journal of Nutrition*, 1438S–1448S.

Coleman-Jensen, A., Rabbitt, M. P., Gregory, C., & Singh, A. (2015). *Household Food Security in the United States in 2014* (pp. 1–43). Retrieved from www.ers.usda.gov/publications/err-economic-research-report/err194.aspx

Conceição, P., Fuentes-Nieva, R., Horn-Phathanothai, L., & Ngororano, A. (2011). Food Security and Human Development in Africa: Strategic Considerations and Directions for Further Research. *African Development Review*, *23*(2), 237–246.

Cook, J. T., & Frank, D. A. (2008). Food Security, Poverty, and Human Development in the United States. *Annals of the New York Academy of Sciences*, *1136*, 193–209. doi:10.1196/annals.1425.001

Dávila, O. G. (2010). Food security and poverty in Mexico: the impact of higher global food prices. *Food Security*, *2*, 383–393. doi:10.1007/s12571-010-0077-0

De Muro, P., & Burchi, F. (2007). *Education for Rural People and Food Security: A Cross Country Analysis* (pp. 1–68). Rome. Retrieved from http://www.fao.org/docrep/010/a1434e/a1434e00.htm

Deaton, J. B., & Lipka, B. (2015). Political Instability and Food Security. *Journal of Food Security*, *3*(1), 29–33. doi:10.12691/jfs-3-1-5

Delavallade, C. (2006). Corruption and distribution of public spending in developing countries. *Journal of Economics and Finance*, *30*(2), 222–239. doi:10.1007/BF02761488

Dincer, O., & Johnston, M. (2015). *Measuring Illegal and Legal Corruption in American States: Some Results from the Edmond J. Safra Center for Ethics Corruption in America Survey* (No. 58) (pp. 1–41).

Duncan, J. (2015). *Global Food Security Governance - Civil Society Engagement in the Reformed Committee on World Food Security* (pp. 1–242). Abingdon: Routledge Taylor & Francis Group.

Fan, S. C., Lin, C., & Treisman, D. (2009). Political decentralization and corruption: Evidence from around the world. *Journal of Public Economics*, *93*, 14–34. doi:10.1016/j.jpubeco.2008.09.001

Florian, B., & Zidas, D. (2003). *Understanding the War in Kosovo* (pp. 1–353). London, Portland: Frank Cass Publishers.

Food and Agriculture Organization. (n.d.). The right to food [Fact Sheet]. Retrieved from http://www.fao.org/worldfoodsummit/english/fsheets/food.pdf

Food and Agriculture Organization. (1996). Rome Declaration on World Food Security and World Food Summit Plan of Action. In *World Food Summit* (pp. 1–36). Retrieved from http://www.fao.org/docrep/003/w3613e/w3613e00.HTM

Food and Agriculture Organization. (2008). An Introduction to the Basic Concepts of Food Security [Fact Sheet]. Retrieved from http://www.fao.org/docrep/013/al936e/al936e00.pdf

Food and Agriculture Organization. (2011). Good Food Security Governance: The Crucial Premise to the Twin-Track Approach. In *ESA Workshop*. Rome.

Food and Agriculture Organization. (2012). *Decent rural employment for food security: A case for action* (pp. 1–42). Rome. Retrieved from http://www.fao.org/docrep/015/i2750e/i2750e00.pdf

Food and Agriculture Organization. (2014a). FAO's Strategic Objective 3: Reduce rural poverty [Fact Sheet]. Retrieved from http://www.fao.org/3/a-i3872e.pdf

Food and Agriculture Organization. (2014b). *Mitigation of Food Wastage - Societal Costs and Benefits* (pp. 1–54).

Food and Agriculture Organization. (2015). The State of Food Insecurity in the World 2015 - Glossary Selected Terms. Retrieved from http://www.fao.org/hunger/glossary/en/

Food and Agriculture Organization, International Fund for Agricultural, & World Food Programme. (2014). *The State of Food Insecurity in the World 2014 - Strengthening the enabling environment for food security and nutrition.* Rome: Food and Agriculture Organization.

Food and Agriculture Organization, International Fund for Agricultural, & World Food Programme. (2015). *The State of Food Insecurity in the World - Meeting the 2015 international hunger targets: taking stock of uneven progress.* (pp. 1–62). Rome. doi:I4646E/1/05.15

Furness, B. W., Simon, P. A., Wold, C. M., & Asarian-Anderson, J. (2004). Prevalence and predictors of food insecurity among low-income households in Los Angeles County. *Public Health Nutrition*, *7*(6), 791–794. doi:10.1079/PHN2004608

Gallup Incorporated. (2014). *Worldwide Research Methodology and Codebook*.

Ginneken, W. van. (2003). Extending social security: Policies for developing countries. *International Labour Review*, *142*(3), 277–294. doi:10.1525/sp.2007.54.1.23.

Grindle, M. S. (2007). Good enough governance revisited. *Development policy review,* 25(5), 533-574.

Gupta, S., Davoodi, H. R., & Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? *Economics of Governance*, *3*, 23–45.

Hamilton, W. L., Cook, J. T., Thompson, W. W., Buron, L. F., Frongillo, E. A., Olson, C. M., & Wehler, C. A. (1995). *Household Food Security in the United States in 1995:*. *United States Department of Agriculture* (pp. 1–104). Retrieved from http://www.fns.usda.gov/sites/default/files/SUMRPT.PDF

Hardoon, D., & Heinrich, F. (2013). *Global Corruption Barometer 2013*. *Transparency International* (pp. 1–48). Retrieved from http://www.transparency.org/gcb2013/report

Hossain, N., Musembi, C. N., & Hughes, J. (2010). *Corruption, Accountability and Gender: Understanding the Connections* (pp. 1–48). Retrieved from http://www.undp.org/content/undp/en/home/librarypage/womens-empowerment/corruption-accountability-and-gender-understanding-the-connection.html

Humphries, D. L., Dearden, K. A., Crookston, B. T., Fernald, L. C., & Stein, A. D. (2015). Cross-Sectional and Longitudinal Associations between Household Food Security and Child Anthropometry at Ages 5 and 8 Years in Ethiopia, India, Peru, and Vietnam. *Journal of Nutrition*, 1924–1933. doi:10.3945/jn.115.210229.one

Ivers, L. C., & Cullen, K. A. (2011). Food insecurity : special considerations for women. *The American Journal of Clinical Nutrition*, *94*, 1740–1744. doi:10.3945/ajcn.111.012617.1

Jackson, C. H., Best, N., & Richardson, S. (2006). Improving ecological inference using individual-level data. *Statistics in Medicine*, *25*, 2136–2159. doi:10.1002/sim.2370

Johnson, J., & Mason, P. (2013). The Proxy Challenge: Why bespoke proxy indicators can help solve the anti-corruption measurement problem. *U4 Anti-Corruption Research Centre* (pp. 1–6). Retrieved from http://www.u4.no/publications/the-proxy-challenge-why-bespoke-proxy-indicators-can-help-solve-the-anti-corruption-measurement-problem/

June, R., Chowdhury, A., Heller, N., & Werve, J. (2008). *A User's Guide to Measuring Corruption*. *United Nations Development Programme* (pp. 1–81). Retrieved from http://www.undp.org/content/undp/en/home/librarypage/democratic-governance/anti-corruption/a-users-guide-to-measuring-corruption.html

Kaufmann, D. (2004). Corruption, Governance and Security: Challenges for the Rich Countries and the World. *SSRN Electronic Journal*, 83–102. doi:10.2139/ssrn.605801

Kaufmann, D., Kraay, A., & Zoido-Lobatón, P. (2000). Governance Matters - From Measurement to Action. *Finance and Development*, 10–13.

Kaufmann, D., Kraay, A., & Zoido-Lobatón, P. (2002). Governance Matters II: Updated Indicators for 2000/01 (Working Paper 2772). Retrieved from http://info.worldbank.org/governance/wgi/pdf/govmatters2.pdf

Kaufmann, D., & Vicente, P. C. (2011). Legal Corruption. *Economics and Politics*, *23*(2), 195–219. doi:10.1111/j.1468-0343.2010.00377.x

Ke, J., & Ford-Jones, E. L. (2015). Food insecurity and hunger: A review of the effects on children's health and behaviour. *Paediatrics & Child Health*, *20*(2), 89–91.

Lessig, L. (2013). "Institutional Corruption" Defined. *Journal of Law, Medicine & Ethics*, 553–555.

Liefert, W. (2004). *Food Security in Russia : Economic Growth and Rising Incomes are Reducing Insecurity*. *Food Security Assessment* (pp. 35–43).

Løvendal, C. R., Knowles, M., & Horii, N. (2004). Understanding Vulnerability to Food Insecurity Lessons from Vulnerable Group Profiling (ESA Working Paper 04-18). Retrieved from http://www.fao.org/docrep/007/ae220e/ae220e00.htm

Lumley, T. (2010). Chapter 5 Ratios and linear regression. In *Complex Surveys: A Guide to Analysis Using R.* (pp. 83–107). John Wiley & Sons, Inc.

Maitra, C., & Rao, D. S. P. (2015). Poverty-Food Security Nexus: Evidence from a Survey of Urban Slum Dwellers in Kolkata. *World Development*, *72*, 308–325. doi:10.1016/j.worlddev.2015.03.006

Maletta, H. (2014). *From hunger to food security: A conceptual history*. Lima, Peru. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2484166

Matheson, J., & McIntyre, L. (2014). Women respondents report higher household food insecurity than do men in similar Canadian households. *Public Health Nutrition*, *17*(1), 40–48. doi:10.1017/S136898001300116X

Mauro, P. (1995). Corruption and Growth. *The Quarterly Journal of Economics*, *110*(3), 681–712.

McKeon, N. (2015). *Food Security Governance - Empowering communities, regulating corporations* (pp. 1–246). Abingdon: Routledge Taylor & Francis Group.

Mehta, A., & Jha, S. (2012). Corruption, food subsidies, and opacity: Evidence from the Philippines. *Economics Letters*, *117*, 708–711. doi:10.1016/j.econlet.2012.07.023

Menkhaus, K. (2012). No access: Critical bottlenecks in the 2011 Somali famine. *Global Food Security*, *1*, 29–35. doi:10.1016/j.gfs.2012.07.004

Nord, M. (2014). *Introduction to Item Response Theory Applied to Food Security Measurement*. *Food and Agriculture Organization* (pp. 1–20). Rome.

Oldenburg, C., & Neef, A. (2014). Reversing Land Grabs or Aggravating Tenure Insecurity? Competing Perspectives on Economic Land Concessions and Land Titling in Cambodia. *The Law and Development Review*, *7*(1), 49–77. doi:10.1515/ldr-2014-0014

Olken, B. A. (2007). Monitoring Corruption: Evidence from a Field Experiment in Indonesia. *Journal of Political Economy, 115(2),* 200-249. doi:10.1086/517935

Organization for Economic Co-operation and Development. (2016a). History. Retrieved March 01, 2016, from http://www.oecd.org/about/history/

Organization for Economic Co-operation and Development. (2016b). List of OECD Member countries - Ratification of the Convention on the OECD. Retrieved March 09, 2016, from http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm

Pérez-Escamilla, R. (2012). Can experience-based household food security scales help improve food security governance? *Global Food Security*, *1*(2), 120–125. doi:10.1016/j.gfs.2012.10.006

Pérez-Escamilla, R., & Segall-Correa, A. M. (2008). Food insecurity measurement and indicators. *Revista de Nuticao*, *21*, 15S–26S.

Pritchard, B., Rammohan, A., & Sekher, M. (2013). Food Security as a Lagging Component of India's Human Development: A Function of Interacting Entitlement Failures. *South Asia: Journal of South Asia Studies*, *36*(2), 213–228. doi:10.1080/00856401.2012.739256

Radimer, K. L., Olson, C. M., & Campbell, C. C. (1990). Development of Indicators to Assess Hunger. *The Journal of Nutrition*, 1544–1548.

Radimer, K. L., Olson, C. M., Greene, J. C., Campbell, C. C., & Habicht, J.-P. (1992). Understanding Hunger and Developing Indicators to Assess it in Women and Children. *Journal of Nutrition Education*, *24*(1), 36S–44S. doi:10.1016/S0022-3182(12)80137-3

Rammohan, A., & Pritchard, B. (2014). The Role of Landholding as a Determinant of Food and Nutrition Insecurity in Rural Myanmar. *World Development*, *64*, 597–608.

Razafindrakoto, M., & Roubaud, F. (2005). How far can we trust expert opinions on corruption? An experiment based on surveys in francophone Africa. *Global Corruption Report 2005*, 292–295.

Riley, S. P. (1999). Petty corruption and development. *Development in Practice*, *9*(1-2), 189–193. doi:10.1080/09614529953368

Rosier, K. (2011). *Food insecurity in Australia: What is it, who experiences it and how can child and family services support families experiencing it?* (pp. 1–9).

Salinas-Jiménez, M. D. M., & Salinas-Jiménez, J. (2007). Corruption, efficiency and productivity in OECD countries. *Journal of Policy Modeling*, *29*, 903–915. doi:10.1016/j.jpolmod.2007.07.002

Sampford, C., Shacklock, A., Connors, C., & Galtung, F. (2006). *Measuring Corruption* [E-book version]. Burlington: Ashgate.

Scaramozzino, P. (2006). *Measuring Vulnerability to Food Insecurity* (ESA Working Paper 06-12). Retrieved from http://eprints.soas.ac.uk/9146/

Schwab, K. (2015). *The Global Competitiveness Report* (pp. 22–41). Retrieved from http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

Smith, L. C., Obeid, A. E., & Jensen, H. H. (2000). The geography and causes of food insecurity in developing countries. *Agricultural Economics*, *22*, 199–215. doi:10.1016/S0169-5150(99)00051-1

Sneath, D. (2006). Transacting and enacting: Corruption, obligation and the use of monies in Mongolia. *Ethnos*, *71*(1), 89–112. doi:10.1080/00141840600603228

Tanga, P. T., Monaheng, L. R. C., Matobo, T., & Abie, S. (2014). The Impact of Improved Road Infrastructure on the Livelihoods of Rural Residents in Lesotho : The Case of Phamong. *Studies of Tribes and Tribals*, *12*(2), 209–218.

Tanzi, V. (1998). *Corruption Around the World - Causes, Consequences, Scope, and Cues*. *International Monetary Funds* (Vol. 45, pp. 559–594).

Tanzi, V., & Davoodi, H. (1998). Chapter 4 - Corruption, Public Investment, and Growth. In *The Welfare State, Public Investment, and Growth* (Spinger-Verlag, pp. 41–60). Tokyo.

The World Bank. (1987). *Poverty and Hunger: Issues and Options for Food Security in Developing Countries* (pp. 1–397). Washington, DC.

The World Bank Group. (2013). *Living our Values* (pp. 1–48). Washington, DC.

The World Bank Group. (2016). Data Overview. Retrieved January 31, 2016, from http://data.worldbank.org/indicator/SI.POV.GINI

The World Bank Group. (2016b). GDP per capita, PPP (current international $). Retrieved January 31, 2016 from http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

The World Bank Group. (2016c). GINI index (World Bank estimate). Retrieved January 31, 2016, from http://data.worldbank.org/indicator/SI.POV.GINI

The World Bank Group. (2016d). Population, total. Retrieved October 8, 2015, from http://data.worldbank.org/indicator/SP.POP.TOTL

Timmer, C. P. (2000). The macro dimensions of food security: economic growth, equitable distribution, and food price stability. *Food Policy*, *25*, 283–295. doi:doi:10.1016/S0306-9192(00)00007-5

Transparency International. (2011). *TI-S Code of Conduct* (pp. 1–7). Retrieved from https://www.transparency.org/files/content/ouraccountability/TIS_CodeOfConduct_3_8_2011.pdf

Transparency International. (2015a). Corruption Perception Index 2014: In Detail. Retrieved October 08, 2015, from http://www.transparency.org/cpi2014/in_detail#myAnchor1

Transparency International. (2015b). Corruption Perceptions Index 2014: Technical Methodology Note. Retrieved October 08, 2015, from http://www.transparency.org/whoweare/organisation/faqs_on_corruption#defineCorruption

Transparency International. (2015c). What is Corruption? Retrieved September 28, 2015, from http://www.transparency.org/what-is-corruption/

Treisman, D. (2007). What Have We Learned About the Causes of Corruption from Ten Years of Cross-National Empirical Research? *Annual Review of Political Science*, *10*, 211–244. doi:10.1146/annurev.polisci.10.081205.095418

Uchendu, F. N., & Abolarin, T. O. (2015). Corrupt practices negatively influenced food security and live expectancy in developing countries. *Pan African Medical Journal*, *20*(110), 1–7. doi:10.11604/pamj.2015.20.110.5311

United Nations. (2004a). *The Global Programme Against Corruption : UN Anti-Corruption Toolkit* (pp. 1–592). Vienna.

United Nations. (2004b). *United Nations Handbook on Practical Anti-Corruption Measures for Prosecutors and Investigators* (pp. 1–219). Vienna. Retrieved from https://www.unodc.org/pdf/crime/corruption/Handbook.pdf

United Nations. (2013). Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings. Retrieved March 09, 2016, from http://unstats.un.org/unsd/methods/m49/m49regin.htm

United Nations. (2015a). *The Millennium Development Goals Report 2015* (pp. 1–75). doi:978-92-1-101320-7

United Nations. (2015b). Transforming our world: the 2030 Agenda for Sustainable Development - Proceedings of the seventieth session United Nations General Assembly (pp. 1–35).

Usfar, A. A., Fahmida, U., & Februhartanty, J. (2007). Household food security status measure by the US-Household Food Security/Hunger Survey Module (US-FSSM) is in line with coping strategy indicators found in urban and rural Indonesia. *Asia Pacific Journal of Clinical Nutrition*, *16*(2), 368–374.

Von Grember, K., Saltzman, A., Birol, E., Wiesmann, D., Prasai, N., Yin, S., Yohannes, Y., Menon, P., Thompson, J., Sonntag, A. (2014). *Global Hunger Index 2014* (pp. 1–54). Bonn, Washington, DC, Dublin. Retrieved from http://www.ifpri.org/publication/global-hunger-index-0?print

Walsh, C. M., & van Rooyen, F. C. (2015). Household Food Security and Hunger in Rural and Urban Communities in the Free State Province, South Africa. *Ecology of Food and Nutrition*, *54*, 118–137. doi:10.1080/03670244.2014.964230

Weaver, L. J., & Hadley, C. (2009). Moving beyond hunger and nutrition: a systematic review of the evidence linking food insecurity and mental health in developing

countries. *Ecology of Food and Nutrition*, *48*, 263–284. doi:10.1080/03670240903001167

Weiss, T. G. (2000). Governance, good governance and global governance: Conceptual and actual challenges. *Third World Quarterly*, *21*(5), 795–814. doi:10.1080/713701075

World Bank. (1992). *Governance and Development* (pp. 1–69). Washington, DC: World Bank Publication. Retrieved from http://documents.worldbank.org/curated/en/1992/04/440582/governance-development

World Food Programme. (2009). Emergency Food Security Assessments (EFSAs) Technical guidance sheet n.5 [Fact Sheet]. Retrieved from http://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197295.pdf

World Food Programme. (2013). *The status of poverty and food security in Egypt: Analysis and policy recommendations*. (pp. 1–42). Retrieved from http://documents.wfp.org/stellent/groups/public/documents/ena/wfp257467.pdf

World Food Programme. (2016). Hunger Glossary. Retrieved January 14, 2016, from https://www.wfp.org/hunger/glossary

World Summit on Food Security. (2009). *Declaration of the World Summit on Food Security* (pp. 16–18). Rome.

Wossen, T., & Berger, T. (2015). Climate variability, food security and poverty: Agent-based assessment of policy options for farm households in Northern Ghana. *Environmental Science & Policy*, *47*, 95–107. doi:10.1016/j.envsci.2014.11.009