AN ECONOMETRIC MODEL FOR FOOD SECURITY IN THE GULF COOPERATION COUNCIL DURING THE PERIOD 1980-2019: COINTEGRATION APPROACH

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ABSTRACT

Food security remains a major concern worldwide, particularly in developing and emerging economies. The Lack of access to enough food results in hunger, malnutrition, and poor health conditions, jeopardizing the sustainable development of the nations. Countries, work hard to develop strategies and policies to compact these negative consequences of food insecurity. On the other hand, securing access to quality food has many benefits to the countries: boosting economic growth, reducing poverty, creating jobs, increasing trade opportunities, increasing global security, and stability, and improving health status. With rapid population growth and unfavorable climatic conditions coupled with deteriorating oil prices, food security remains a significant concern for the GCC countries. Maintaining it is of strategic importance for national security and social stability. The food market in the GCC is highly dependent on imports which makes it vulnerable to any import disruption. The purpose of this research was to examine the dynamics of the food imports bill for the GCC during the period 1980 to 2019, using an econometric model. The cointegration approach of autoregressive distributed lag (ARDL), vector error correction model (VECM), and Granger causality analysis was employed. The study found that there is a long relationship between the food imports bill and its dynamics, with an adjustable-rate of 37%, indicating that 37% of the deviations in the short run from the long-run path are corrected each year. The study confirmed that in the long run, the food imports bill was positively influenced by GDP per capita, exports, inflation, global prices of food, and regional instability, and negatively influenced by local the production index. Population growth was only a significant impact in the short run. Moreover, causality analysis demonstrated the existence of a one-directional causality running from GDP per capita, exports, inflation, global food prices, and population growth to food imports bills in the GCC in the short run. The implications of the findings were discussed and a food security framework was developed based on four pillars: government support, private sector engagement, foreign direct investment, and regional network. The integration of these pillars is important for addressing food security in the GCC from both supply and demand sides.

ABSTRAK

Keselamatan makanan terus menjadi kebimbangan utama di seluruh dunia, terutamanya dalam sector ekonomi yang sedang pesat membangun Kekurangan akses kepada makanan yang mencukupi boleh mengakibatkan kelaparan, kekurangan zat makanan dan keadaan kesihatan yang buruk, yang akan menjejaskan pembangunan negara mapan. Negara-negara di seluruh dunia berusaha untuk membangunkan strategi dan dasar bagi kesejahteraan dalam ketidakamanan makanan ini. Sebaliknya, untuk akses kepada makanan berkualiti, negara perlu dalam meningkatkan pertumbuhan ekonomi, mengurangkan kemiskinan, mewujudkan pekerjaan, meningkatkan peluang perdagangan, meningkatkan keselamatan dan kestabilan global serta meningkatkan status kesihatan. Dengan pertumbuhan penduduk yang pesat dan keadaan iklim yang tidak menggalakkan serta harga minyak yang semakin merosot, keselamatan makanan kekal menjadi kebimbangan penting bagi negara-negara GCC. Ini adalah kepentingan strategik untuk keselamatan negara dan kestabilan sosial. Pasaran makanan di GCC sangat bergantung pada bahan import yang menjadikannya terdedah kepada inflasi yang akan berlaku. Tujuan penyelidikan ini adalah untuk mengkaji dinamik bilangan import makanan bagi GCC dalam tempoh 1980-2019, menggunakan model ekonometrik. Pendekatan kointegrasi lag teragih autoregresif (ARDL), model pembetulan ralat vektor (VECM) dan analisis Granger telah digunakan. Kajian mendapati bahawa terdapat hubungan yang panjang antara bilangan import makanan dan dinamiknya, dengan kadar pelarasan sebanyak 37%. Ini menunjukkan bahawa 37% daripada sisihan dalam jangka pendek dari laluan jangka panjang diperbetulkan setiap tahun. Kajian itu mengesahkan bahawa dalam jangka panjang, bilangan import makanan dipengaruhi secara positif oleh KDNK per kapita, eksport, inflasi, harga makanan global, dan ketidakstabilan serantau, dan dipengaruhi secara negatif oleh indeks pengeluaran tempatan. Pertumbuhan penduduk hanya memberi kesan yang ketara dalam jangka pendek. Selain itu, analisis menunjukkan kewujudan satu arah yang signifikasi daripada KDNK per kapita, eksport, inflasi, harga makanan global dan pertumbuhan penduduk kepada bil import makanan dalam GCC dalam jangka pendek. Implikasi penemuan telah dibincangkan dan rangka kerja keselamatan makanan yang telah dibangunkan. Rangka kerja itu berdasarkan empat teras iaitu; sokongan kerajaan, penglibatan sektor swasta, pelaburan asing dan rangkaian serantau. Penyatuan tonggak ini adalah penting untuk menangani keselamatan makanan dalam GCC dari aspek penawaran dan permintaan.

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LIST ABBREVIATIONS

AMF	-	Arab Monetary Fund
ARDL	-	Autoregressive Distributed Lag
CAGR	-	Compound Annual Growth Rate
CPI	-	Consumer Price Index
DOLS	-	Dynamic Ordinary Least Squares
EER	-	Effective Exchange Rate
ECM	-	Error Correction Model
EDA	-	Exploratory Data Analysis
FAO	-	Food and Agriculture Organization
FMOLS	-	Fully Modified Ordinary Least Squares
GFSI	-	Global Food Security Index
GRFC	-	Global Report on Food Crises
GDP	-	Gross Domestic Product
GCC	-	Gulf Cooperation Council
H-O	-	Heckscher-Ohlin
IFPRI	-	International Food Policy Research Institute
IFAD	-	International Fund for Agricultural Development
ISDB	-	Islamic Development Bank
LLC	-	Levin, Lin and Chu
MENA	-	Middle East and North Africa
PURT	-	Panel Unit Root Tests
PVECM	-	Panel Vector Error Correction Mo
R&D	-	Research and Development
RO	-	Research Objectives
SAARC	-	South Asian Association for Regional Cooperation
USDA	-	United States Department of Agriculture
VAR	-	Vector Auto-Regressive
VECM	-	Vector Error Correction Model
WPI	-	Water Poverty Index

CHAPTER 1

INTRODUCTION

1.1 Introduction

According to the Food and Agriculture Organization (FAO), food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for active and healthy life (Bilali, 2019).

Food security is a complex, multifaceted issue influenced by culture, environment and geographical location. It includes four dimensions: food availability meaning sufficient quantities of food available consistently (FAO, 2019); food access including sufficient resources to obtain appropriate and nutritious foods, (Gross *et al.*, 2000; Rivera and Qamar, 2003); food utilization, using appropriate food based on knowledge of basic nutrition and care (Weingärtner, 2004; Pieters *et al.*, 2013; Pangaribowo *et al.,* 2013); and stability in food availability, access, and utilization (FAO, 2009).

A famous report that examines the state of food systems in countries, regions, and around the world is the Global Food Security Index (GFSI) which is developed by the Economist Intelligence Unit and supported by Corteva Agriscience. The index provides a common framework against which countries' food security can be benchmarked. The index addresses the issues of affordability, availability, quality, and safety of food, natural resources, and resilience in 113 countries around the world.

The report for the year 2019 has shown a rise in food prices worldwide (as depicted in Figure 1.1), with the sharpest increases seen in Venezuela and Syria, highlighting the need for greater efforts to make nutritious, quality food more accessible to lower-income populations. It also emphasized the potential threat of the

environmental crisis to food security and how proper investment and advances in food innovation can help to mitigate this risk (EIU, 2019).

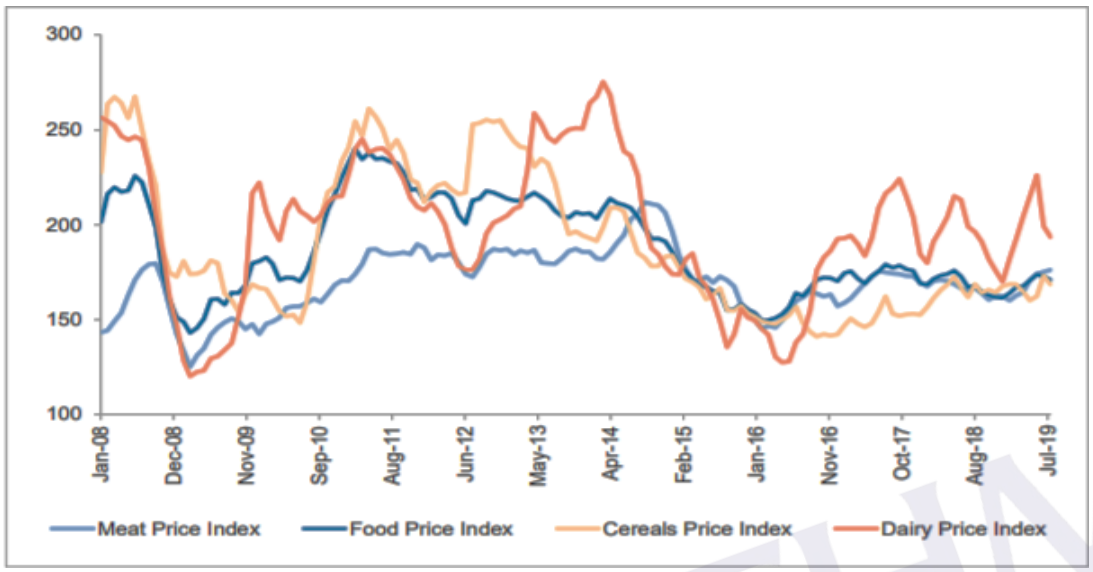

Figure 1.1: Global Food Price Index (Source: Bloomberg-Alphen Capital 2019)

Figure 1.1 shows that although the food price index started high in Jun 2008, it began to fluctuate and show a declining trend thereafter until Jul 2019. The highest decline in the index has been shown in Jan 2016. The variation in the food price index is largely attributed to the great variations in the cereal price index as compared to the meat and dairy price indices, both exhibiting moderate variations during the period Jan 2008 to July 2019.

According to the GFSI, 2020, the top five countries ranked in terms of food security (out of 100 points) are Finland which scored 85.3 points, followed by Ireland scored 83.8 points, Netherlands scored 79.9 points, Austria scored 79.4 points, and the Czech Republic which scored 78.5 points. For the GCC, Kuwait ranked 33rd globally with a score of 70.7 points, followed by Oman ranked 34th with a score of 70.2 points, Qatar 37th with a score of 69.6 points, Saudi Arabi 38th with a score of 69.5 points, UAE 42nd with a score of 68.3 points, and Bahrain 49th with a score of 64.6 points. The GCC countries have a good ranking regarding food availability, affordability, quality, and safety, and lower in natural resources and resilience. For example, Saudi Arabia ranked 8th globally in food availability, Oman ranked 12th in food affordability, and UAE ranked 17th in food quality and safety. The best country in nature resources and

resilience is Oman which scores 84th globally (EIU, 2020). This shows that GCC is to a large extent food secure, however, they suffer from self-sufficiency due to the nature of their natural resources and resilience.

The GFSI 2019 reveals that nearly all the countries within the index (88 percent) have enough food supply for their population. However, according to the report of the Food and Agriculture Organization of the United Nations (FAO) on State of Food Security and Nutrition in the World, which provides a broader look at the extent of food insecurity, beyond hunger, shows that 17.2 percent of the world population, or 1.3 billion people, have experienced food insecurity at moderate levels. This means that they do not have regular access to nutritious and enough food – even if they are not necessarily suffering from hunger, they are at greater risk of various forms of malnutrition and poor health. The combination of moderate and severe levels of food insecurity brings the estimate to 26.4 percent of the world population, amounting to a total of about 2 billion people (FAO, 2019). This is a problem not just in a select few countries, but in many countries worldwide: over a third of countries in the GFSI indicate that more than 10 percent of their population is undernourished.

Previous reports on Food Crises estimated that 124 million people in 51 countries are currently facing the crisis of food insecurity, compared to 108 million people across 48 countries in 2017 (Klaus Schwab, 2018). Conflicts and insecurity as the primary drivers of food insecurity in 18 countries. Worldwide there are more than 820 million people who live with hunger underscoring the challenge of the achievement of zero hunger by 2030, and probably to more than 9 billion by 2050 (FAO, 2014; WHO, 2019). It was also estimated that nearly 821 million people in 2017 with an increase of 17 million compared to that in 2016 are undernourished (FAO, 2018), speculating that the 2030 agenda for sustainable development would restore a world free of hunger, food insecurity, and malnutrition (FAO, 2019). During the years (2016 to 2018), there have been more than 100 million people reported every year to have faced periods of acute food insecurity (Escamilla and Vianna. 2012). The demand for food is expected to grow substantially by 2050 due to the increase in world population which will be expected to reach 9.1 billion (FAO, 2009).

In Arab countries, food security constitutes a major challenge due to the increasing population, rising demand for food, degradation of natural resources, and conversion of farmland to urban use. According to a report issued jointly by the World Bank, the FAO, and the International Fund for Agricultural Development (IFAD) in

2009, the Arab countries are the largest importers of cereal in the world. Despite their efforts to reduce food reliability from external sources, they continue to remain the largest importers of cereals, which is the main staple food in the Arab region (Sadik *et al*, 2014).

The situation of food imports in the Gulf Cooperation Council (GCC) especially is even more challenging. About 70 percent of the food in the GCC is imported from overseas with an estimated food retail market worth over US$50 billion annually (Middle East Food Sector, 2016). Table 1.1 shows the GCC's food import bill during the period 2011, 2015, and 2020 (estimates).

Table 1.1: GCC Food import (US$ billion)

Country	2011	2015	2020 (estimate)
Bahrain	0.8	1.1	1.6
Kuwait	2.5	3.6	5.3
Oman	2.1	3.3	4.8
Qatar	1.3	2.1	3.3
Saudi Arabia	17.9	24.5	35.2
UAE	3.8	5.5	8.4
GCC Total	28.4	36.4	53.1

Source: Economic Intelligence Unit (2020)

Table 1.1 shows that GCC's total food import bill increased from US$ 28.4 billion in 2011 to US$ 36.4 billion and is expected to reach US$ 53.1 billion in 2020. The food import bill for all GCC counties, with no exception, has been showing a tremendous increase during the period 2011 to 2020. Saudi Arabia has the highest food import bill in 2020, amounting to US$ 35.2 billion, while Bahrain and Qatar scored the lowest food import bills, amounting to US$ 1.6 billion, and US$ 3.3 billion in the two countries respectively in the same year.

Other similar reports indicated that the GCC's food imports increased at a Compound Annual Growth Rate (CAGR) of 3.1 percent between 2011 and 2016 and are expected to expand at (CAGR) of 4.2 percent in 2012, from an estimated 48.1 million MT in 2016 to 59.2 MT in 2021 (Global Islamic Economy report, 2019), with Saudi Arabia having the largest importer with the share of 44.2 percent, followed by the UAE with the share of 30.6 percent, and Kuwait with the share of 9.1 percent (Alphen Capital, 2019). The GCC's food sector is an import-driven market because of

the deficiency in enough arable land and water shortage which restrict farming activities in the region. The large oil exports earnings of the GCC and the continuous efforts of their countries to boost food security in the region have enabled the GCC states to achieve a satisfactory score in the Global Food Security Index (GFSI) in 2020, including the core dimensions of food security- affordability, availability, quality, and safety.

Table 1.2: The performance of the GCC in the global food security index 2020

Global Ranking	Country	Overall score	Affordability	Availability	Quality and safety	Natural resources and resilience
33rd	Kuwait	70.7	82.7	68.3	86.4	37.2
34th	Oman	70.2	88.6	59.1	83.7	43.8
37th	Qatar	69.6	80.3	70.7	84.3	33.6
38th	Saudi Arabi	69.5	79.6	73.0	79.8	34.1
42nd	UAE	68.3	73.0	66.5	88.8	42.4
49th	Bahrain	64.6	82.6	56.8	76.7	33.7

Source: EIU (2021)

The results of the report, as reflected in table 1.2 showed that Kuwait ranks relatively high among its GCC peers, occupying the 33rd among the total 113 countries analyzed by the GFSI, followed by Oman (34), Qatar (37), Saudi Arabia (38), UAE (42) and Bahrain secured the lowest rank (49), which imports close to 94 percent of its food requirements (EIU, 2021). Saudi Arabia ranked 8th globally in terms of availability dimension, Oman ranked 12th in terms of affordability, and UAE ranked 17th in terms of quality and safety of food dimension (EIU, 2021). The weakest performance was related to natural resources and resilience.

This satisfactory performance in the food security index in the Gulf states is attributed to the fact that the food sector is highly subsidized in the GCC states. Populations benefit from a wide range of support measures (subsidies and price controls) designed to ensure food remains affordable. However, energy, food, and water subsidies in many Gulf countries are on paths that may be unsustainable in the long term. With the increasing population growth of the GCC and declining oil prices, food security in GCC will be at high risk.

The structure of the economy of GCC renders them vulnerable to food security. These countries are highly dependent on oil resources. According to the

GCC-STAT report of 2018, oil contributes 42.2 percent of GDP for Kuwait, 32.3 percent for Qatar, 29 percent for Oman, 25 percent for Saudi Arabia, 22.3 percent for the UAE, and 12.4 percent for Bahrain. In 2017, the oil revenue share to total government revenue was 62.0 (GCC-STAT, 2018).

In their attempts to close the gap between food production and consumption, GCC countries tried to adopt a self-sufficiency policy, capitalizing on oil export earnings to finance their food imports. However, the variation in the oil prices and the possibility of the depletion of the oil reserves will deprive the ability of these countries to cushion the higher food prices. The dependence of the food import of the GCC on oil price revenues challenges the food security in these countries (Lampietti *et al.*, 2011). The falling oil prices could mean fewer investments in the food sector, as well as fewer food imports. Bigger economies like Saudi Arabia and Qatar may withstand the fluctuating oil price but smaller economies such as Oman, Bahrain, and Kuwait could be severely affected. Lack of diversification on the other hand leads to deterioration of the trade between food and oil and the imports which are financed through the revenues earned by Oil exports (Bailey and Willoughby, 2013).

The changes in the food prices will also have an impact on food security and the poor will be affected the most as they will spend most of their income on food. The balance between demand and supply of food does not indicate that all the households in the nation are food secure. Sometimes they do suffer from food insecurity because of the lack of entitlement to food, which economists will call as effective demand. For instance, following a drought and wildfires in 2010, Russia imposed a temporary ban on wheat exports (Welton 2011; Trostle *et al.* 2011). Similar situations have also emerged during the more recent food crisis of 2007/2008 when food prices spiked and caused governments of major exporting countries to impose restrictions and/or bans on exports for fear of food shortages (Trostle *et al.* 2011; Maetz *et al.* 2011). For net food-importing countries, such episodes represent an existential threat to national food security.

Rising food prices threaten the macroeconomic stability in countries with poor resources and declining petroleum prices make the oil-rich countries more vulnerable to economic shocks. These shocks result in food insecurity, depending on the countries' resource endowment and fiscal balance, often leading to a decline in employment, which is a challenge to food access. Natural disasters resulting in a decrease in food production generate food-price shocks that will be reflected in

inflation. The rise in food prices threatens macroeconomic stability primarily through inflation. As a result of which many countries like UAE, Oman, and Bahrain have increased wages for public sector employees and have tried to support the poor by increasing bread subsidies, implementing direct cash transfers, and lifting tariffs on basic food commodities (Lahn, 2016). However, these measures are not sustainable in the long term.

One important aspect related to food security, which is generally overlooked, is related to wasteful practices by people regarding food, energy, and water. Although this is a global phenomenon, it is excessively prevailing in the GCC states (Baig *et al.* 2018). Studies have shown that approximately one-quarter of all food supplied for human consumption is wasted across the food supply chain (Kummu *et al.* 2012). To quote "high-income countries like the Gulf States, losses at household consumption stage contribute to the largest food waste. Roughly 6.5 percent of cereal food is wasted at the household level, excluding all other losses (FAO 2013). An important aspect of food waste is that food waste represents the waste of essential resources, as large quantities of water and energy are used to produce the wasted food. Agriculture already uses 70 percent freshwater withdrawal globally (and up to 90 percent freshwater withdrawal in the arid regions) and any increased production will likely mean more water use. In terms of calories 1554 e Kcal/day/person is wasted just from cereals and potatoes, a half of the daily intake requirement for healthy life'' (Elmi, 2017).

Reducing food waste as an effective tool to lessen food insecurity is a simple option and is overlooked. In the GCC, the wastage behavior is related to high income and subsidized food prices, water, and energy. GCC states need to target individual behavior change intervention strategies and challenge social norms, emphasizing the positive food balance sheet and environmental outcomes (Dou *et al.* (2016). Food waste-saving practices are urgent and practical, with no costs, trade-offs, or conflicts (Elmi, 2017). Efforts to raise awareness and address public awareness campaigns, however, are likely to have limited impact unless accompanied by changes to regulations or pricing (The Economist 2012). For example, removing subsidies (whether food, oil, electricity, water. etc) does not only reduce the huge government deficits for many of the GCC countries, improving consumption behavior but also will generate additional resources that can be used for promoting food security in these countries.

To address food insecurity, the GCC states have implemented various initiatives and invested in agricultural production locally and overseas as a strategy to reduce food imports and reliance on international markets for food. For instance, Saudi Arabia in its attempt to achieve food security started growing wheat in its 1.7 percent arable land and became the sixth-largest wheat exporter in the world (Thirarath, 2016). However, this wheat production policy was considered a failure because the project costs the country billions of dollars and reduced the already existing little supply of water in the country.

Due to the limited water resources and arable land, and the high cost of domestic production, some of the Gulf countries invested in farmlands in Ethiopia, Madagascar, Mali, Serbia, Sudan, Tanzania, and Zambia to ensure food security (Alphen Capital, 2019). Even since the 1970s there has been a steady growth of food imports to MENA due to rapid population growth and changing patterns of food consumption based on rising incomes (Harrigan, 2012). Saudi Arabia, for example, started buying arable land in Ethiopia and Sudan. However, transferring agricultural land from subsistence farming to export crops has led to even more food shortages (Katkhuda, 2016). Also, the UAE's Al Dahra recently announced plans to invest $400 million in eight Serbian farming companies, with an additional $400 million in loans from the Abu Dhabi Development Fund to help develop the agricultural sector resulting in minimizing the risk of conflict with local communities and reduces start-up times, problems encountered with earlier land-based investments (Woertz, 2013). The political stability of the countries in which GCC states have invested is a major challenge to secure the sustainability of these projects.

Public expenditure on Research and development (R&D) is critical to developing the technological innovations necessary to increase agricultural productivity and reduce environmental impact. modern technologies suggest a level of food production that will sustain the global population, both political will and enough investments in modern agriculture are needed to address the food crisis in GCC. The Global Food Security Index 2019 report indicated that government spending in 2016 showed an overall decline in central government spending on agriculture relative to the sector's contribution to GDP, which has fallen worldwide from the previous year. Moreover, Agricultural research in GCC countries is not sufficiently promoted with enough incentives which is a major constraint to enhancing domestic food production (Elmi, 2017).

The GCC governments need to address the socio-economic and demographic dynamics in the region to achieve satisfactory levels of food security for their nations and increase spending on agriculture and research related to the food sector.

Literature about food security in GCC can be acquired from two main sources: reports of international organizations such as the FAO, and academic papers in peer-reviewed journals or proceedings of international conferences. The main international report that provides assessments of food security around the world which complement each other is "The State of Food Security and Nutrition in the World 2019: Safeguarding against economic slowdowns and downturns'' prepared by the FAO in collaboration with a team of technical experts from FAO, IFAD, UNICEF, WFP, and WHO. The other one is Global Report on Food Crises (GRFC), produced by the Food Security Information Network (FSIN). While the GRFC has a narrow focus on acute food insecurity for countries experiencing food crises, the State of Food Security and Nutrition has a wider scope and monitors food security in the whole world. While the two reports provide good information on food security, their data need to be combined with data from other sources to have a complete picture of the dynamics of food security in the GCC or another context.

The other literature assessed food security in the GCC in the form of academic research or reports. For example, the study of Shira *et al.* (2018) characterized the food security status of GCC countries and documented predominant strategies they have taken to increase domestic food production to facilitate access to food imports. Alessandra *et al.* (2017) indicated a positive correlation between Water Poverty Index (WPI) and the Global Food Security Index (GFSI) for the Middle East and North Africa (MENA). The sixth Arab Conference for Investment in Food Security held in the United Arab Emirates in 2018 persisted that it is imperative to boost investments in land usage and water efficiency to enhance food productivity (United Arab chambers Report, 2018).

According to Sara *et al.* (2015), better food safety net programs in the MENA have contributed to a notable increase in food affordability. The region, however, experienced a decline in food availability, owing to more limited food supplies and higher volatility of agricultural production. The most frequent challenges faced by the countries of the MENA include public expenditure on agricultural research and development as well as the volatility of agricultural production.

Elmi (2016) addresses food security in the GCC States in terms of constraints imposed by land and water resources scarcity. Food security in GCC states is further exacerbated due to the rapid population growth, unsustainable consumption and wastage, land degradation, and climate change. The research reviews risks, both natural and human-centered, associated with complete reliance on food imports as a motivating factor to refocus on domestic food production. Unlike traditional ways of narrowly focusing on one aspect of meeting food security at a time, the study proposes a new way of thinking to ameliorate food security situations and highlights a mix of untapped opportunities to relieve food security concerns. Food, energy, and water are plagued with wasteful practices so that food wastage at the household level is greater than cereal produced locally. Consequently, building a culture of conservation among people in the Gulf Cooperation Council states and promoting conservation practices could induce significant amounts of food resources saved. The lack of agricultural research incentives is a major constraint to enhancing domestic food production. Hence, the government of the GCC should encourage agriculture research at their higher education institution and agricultural research centers.

Although these studies have provided some insights on food security in GCC, their analyses have been based on cross-sectional data, sometimes with time-series data, with limited variables mostly related to land and water resources scarcity. Further, it is observed that most of the contributions toward food security in the GCC are in the form of reports. Reports do not establish the relationship between variables, thus lacking a consistent analytical framework based on modeling and no econometric model addressing the integration of supply and demand related to food security. This is the research gap in the study. There is a need for a comprehensive study that assesses the impact of the socio-economic and demographical dynamics on food security in the region, using perhaps an expanded time series. This study fills that gap and develops an econometrics model to capture the link between food security in the GCC and the associated socio-economic and demographic factors.

The method used in the research is the cointegration approach with ARDL and Granger causality. The justification for using ARDL is it is more consistency and performs better for small sample size data to capture the long and short run dynamics of food security which is suitable for this research.

The Granger causality was used to explore the causality and direction of the variables. Causality tests are used to determine whether there is a unidirectional or bidirectional casualty between the model variables.

1.2 Problem statement

In general, the geographical economy of the GCC countries is dominated by less rain, much oil, and a rapidly growing population. Due to the limited agricultural resources, there is a deficiency in the production of enough food in the region. Thus, creating a gap between food production and consumption.

The GCC countries are importing 90 percent of food products from other countries with Qatar topping the GCC in terms of their dependence on imports at 97 percent, followed by Bahrain at 92 percent, Kuwait at 91 percent, and the UAE and Oman at 89 percent each (FAO, 2019).

The Global Agricultural Information Network (GAIN) expected GCC to spend USD 53.1 billion on food imports in 2020. The food imports for the UAE are expected to rise from US$ 5.5 billion by 2015 to US$ 8.4 billion by 2020, Bahrain from US$ 085 billion by 2015 to US$ 1.1 billion by 2020, Kuwait from US$ 2.5 billion by 2015 to US$ 3.6 billion by 2020, Oman from US$ 2.1 billion by 2015 to US$ 3.3 billion by 2020, Qatar from US$ 1.3 billion by 2015 to US$ 2.1 billion by 2020 and Saudi Arabia from US$ 17.9 billion by 2015 to US$ 24.5 billion by 2020 (Hassen and Bilali, 2019).

The self-sufficiency in the GCC region of food may be expected to drop in the coming years because of the population growth, urbanization, and environmental conditions. The global food system in the GCC is highly oil-dependent, because of which high oil prices contribute to soaring food prices. On the other hand, if oil prices decline, this will inversely impact the ability of GCC countries to import food, and hence their food security will be in jeopardy. According to the Middle East report 2016, a reducing oil price is expected to cut off the energy export receipts of the GCC from US$743 billion in 2012 to about US$390 billion in 2016, leading to a fiscal balance deficit for most GCC economies which will affect their ability to cover their increasing food bill.

Therefore, policy makers and governments across the Gulf Cooperation Council (GCC) rate food security as being a great concern, and the problem of food security in the gulf countries needs to be urgently addressed as the demand for food is

expected to grow while the supply to decrease. Increasing food production is a key to providing continued growth in food supplies for GCC (Efron *et al*, 2017). Further, it is not only important to enhance food production, but also necessary action should be taken to reduce food wastage. A quarter of the food produced worldwide is wasted and this reduction will lead to a significant change globally (Porkka *et al*, 2017). Increasing awareness among a population to reduce food waste, coupled with reform to reducing or removing any kind of subsidies provided by the government for food, water, electricity, and other services, will enhance food security in the GCC.

1.3 Research questions

The research will pose the following research questions to facilitate the focus of the research and create a road map for the methodology that will be adopted in the process.

a. What are the main factors influencing the food imports bill in the GCC during the period 1980-2019? (RO1)
b. How do regional instability and other macroeconomic factors (such as GDP per capita, population growth, exports, etc) impact the food imports bill for the GCC in the short and long-run? (RO2)
c. What is the speed of adjustment of the GCC economies to any shocks in the food import? (RO3)
d. What is the type of causality existing among the food imports bill dynamics for the GCC during the period 1980 to 2019? (RO4)
e. What are the prospects of food security in the GCC and what are the best strategies of food security that the GCC can be adopted? (RO5)

1.4 Research objectives

The study aims to examine the determinants of food security in the GCC, from the period 1980-2019, namely an econometric model. Specifically, the research objectives (RO) can be summarized as follows:

a. To identify the key factors that influence the state of the food imports bill in the GCC during the same period (1980-2019)

b. To examine the impact of regional instability and other macroeconomic indicators (such as GDP per capita, population growth, exports… etc.) on the food imports bill for the GCC
c. To determine the rate of adjustment of the GCC economies to any shocks to the food imports bill?
d. To determine the direction of causality existing among the food imports bill dynamics in the GCC during the period 1980-2019
e. To propose new policies and strategies that will promote the status of food security for the GCC states.

1.5 Scope of the study

The scope of the study includes the geographical scope, the time scope, and the scope of analysis. The geographical scope of this study includes highlighting the key trends, growth drivers and challenges for food security prevailing in the six Gulf Cooperation Council states, namely Bahrain, Kuwait, Qatar, Saudi Arabia, United Arab Emirates, and Oman.

The scope of time includes examining food security issues for all the GCC states during the period that extended from 1980 to 2019. This provides a panel framework that enables to making of good inferences on the factors influencing food security in the GCC countries, and the challenges prevailing during the given period.

The scope of analysis examines the determinants of food security in these countries. This involves trend analysis of the food security indicators from 1980 to 2019. One econometrics issue associated with panel data is the question of data stationarity and endogeneity. Hence the research will use advanced econometric techniques. To avoid spurious relationships in such cases, the study will employ co-integration techniques of panel Autoregressive Distributed Lag (ARDL); Vector Error Correction Model (VECM), and Granger causality. The suggested model will include the dependent and independent variables. The dependent variable is the food import bill and independent variables are GDP per capita, population growth, exports, domestic production, food prices, consumer price index, regional instability.

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LIST OF PUBLICATIONS

1. Devesh, S. & Affendi, A.M.A. (2021). Modelling the Impact of Oil Price on Food Imports: Case of Oman. *International Journal of Energy Economics and Policy* 11 (4), 113-120 (Scopus & ABDC ranked).

2. Devesh, S & Affendi, A.M.A.(2020) Food Security Dynamics in Oman: VECM Approach. *Advances in Dynamical Systems and Applications* 15 (2), 249-263 (Scopus).

VITA

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