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ANALYZING THE TRENDS AND SEASONALITY IN UGANDA'S FOOD IMPORTS FROM 1996 TO 2025.

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF STATISTICS AND PLANNING IN PARTIAL FULFILMENT FOR THE AWARD OF BACHELOR'S DEGREE OF SCIENCE IN QUANTITATIVE ECONOMICS MAKERERE UNIVERSITY

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DECLARATION.

I hereby declare that this research is my own work towards the award of Bachelor of Quantitative Economics of Makerere University and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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APPROVAL

This acknowledgment is made in partial fulfillment of the requirements for the Bachelor's degree in quantitative Economics at Makerere University. The dissertation, completed under my close supervision and titled "Analyzing the seasonality and trends in Uganda's food imports from 1996 to 2025." is now ready for submission to the department of Planning and Applied Statistics under the school of Statistics and Planning.

Signature..... Date 25/8/26

Supervisor. Dr. Richard Tuyiragize

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LIST OF ACRONYMS

ACF- Autocorrelation Function

ADF - Augmented Dickey-Fuller

AIC- Akaike Information Criterion

ARIMA- Autoregressive Integrated Moving Average

BIC- Bayesian Information Criterion

BoU - Bank of Uganda

CMA- Centered Moving Average

COMESA- Common Market for Eastern and Southern Africa

FAO - Food and Agriculture Organization

FS - Food Security

GEA - Government Expenditure on Agriculture

IPC – Infection Prevention and Control

MA- Moving Average

OLS - Ordinary Least Squares

PACF- Partial Autocorrelation Function

SDG - Sustainable Development Goals

SSA- Social Security Administration

WDI - World Development Indicators

ABSTRACT

This study examined the long-term trends, seasonal patterns, and future projections of food imports in Uganda. The increasing dependence on imported food products has raised concerns regarding food security, trade balance, and the sustainability of domestic agricultural production. The study utilized quarterly food import data covering the study period and applied time-series analytical techniques to assess historical patterns and forecast future import levels.

Trend analysis was conducted using the unit root test, while seasonal variations were assessed through seasonality diagnostics. Forecasting was performed using an ARIMA model selected based on its statistical performance and diagnostic adequacy. Model evaluation was conducted using residual diagnostics and forecasting accuracy measures to ensure the reliability of the results.

The findings revealed a significant upward trend in Uganda's food imports over the study period, indicating increasing reliance on external food sources. Seasonal fluctuations were absent across quarters, suggesting that import demand does not vary systematically throughout the year. The forecasting results indicated that food imports are likely to continue increasing in the coming years if current patterns persist. Diagnostic tests confirmed that the selected forecasting model adequately captured the underlying characteristics of the data and produced reliable forecasts. The study concludes that Uganda's food import dependence is likely to remain high unless measures are implemented to strengthen domestic agricultural productivity and food value chains. It is recommended that policymakers invest in agricultural modernization, improve storage and processing facilities, enhance market access for farmers, and promote policies that support increased local food production. These interventions could reduce import dependence and contribute to long-term food security and economic stability in Uganda.

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter focuses on the background, problem statement, purpose, objectives, research questions, hypothesis, scope, and importance are all presented in this chapter.

1.1 Background of the study

This is a time series study of the food imports to Uganda. Food imports refer to goods entering a country from abroad that are classified as food products under international trade statistics. The food imports include beverages, live animals, meat, dairy products, fish and crustaceans, vegetables and oil-seeds. Seasonality aims to study the short-term fluctuations within the years of study; trends are aimed at studying the long-term steady increase or fall. Uganda's reliance on food imports stems from colonial era policies that prioritized cash crops like cotton, coffee, tea and tobacco for export revenue while neglecting domestics food production. British colonial administration focused on export-oriented agriculture to fund infrastructure such as the Uganda railway, diverting the fertile land from staples to crops like cotton this created a legacy of producing what we don't eat and importing the basics which persisted even after independence. Political instability in 1970s to 1980s further disrupted output increasing import dependency. Food imports as a share of merchandise Imports fluctuated, peaking a 21.15% in 1997 and averaging around 13% to 14 % in recent years dropping to 10.7% in 2023 amid efforts to boost local production.

Agriculture drives around 25% of Uganda's GDP and employs most rural households yet low yields, limited inputs, and post-harvest losses drive imports of wheat, rice, vegetable oils, sugar, and cereals which mainly come from Kenya, India, Netherlands and Egypt. Moreso, population growth, urbanization which shifts diets to consumption of processed food, climate variability causing low yields and inadequate processing infrastructure have led to import dependency. Despite being a net exporter of staples like maize and beans regionally, Uganda faces a negative food trade balance due to quality gaps and global shocks. Imports help stabilize supply but strain foreign exchange, with projections showing rising dependency unless productivity improves through irrigation and value addition. Food imports bridge domestic gaps but worsen vulnerabilities, contributing to malnutrition amid poverty and unequal access particularly in rural

and northern Uganda areas like Karamoja. Reliance on imports widens disparities, as urban consumers access divers processed foods while rural areas face seasonal shortages. Shifting diets towards imported ultra-processed food items undermines traditional nutrition, while refugee inflows increase demand for food from their original countries. Trade is governed by the Ministry of Trade, Industry and Cooperatives with standards enforced by the Uganda National Bureau of standards under East African community and COMESA frameworks. Policies like National Food and Nutrition policy and Food systems Transformation Pathways aimed at reducing imports through coordination with the National Food Coordination Committee. Institutions such as Ministry of Agriculture promote self-sufficiency though challenges like weak enforcement, limited funding and alignment gaps. Regional integration facilitates imports but institutional efforts help to reduce unnecessary imports.

Some studies have been made and I have tried to summarize some of them. Bantebya Kyomuhendo (2017) in determinants of import demand of rice in Uganda said that rice plays an important role as both a food and a cash crop in the country. The crop continues to be one of the most important crop among the cereal crops (sorghum, maize, millet) grown in the country, occupying a total of 95,277 thousand hectares of land with an estimated output of 258,193 thousand tons. She added that it is also the second most important grain commodity after maize grown for commercial purposes and it is estimated that 59% of the area is under lowland rice, 36 % is upland rice and rain fed while only 5% is irrigated. Since the crop is that important, especially in urban areas especially among the youth, and government institutions in the country a strategy plan was drawn up in 2009 to redirect the farmer's efforts to benefit consumers as well as the nation at large. Prior to the formulation of this strategy, a number of studies carried out in the country established that the crop competed well within the farming system had higher yields than those in Asia Kijima et al. was profitable and was facing increasing demand due to changes in tastes, especially in urban areas. However, increases in domestic production is currently faced by many constraints among which are post harvesting practices leading to physical losses and poor milling facilities and many more constraints highlighted in. To fill this demand, it has become mandatory to increase supply and that would have to come from either domestic production or imports. Uganda has some of the highest population growth figures in Africa (around 3% per annum) and agricultural growth can hardly cope with population growth, the American Library Association has stated in Agricultural dynamics and food security trends in Uganda. Uganda's bimodal rainfall creates harvest peak and

lean seasons, driving seasonal import spikes to bridge gaps. Economic theories of storage and price seasonality explain high pre-harvest price surges due to poor infrastructure, limited storage and rainfed farming. Imports offset deficits from erratic weather, but reinforce dependency. closing yield gaps and improving post-harvest handling could mitigate this, turning seasonal surpluses into reliable surplus.

This study covers the key food Imports to Uganda from the various countries, though Uganda largely gets its food from agriculture being a land locked country. Agriculture contributed 26.5% to GDP and 36% to export earnings in fiscal year 2024/2025 despite this, Uganda faces persistent challenges in food sufficiency necessitating substantial food-imports. These imports, valued in billions annually and sourced primarily from neighbors like Kenya as well as distant such as the Netherlands and India help bridge gaps in domestic production driven by factors like population growth, urbanization, limited processing capacity.

Uganda is endowed with vast agricultural potential: over 70% of its land is arable, it benefits from a favorable tropical climate with reliable bimodal rainfall patterns supporting two major cropping seasons each year, and it hosts abundant water resources, including Lake Victoria and numerous rivers. Despite these natural advantages, the country has paradoxically remained a net food importer for decades, with food imports consistently constituting a significant share of total merchandise imports averaging around 13% to 14% historically and standing at approximately 10.7% in 2023, even as absolute import values continue to rise in response to growing demand.

This persistent reliance on imported food is driven by a complex interplay of structural, climatic, economic, and social challenges. Agricultural productivity remains low due to heavy dependence on rain-fed smallholder farming, limited access to quality inputs (seeds, fertilizers, and mechanization), inadequate extension services, poor soil management practices, and substantial post-harvest losses estimated at 20 to 40% for key staples. Production growth has hovered at 2 to 3% annually, failing to keep pace with the country's rapid population growth rate of approximately 3.3%, which has pushed the total population beyond 49 million by 2025. Rapid urbanization, now exceeding 26% of the population living in urban areas has shifted dietary preferences toward convenient processed and imported foods such as wheat-based products, rice, vegetable oils, sugar, dairy, and packaged goods, further widening the domestic supply-demand gap.

Seasonal fluctuations compound these issues. Uganda's two main agricultural seasons (March–July and September–December) create pronounced harvest peaks followed by lean periods, during which domestic supply dwindles, prices surge, and imports spike to bridge shortages and stabilize markets. Climate change has intensified this vulnerability through increasingly erratic weather patterns like prolonged droughts, excessive rainfall, flooding, and pest infestations that disrupt planting and harvesting cycles, particularly in vulnerable regions such as the northern and eastern "cattle corridor" and Karamoja sub-region. These shocks not only reduce yields but also exacerbate food insecurity for millions, with chronic malnutrition indicators remaining stubbornly high: nearly 29% of children under five are stunted, and over half suffer from anemia.

Economically, heavy food import dependence strains Uganda's foreign exchange reserves, contributes to a chronic trade deficit, and exposes the economy to external shocks, including global commodity price volatility (e.g, spikes triggered by the Russia-Ukraine conflict affecting wheat and edible oils) and supply chain disruptions. While regional trade within the East African Community facilitates inflows from neighboring Kenya, reliance on distant suppliers such as India, the Netherlands, Egypt, and Ukraine, increases transportation costs and risks. At the same time, Uganda exports high-value cash crops and occasional surpluses of staples like maize and beans, perpetuating a colonial-era pattern of exporting raw agricultural commodities while importing processed or essential foods.

Socially, this import reliance deepens inequalities. Rural smallholder farmers, who constitute the majority of the poor, struggle to compete with cheaper or higher-quality imported goods, undermining local livelihoods and perpetuating poverty cycles. Vulnerable groups including women, children, refugees (Uganda hosts over 1.7 million, primarily from South Sudan and the Democratic Republic of Congo), and households in food-insecure regions bear the brunt of price hikes and supply instability, threatening long-term human capital development and social stability.

In light of these multifaceted challenges, a comprehensive analysis of the seasonality and long-term trends in Uganda's food imports is urgently needed. Such an analysis will reveal patterns of intra-annual import surges during lean seasons, identify key drivers of sustained dependency, quantify the impacts of climate variability and global shocks, and provide evidence-based insights to guide policy interventions. Ultimately, this research aims to inform strategies for enhancing domestic agricultural productivity, improving storage and processing infrastructure, strengthening

resilience to climate risks, and progressively reducing import reliance, thereby advancing national goals of food security, economic sovereignty, and sustainable development as outlined in Vision 2040 and the Third National Development Plan.

1.2 Problem statement.

Despite its vast agricultural potential including over 70% arable land and a favorable bimodal climate, Uganda paradoxically remains a persistent net food importer, an unsustainable dependency driven by low smallholder productivity, massive post-harvest losses, rapid population growth, and urbanization caused dietary shifts. This structural reliance on imported staples heavily drains foreign exchange reserves, exacerbates the national trade deficit, and exposes the domestic economy to volatile global market shocks and climate-induced supply disruptions. Left unaddressed, this crisis threatens to trigger escalating humanitarian emergencies with projections already placing 1.42 million people in high acute food insecurity through early 2026 while deeply entrenching social inequalities, worsening chronic child malnutrition, and severely undermining Uganda's strategic self-sufficiency goals under Vision 2040.

1.3 Objectives of the study

1.3.1 The overall objective

To analyze the seasonality and trends of Uganda’s food imports from 1995 to 2025.

1.3.2 The specific objectives

Analyze the long-term trend in Uganda’s food imports.

Examine the seasonality of Uganda’s food imports from 1995 to 2025.

Establish the relationship between food imports and GDP

Forecast Uganda’s food imports for the next five years.

1.4 Research hypothesis

Objective: Examine the seasonality of Uganda’s food imports from 1995 to 2025

Null hypothesis: There is no significant seasonal variation in Uganda’s food imports throughout the year.

Alternative hypothesis: Uganda’s food imports exhibit significant seasonal fluctuations.

Objective: Analyze the long-term trend in Uganda's food imports.

Null hypothesis: There is no significant long-term trend in the volume of Uganda's food imports.

Alternative hypothesis: There is a significant long-term trend in Uganda's food imports.

Objective: Determine the effects of dependence on food importation on GDP.

Null hypothesis: High dependence on food importation has no significant effect on Uganda's GDP

Alternative hypothesis: High dependence on food importation significantly correlates with Uganda's GDP.

1.5 Significance of the study

This study directly aligns with Uganda's overarching developmental frameworks, including Vision 2040 and the Third National Development Plan (NDP III), by shifting national strategy from reactive import management to proactive domestic supply stabilization. By replacing annual aggregate data with granular, high-frequency seasonal insights, the research equips policymakers with the precise evidence needed to design targeted interventions. These insights can guide the strategic deployment of grain reserves, seasonal credit schemes, and climate-resilient crop calendars, effectively accelerating Uganda's transition toward agro-industrialization and reducing its long-term dependency on imported staples.

From an economic perspective, analyzing food import trends provides a vital blueprint for addressing Uganda's chronic trade deficit and preserving foreign exchange reserves. By identifying specific commodities ripe for import substitution and local value addition such as edible oils, wheat, and rice the study highlights avenues to redirect capital into foundational agricultural investments like irrigation, mechanization, and processing infrastructure. Furthermore, understanding these seasonal trade dynamics allows Uganda to optimize its position within the East African Community (EAC) and the African Continental Free Trade Area (AfCFTA), transforming domestic seasonal shortfalls into strategic opportunities for intra-regional trade and surplus sharing.

Socially and environmentally, the study serves as a critical mechanism for safeguarding vulnerable populations, including refugee communities and climate-exposed regions like Karamoja. By linking climate-induced agricultural shocks to seasonal import surges, the research aids in the

development of robust early warning systems that mitigate acute food insecurity and combat chronic child malnutrition. Ultimately, integrating monthly trade statistics with climate and price data bridges a major literature gap in global food systems resilience, offering actionable strategies for climate-smart agriculture that protect local livelihoods against both volatile global market spikes and unpredictable, erratic weather patterns.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on food imports. The study empirically presented the related studies done by previous research on the study topic; the review of the literature is guided by the specific research objectives. The theoretical review explores the key theories and models relevant to analyzing the food imports in Uganda from 1995 to 2025.

2.1 Theoretical review

Import Demand Theory explains the factors that influence a country's demand for imported goods. The theory suggests that imports are determined by factors such as national income, population growth, domestic production, relative prices, exchange rates, and consumer preferences.

According to the theory, when domestic production is insufficient to meet consumer demand, countries increase imports to bridge the supply gap. Similarly, rising incomes and urbanization increase the demand for diverse food products, leading to greater food imports.

In Uganda, the increasing demand for commodities such as rice, wheat, sugar, and vegetable oils has often exceeded domestic production capacity. Consequently, imports have become an important source of food supply. The theory therefore provides a useful framework for understanding the long-term trends observed in Uganda's food imports from 1996 to 2025. This theory is appropriate because the study seeks to analyze the factors driving food imports and how these factors have influenced import trends over time. It explains the economic forces behind food importation. Food Security Theory is relevant because food imports are not only influenced by economic factors but also by the need to ensure food availability and stability. It helps explain seasonal import fluctuations that occur when domestic food supplies become inadequate. Together, the theories provide both an economic and food security perspective, enabling a more holistic analysis of food imports.

2.2 Conceptual framework

A conceptual framework in research outlines all the constructs that compose a study and illustrates the relationships among these variables, helping to clarify their interactions and overall significance (Ivey, 2015). Camp (2001) describes it as a structured approach used to explain the development of the research phenomenon. Walden University (2020) notes that conceptual

frameworks are more frequently used in qualitative research, while theoretical frameworks are typically employed in quantitative research. Nevertheless, theoretical frameworks can also be applied in qualitative research.

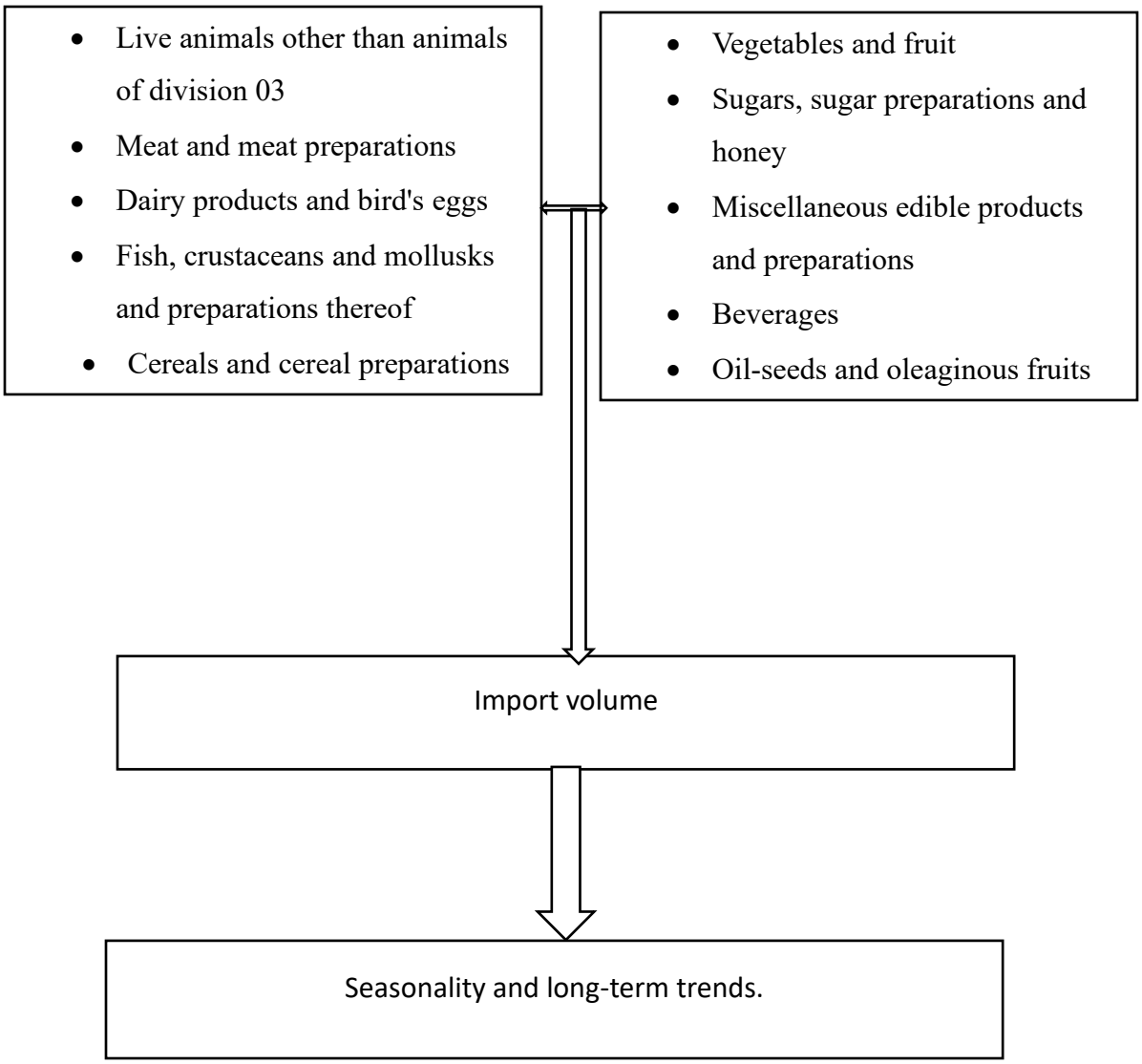

Figure 1 Conceptual Framework

2.3 Empirical review of literature

2.3.1 Live Animals

The importation of live animals is mainly intended to improve livestock breeds, increase domestic production, and support the agricultural sector. According to the Food and Agriculture Organization (FAO, 2022), developing countries often import breeding animals to enhance productivity and improve food security. Uganda occasionally imports live cattle, poultry, and other livestock when domestic production cannot satisfy demand or when improved genetic breeds are required.

Studies by the World Bank (2021) suggest that growth in income, urbanization, and increased demand for animal protein contribute significantly to livestock imports. However, high import dependence may expose countries to disease transmission risks and increased foreign exchange expenditure.

During the dry season, the majority of Batwa households reported greater difficulty in acquiring sufficient quantities and quality of food Petterson et al. (2017) has explained. Petterson et al. (2017) added that; The main food source for the Batwa during the rainy season is subsistence agriculture: crop cultivation and small livestock rearing. During the dry season household agriculture is supported by food bartered in exchange for manual labour, trade with other farms, or cash earned from employment used to purchase food at the market. Batwa displaying some of the lowest health indicators in the country; they have been highlighted as one of the world's most vulnerable populations due to these factors; Substantial inequities with regard to access to education; in 2012 the adult literacy rate for the Batwa living in Kanungu District was less than 12 % compared with more than 75 % among the neighboring non-Indigenous populations in the Southwestern Province, combined with persistent ethnic discrimination and relatively unsuccessful adjustment to agricultural livelihoods and the cash economy.

2.3.2 Meat and Meat Preparations

Meat imports are increasing in many developing countries due to population growth, urbanization, and changing consumer preferences. According to FAO (2023), demand for processed meat products has risen steadily because of changing lifestyles and expanding supermarket chains.

Uganda imports processed meat products to supplement domestic production, particularly during periods of low local supply. Research indicates that meat imports help stabilize domestic markets but may reduce competitiveness of local livestock farmers if not properly regulated.

Benson et al. (2008) argued; the rise in global food prices that has been experienced since 2003 and which accelerated in 2007 and 2008 is likely to affect Ugandan households. The factors most commonly highlighted as contributing to this global price rise include increased costs of food production, processing, and marketing linked to sharply higher oil prices, the use of food crops for biofuel production in the United States and Europe, growing meat consumption particularly in the emerging economies of Asia increasing demand for animal feed, poor harvests in certain major agricultural regions, and consistent under-investment in agriculture over past decades resulting in agricultural production not keeping pace with population or broader economic growth. Several other factors can also be identified, including a weak US dollar on foreign exchange markets, disincentives to agricultural production and trade stemming from protectionist or distortionary trade policies, climate change, and speculative behavior by both governments and commercial agents.

Van et al. (2013) argued, Uganda National Household Survey (UNHS) of 2005 and 2006, they determined whether households were net buyers or sellers to gauge the likely impact of the food crisis. They found that the poor purchased only small quantities of food from the market. This fact, coupled with Ugandans' having a varied diet that gives prominence to traditionally nontrade crops and a poor pass-through of world-to-local prices, led the researchers to conclude that the immediate impact was likely to be small. As a follow-up to this study, Simler (2010) disaggregated by regions and individual food items, used more recent price data, and estimated the immediate impact on sales and purchases again. He found that both incidence and depth of poverty increased, by 2.6 and 2.2 percentage points, respectively, higher than the impact found by Benson, Mugarura, and Wanda (2008).

2.3.3 Dairy Products and Birds' Eggs

Dairy imports include milk powder, cheese, butter, yoghurt, and eggs. Although Uganda has a growing dairy industry, some specialized dairy products continue to be imported due to technological limitations and consumer demand. The International Dairy Federation reports that imports of dairy products are largely driven by industrial processing requirements, seasonal

shortages, and changing dietary patterns. Increased household income and urbanization further increase demand for imported dairy products.

Akidobe (2011) concluded, “Demand for food legume, despite the increase in prices, is expected to grow 10% by 2020 and 23% by 2030 globally. The expected growth rate in SSA is higher than the world average growth rate. This signals a positive outlook for pulses in SSA. The expected growth in supply and price would ensure the availability of pulse crops and its contribution to increasing revenues for pulse producers. However, prohibitive price increases could hinder consumption and weaken food security.”

Isaac et al. (2017) Increasing agricultural production is crucial to securing food and more foreign exchange through trade. Therefore, it is important to put in place policies and strategies that promote good agricultural practices such as use of improved technologies, soil and water conservation techniques among farmers to shield them against impacts of extreme events and climate change. The study aims at scoping the agricultural production, climate change, agricultural trade and food security status in Uganda. Specifically, the study seeks to: document the agricultural production and agricultural systems in Uganda; analyze policies governing agricultural production in Uganda; establish the existing linkage between food production and food security in Uganda; assess the relevance of trade policies to trade in agricultural produce; and assess climate change, its implications on agricultural food production and how it impacts trade and food security.

2.3.4 Fish, Crustaceans, Mollusks and Their Preparations

Fish contributes significantly to food security and nutrition. Although Uganda possesses abundant freshwater resources, imports of processed fish products continue because of increasing domestic demand and declining natural fish stocks. Research by the FAO indicates that processed fish imports have increased due to urban consumers preferring packaged seafood products with longer shelf lives. International trade also allows countries to diversify seafood consumption beyond locally available species.

Mubiru et al. (2023) Beef is a major source of animal protein across the globe and its consumptions increases annually. Globally beef consumption is expected to reach 72 million t by 2025 from 70 million in 2021 (OECD–FAO 2021). In Africa annual beef production was over 45 million kgs in each of 26 countries (FAOSTAT). In Uganda beef production had highest growth rate of 6.5%

between 2001 and 2010 (FAOSTAT) and in 2018 was estimated at 217 million kgs (UBOS 2018). For the past 50 years, beef consumption in Uganda has been growing at a rate of 2%. The growth of the sector presents opportunities that can be harnessed for economic growth, increased revenue, employment and improved livelihoods. However, development of interventions for harnessing economic growth requires an in depth understanding of the sector and the value chain dynamics therein. To this end, ILRI commissioned a situational analysis of Uganda's beef sector to provide relevant information for decision-making. The study relied on secondary information, databases and some key informant interviews. Information was obtained for all the segments of the beef value chain and its enablers. Information on quantities, quality, systems, costs, prices, markets, seasonality, challenges, opportunities and projections was obtained and synthesized; ultimately, potential intervention areas were identified.

2.3.5 Cereals and Cereal Preparations

Cereals constitute one of Uganda's largest food import categories. Wheat and rice are imported because domestic production remains insufficient to satisfy growing demand. According to the World Bank (2022), population growth, climate variability, and changing dietary habits continue to increase cereal imports in East Africa. Several studies conclude that cereal imports play a crucial role in maintaining food availability during periods of drought and poor harvests. However, excessive reliance on imported cereals exposes countries to international price fluctuations and exchange rate risks.

Tatangire(2014) argued that the livestock subsector is one of Uganda's important growth sectors with prospects of improving livelihoods of the rural poor. Small livestock (such as chicken, goats and pigs) are a particularly important "insurance" and "living bank" for poor households, which sell them to cope with shocks and stressors as well as meeting planned financial needs such as school fees obligations. Piggery especially presents tremendous opportunity for rural households to generate income and to move out of poverty because it requires low capital investment and gives relatively quick and attractive returns. Increasingly, more poor women and men are taking on pig rearing because of a guaranteed market. In Uganda, the pig sector is largely dominated by smallholders, who collectively constitute more than 90% of the agricultural system. Smallholders rank pig and crop production highly (highest) as an important source of livelihood and a guaranteed income generator for women.

The literature indicates a generally increasing trend in food imports over the last three decades. During the late 1990s, economic liberalization policies encouraged international trade and reduced restrictions on imports. As a result, Uganda experienced growth in imports of cereals, vegetable oils, sugar, and processed food products. Population growth has been one of the major contributors to this trend. Uganda's population more than doubled during the study period, creating substantial pressure on food systems. Rising incomes also encouraged consumers to diversify their diets and consume more imported foods. Studies have found that imported products such as rice and wheat-based foods became increasingly common, especially in urban areas.

2.3.6 Vegetables and Fruits

Uganda imports vegetables and fruits mainly to meet demand for products that are either not produced locally or are unavailable during certain seasons. Increased urbanization and consumer preference for diversified diets have significantly increased imports. Empirical evidence suggests that income growth and globalization have expanded consumer access to imported fruits and vegetables, thereby increasing import volumes. Seasonal production gaps also contribute to import dependence.

Another notable trend is the growth of food processing industries. The expansion of bakeries, restaurants, supermarkets, and manufacturing firms increased demand for imported raw materials. Wheat imports, for example, continued to rise because domestic climatic conditions are not favorable for large-scale wheat production. The composition of Uganda's food imports has evolved considerably. Wheat and wheat products remain among the largest food imports due to strong consumer demand for bread, chapati, biscuits, and pasta. Rice imports have also increased because of changing dietary preferences associated with urbanization and modernization.

Vegetable oils constitute another important category. Although Uganda produces some oil crops, domestic production has often been insufficient to satisfy growing demand from households and industries. Sugar imports have periodically increased to address domestic shortages and stabilize market prices. The country has also witnessed growth in imports of processed and packaged foods. This shift reflects changes in consumer lifestyles, increasing urban employment, and the expansion of modern retail outlets. The changing composition of imports demonstrates the transformation of Uganda's food consumption patterns over time.

Seasonality refers to recurring fluctuations that occur at regular intervals throughout the year. In agriculture-dependent economies such as Uganda, seasonal patterns are closely linked to rainfall cycles, planting seasons, and harvest periods. Uganda experiences two rainy seasons and two harvest seasons in many parts of the country. During harvest periods, domestic food supplies increase and market prices often decline. Consequently, imports may reduce because local production is sufficient to meet demand. In contrast, imports tend to rise during lean seasons when household food stocks are depleted and domestic market supplies become scarce. Seasonal fluctuations are particularly evident for cereals and staple foods. Traders often increase imports in anticipation of shortages or expected price increases. Such behavior contributes to predictable patterns in import volumes throughout the year.

2.3.7 Sugars, Sugar Preparations and Honey

Sugar imports occur despite Uganda's domestic sugar industry because demand occasionally exceeds supply. Imports also include specialized sugar products and processed sweeteners used by food manufacturers. According to the International Sugar Organization, fluctuations in domestic production, weather conditions, and industrial demand influence sugar import volumes. Liberalized trade policies have further facilitated sugar imports into developing economies.

Climate variability has emerged as a major factor influencing food imports. Uganda's agriculture is predominantly rain-fed, making production highly vulnerable to weather conditions. Droughts reduce crop yields and frequently result in food shortages. In such situations, imports become an important mechanism for maintaining food supplies. Floods can also destroy crops, damage infrastructure, and disrupt food distribution systems. Pest and disease outbreaks further threaten agricultural production. The increasing frequency of climate-related shocks has heightened concerns regarding food security and strengthened the role of imports as a buffer against production instability. Researchers argue that climate change is likely to increase uncertainty in agricultural production, making import management and food reserves increasingly important components of national food-security strategies. Several factors influence food import demand in Uganda. Population growth remains one of the strongest determinants because it directly increases food consumption requirements. Urbanization is another important factor because urban consumers typically demand more processed foods, rice, wheat products, and convenience foods than rural populations. Income growth influences both the quantity and quality of food consumed.

As household incomes rise, consumers often diversify their diets and purchase higher-value food products. Exchange rates also affect imports because depreciation of the local currency increases the cost of imported goods. Domestic production constraints continue to play a major role. Low productivity, limited irrigation, inadequate access to agricultural inputs, post-harvest losses, and weak infrastructure reduce the ability of local producers to meet growing demand. These constraints create a persistent need for food imports.

2.3.8 Miscellaneous Edible Products and Preparations

This category includes processed foods, sauces, spices, instant foods, food additives, and packaged food products. Rising urbanization, increased disposable income, and lifestyle changes have accelerated demand for convenience foods. Research by the FAO indicates that processed food imports continue to rise because consumers increasingly prefer ready-to-eat foods, while local food processing industries are still developing.

Food imports have both positive and negative implications for food security. On the positive side, imports supplement domestic food supplies, stabilize prices, and reduce the severity of shortages during emergencies. They provide consumers with a wider variety of foods and contribute to nutritional diversity. However, excessive reliance on imports can expose a country to international market risks. Global food-price increases, exchange-rate fluctuations, and disruptions in international supply chains can threaten food availability and affordability. Events such as pandemics, geopolitical conflicts, and export restrictions highlight the vulnerability of import-dependent food systems. Therefore, many scholars recommend a balanced approach that promotes domestic agricultural development while maintaining strategic imports to address temporary shortages.

2.3.9 Beverages

Food-related beverages include fruit juices, soft drinks, mineral water, coffee substitutes, and other non-alcoholic beverages. Beverage imports are driven by consumer preferences, tourism, multinational retail expansion, and product diversification. Studies show that increased globalization has expanded access to international beverage brands, leading to steady growth in beverage imports despite local beverage production.

Empirical studies on Uganda's food imports have largely focused on specific commodities such as rice. Research shows that population growth, domestic production levels, consumer demand, and

prices significantly influence import volumes. Studies also demonstrate that urbanization has increased demand for imported foods, particularly among middle-income households. Regional and international studies similarly find that food imports tend to increase with economic growth and changing consumption patterns. Evidence from developing countries suggests that food-import dependence is often associated with structural transformation, urban expansion, and integration into global markets. Despite these contributions, relatively few studies examine food imports using long-term monthly or quarterly data. As a result, there is limited understanding of detailed seasonal patterns and structural changes over extended periods.

2.4 Research Gaps

Although substantial literature exists on agricultural trade and food security, important gaps remain. First, there is limited research focusing specifically on seasonality in Uganda's food imports from 1996 to 2025. Second, many studies rely on annual data, making it difficult to identify seasonal fluctuations. Third, there is insufficient application of advanced time-series techniques such as seasonal decomposition, SARIMA models, and structural-break analysis. Fourth, few studies integrate climate variability, trade policy, and food security within a single analytical framework. Finally, there is limited commodity-specific analysis beyond rice and a few major imports.

CHAPTER THREE: RESEARCH METHODLOGY

3.0 Introduction

This chapter outlines the research design used in this study. It details the population, sampling techniques, sample size, research procedures, data collection methods, and data analysis. This section provides a comprehensive blueprint for the processes of data collection, measurement, and analysis.

3.1 Research design

The research design functions as the blueprint for data collection, measurement, and analysis, providing a structured approach to addressing research questions (Bryman & Bell, 2015). It outlines the overall plan and strategy for the investigation, essentially serving as a strategic framework to achieve the research objectives (Saunders et al., 2019).

In this study there are two types of research design that were used that is descriptive research design and longitudinal research design. The descriptive research design aims to systematically describe a population, situation, or phenomenon without manipulating variables. It focuses on what exists rather than why it exists. A longitudinal study design is a research approach that involves collecting data from the same subjects repeatedly over an extended period to observe changes and trends over time. The longitudinal study is necessary for this study because the data is time series data.

3.2 Data sources

The data used in this study is secondary data. Secondary data refers to information that has already been collected, recorded, and analyzed by someone else for a different purpose but is later used for a new research study. For this study in particular data was got from UBOS website spanning from 1996 to 2025. Given that the study had a time span of 29 years it was costly to collect thus secondary data was favorable.

3.3 Variables and Measurements

The study was more of a univariate analysis which aimed at forecasting the future food imports in Uganda. The dependent variable in this study is Gross Domestic Product and the independent

variable is food imports. The food imports are made up of live animals and other animals in division 3, meat, dairy products, fish, cereals, vegetables, sugars, beverages and oil-seeds.

3.4 Classification of variables

This includes the data classification of the different variables used in the study. Given that all the variables adopted in this study are continuous, they can be further classified as ratio or interval variables as shown in the table below;

Variable	Classification	Frequency.
Gross Domestic Product.	Ratio	Annually
Food Imports	Ratio	Seasonal and annual

Table 1: Classification of variables

3.5 Data analysis

The analysis was done using STATA statistical software and excel. The analysis was done at two levels that is univariate level and bivariate level. In this study a quantitative analysis was done where descriptive statistics were got and several hypotheses were tested.

3.5.1 Descriptive analysis

Descriptive statistics were used to summarize the characteristics of the study variables. Continuous variables were analyzed by calculating the mean, standard deviation (SD), minimum, and maximum values. The mean was used to describe the average value of each variable, while the standard deviation measured the degree of variability or dispersion of observations around the mean. The minimum and maximum values were reported to indicate the range of the observed data and to identify the lowest and highest values recorded. These descriptive statistics provided an overall summary of the distribution and variability of the study data before inferential statistical analyses were conducted.

Test for normality

Shapiro-Wilk test

The Shapiro Wilk test was used to assess the normality of the data (or model residuals) before conducting further statistical analyses. The test was chosen because it is a powerful and widely

recommended method for evaluating whether a dataset follows a normal distribution, particularly for small and moderate sample sizes.

This test was developed by Samuel Snarfold Shapiro and Martin Wilk. It is the most widely used test.

H_0: The data is normally distributed

H_a: The data is not normally distributed

The test statistic $w = \frac{\left(\sum_{i=1}^{n} xa_i\right)^2}{\left(\sum_{i=1}^{n} x-\overline{x}\right)^2}$

If the p value is less than the chosen alpha level, then the null hypothesis is rejected and there is evidence that the data tested are not normally distributed.

3.5.2 Trend Analysis

Test for trend

The Augmented Dickey Fuller (ADF) test was used to determine whether the time-series data were stationary by testing for the presence of a unit root. Stationarity is a fundamental assumption in time-series modelling because many forecasting models, including the Autoregressive Integrated Moving Average (ARIMA) model, require the underlying series to have a constant mean and variance over time. Non-stationary data often exhibit trends or other systematic changes that can lead to unreliable model estimates and inaccurate forecasts. The ADF test was selected because it accounts for higher-order serial correlation by including lagged differences of the dependent variable.

Augmented Dickey-Fuller Test

Augmented Dickey Fuller test (ADF Test) is a common statistical test used to test whether a given Time series is stationary or not.

H_0: The series is non-stationary.

Ha: The series is stationary.

It is from the test statistic and the p-value, you can make an inference as to whether a given series is stationary or not.

3.5.2 The relationship between food imports and GDP

At this level, the possible relationships between the variables under study were explored using Pearson correlation analysis by taking the variables in pairs.

$$R=\frac{\sum(x_i-\bar{x})}{\sqrt[2]{\sum(x_i-\bar{x})^2\sum(y_i-\bar{y})^2}}$$

R= correlation coefficient

x_i= values of the x-variable in the sample

$\bar{x}$= mean of the x-variable

y_i= values of the y-variable in the sample

$\bar{y}$= mean of the y-variable

3.5.3 Forecasting

Autoregressive Integrated Moving Average (ARIMA)

At this level summary descriptive were obtained on all the variables and all the individual components in the food imports such as mean, median, standard deviation, skewness, minimum and maximum values.

The study used Autoregressive Integrated Moving Average (ARIMA) model to predict the future food imports because this was a univariate time series analysis.

ARIMA is an acronym that stands for Auto-Regressive Integrated Moving Average. Specifically, AR Autoregression is a model that uses the dependent relationship between an observation and some number of lagged observations. Integrated is the use of differencing of raw observations in order to make the time series stationary. Moving Average is a model that uses the dependency between an observation and a residual error from a moving average model applied to lagged observations.

The standard notation used is of; ARIMA (p, d, q) where the parameters are substituted with integer values to quickly indicate the specific ARIMA model being used.

p is the number of lag observations included in the model, also called the lag order.

d is the number of times that the raw observations are differenced, also called the degree of differencing.

q is the size of the moving average window, also called the order of moving average.

The Autoregressive model (AR)

Autoregressive models are based on the idea that current value of the series, X_t, can be explained as a linear combination of p past values, X_{t-1}, X_{t-2}, ..., X_{t-p}, together with a random error in the same series.

An autoregressive model of order p, abbreviated AR(p), is of the form p

$X_t=\emptyset_1 X_{t-1}+\emptyset_2 X_{t-2}+\ldots+\emptyset_p X_{t-p}+w_t=\sum_{i=1}^{p} \emptyset_i X_{t-i}+w_t$

where X_t is stationary, $w_t \sim$ wn $(0,\sigma_w^2)$, and $\emptyset_1$, $\emptyset_2$, ..., $\emptyset_p$ ($\emptyset_p \neq 0$) are model parameters. The hyperparameter p represents the length of the "direct look back" in the series.

The Moving Average model (MA)

A moving average model of order q, or MA(q), is defined to be

$X_t=w_t+\theta_1 w_{t-1}+\theta_2 w_{t-2}+\ldots+\theta_q w_{t-q}=w_t+\sum_{j=1}^{q} \theta_j w_{t-j}$

Where $w_t \sim$ wn $(0, \sigma_w^2)$, and θ_1, θ_2, ..., θ_q ($\theta_q \neq 0$) are parameters.

Although it looks like a regression model, the difference is that the w_t is not observable.

Contrary to AR model, finite MA model is always stationary, because the observation is just a weighted moving average over past forecast errors.

Box-Jenkins approach.

ARIMA models have numerous parameters and hyper parameters, Box and Jenkins suggest an iterative three-stage approach to estimate an ARIMA model.

The steps followed;

Model identification: Checking stationarity and seasonality, performing differencing if necessary, choosing model specification ARIMA(p,d,q).

Parameter estimation: Computing coefficients that best fit the selected ARIMA model using maximum likelihood estimation or non-linear least-squares estimation.

Model checking: Testing whether the obtained model conforms to the specifications of a stationary univariate process (i.e. the residuals should be independent of each other and have constant mean and variance). If failed go back to step 1.

Testing for stationarity.

Augmented Dickey-Fuller Test.

The Augmented Dickey Fuller (ADF) test was used to determine whether the time-series data were stationary by testing for the presence of a unit root. Stationarity is a fundamental assumption in time-series modelling because many forecasting models, including the Autoregressive Integrated Moving Average (ARIMA) model, require the underlying series to have a constant mean and variance over time

Augmented Dickey Fuller test (ADF Test) is a common statistical test used to test whether a given Time series is stationary or not.

H_0: The series is non-stationary.

Ha: The series is stationary.

It is from the test statistic and the p-value, you can make an inference as to whether a given series is stationary or not.

Test for Seasonality

The non-parametric and parametric test will be used for making a decision about presence or absence of seasonality and the seasonal factors will be estimated.

Hypothesis

H0: The series has no seasonality

Ha: The series has seasonality

Tests using the moving average (MA) method

Add: yt = Tt + St + Ct + It

Multiplicative: yt = Tt x St x Ct x It

And the moving average (MA) = Tt + Ct for an additive model and (MA) = Tt x Ct for a multiplicative model.

The specific seasons are: yt – MA = St + It for additive model and; yt/MA = St x It for multiplicative model.

Computation of a moving average

In case of a quarterly series yt observed 4 times per year at times t=1, 2, 3, … the moving average is computed as follows:

The first MA = (y1 + y2 + y3 + y4)/4, the second MA = (y2 + y3 + y4 + y5)/4, third MA = (y3 + y4 + y5 + y6)/4 and so on.

If L is an even number, then the moving averages must be centered to correspond to a specific quarter. The computation of the centered moving average (CMA) follows:

Step 1: Calculate L- period moving average of the original data; 35

Step 2: Calculate 2- period moving average of the moving averages resulting from step 1 resulting in a centered moving average;

Kruskal-Walli's test

Ri = the sum of the ranks of the yt's in the i^{th} season;

n_i = number of specific seasons in the i^{th} season;

n = total number of specific seasons;

$n= n_1 + n_2 + n_3 + \ldots + n_L$

Let $\bar{Ri}$ = average rank in the i^{th} season = R_i

Let $\bar{R}$ = the overall average rank;

$H= \frac{12}{n(n+1)} [\sum \frac{R^2}{n_i}]-3(n+1)$

n_i = number of observations in the ith season;

n = total number of specific seasons;

$= \sum n_i$

yi' = specific seasonal for time t,

$R_i = \sum Rank(yi)$ i^{th} season

Reject H_o if $H > X^2_{\alpha}(L-1)$

Where $X^2_{\alpha}(L-1)$ is the upper α x 100% point of the chi-square distribution with L-1 degrees of freedom.

3.6 Ethical considerations.

It was important to be transparent about the origins of data and other information and properly credit the original sources. This involved identifying where the data came from, acknowledging the original researchers or institutions, and being upfront about any changes made to the research. Failure to do so could have led to issues such as plagiarism, misrepresentation, and a loss of credibility. By being transparent and accurately attributing the data, the research maintained its integrity and adhered to the ethical academic standards.

3.7 Limitations of the study.

Some of the variables that were initially adopted in the study were dropped because they contained missing information. Additionally, the variables that were retained had varying start periods, which required the researcher to exclude certain values from some of the variables to ensure consistency in the number if observations across all variables. This adjustment process unfortunately led to loss of some data points.

CHAPTER FOUR: PRESENTATION OF FIDINGS

4.0 Introduction

The purpose of the study was to conduct a statistical analysis of food imports in Uganda 1996-2025. The subsequent sections will present the descriptive statistics, including measures of central tendency and dispersion, followed by inferential statistics to test hypotheses and determine the relationships between food imports and GDP. The findings from this analysis will be critically discussed to highlight their implications for policy and practice.

4.1 Description of Food imports

Variable	Obs	Mean	Std. Dev.	Min	Max
Imports	118	105893.01	73405.332	11893.905	453181.22
GDP	30	82.708	40.844	27.92	162.606

Table 2 Descriptive statistics of the variables

Table 2 presents the descriptive statistics for the study variables, namely food imports and Gross Domestic Product (GDP). The statistics include the number of observations, mean, standard deviation, minimum, and maximum values. The results indicate that food imports had 118 observations, with an average (mean) value of 105,893.01. The standard deviation of 73,405.33 suggests considerable variation in food import values over the study period, indicating that imports fluctuated substantially across different quarters. The minimum value of food imports was 11,893.91, while the maximum value reached 453,181.22, reflecting a wide range between the lowest and highest import levels. This large variation may be attributed to changes in domestic demand, international food prices, exchange rate movements, and seasonal factors affecting food imports.

For GDP, the dataset comprised 30 observations, with an average value of 82.71 and a standard deviation of 40.84. The minimum GDP recorded during the study period was 27.92, while the maximum was 162.61. The relatively high standard deviation indicates that Uganda's GDP experienced notable changes over the period under study, reflecting economic growth and fluctuations in economic activity.

4.2 Trend analysis

The long-term trend analysis was conducted to examine the direction and pattern of Uganda's food imports over the study period. The trend analysis was aimed to indicate whether the food imports have generally increased over time.

Visualization of the different components of food imports.

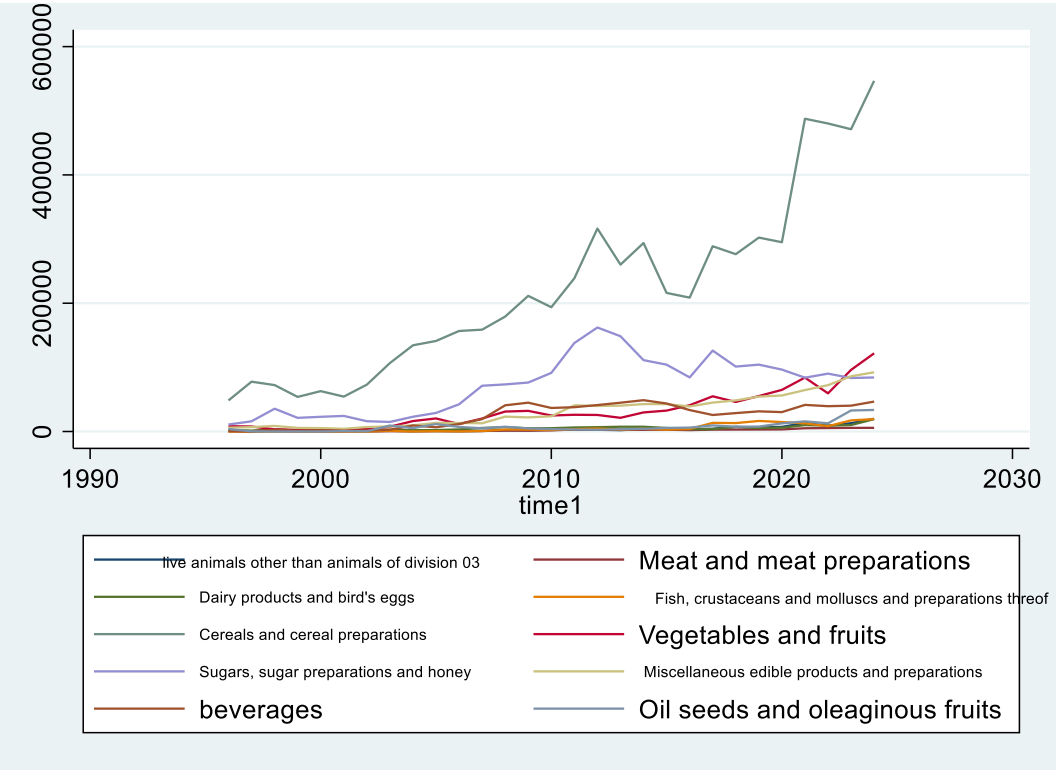

Figure 2 Trends in food imports

Figure 2 illustrates the trends in the different categories of food imports over the study period. The graph shows that food imports generally exhibited an upward trend, although the rate of increase varied across commodity groups. One category experienced a particularly sharp and sustained increase, especially after 2020, indicating that it accounted for the largest share of food imports during the latter part of the study period. Other food categories, including vegetables and fruits, cereals and cereal preparations, dairy products and birds' eggs, beverages, meat and meat preparations, fish, crustaceans and mollusks, sugars and honey, oil seeds and oleaginous fruits, and miscellaneous edible products, also displayed increasing trends, but at relatively slower and more gradual rates. While some categories experienced temporary fluctuations over time, there was no clear evidence of recurring seasonal patterns, suggesting that changes in food imports were

primarily driven by long-term growth rather than seasonal effects. Overall, the figure indicates a persistent increase in food imports across most commodity groups, reflecting rising demand for imported food products over the study period.

Unit root test using the ADF test.

Dickey-Fuller test for unit root			Number of observations=117	
Interpolated Dickey-Fuller				
	Test statistic	1% critical value	5% critical value	10% critical value
Z(t)	0.834	-3.504	-2.889	-2.579
MacKinnon approximate p-value for Z(t) = 0.9922				

Table 3 Results for ADF test of the imports

From the table, we fail to reject the null of non-stationarity because the p-value is way larger than the level of significance showing that the data of food imports is not stationary. This means there exists a long-term trend in the data.

4.3 Seasonality analysis.

The seasonal analysis was conducted to find out whether there existed seasonal patterns in the data. From the correlogram, we observe a long-term trend and non-stationarity but not quarterly seasonality in the data. The correlogram analysis revealed strong positive autocorrelation in Uganda's food imports. The autocorrelation coefficient at lag 1 was 0.8319 and remained positive across all subsequent lags, declining gradually rather than dropping sharply. This pattern suggests that the series is non-stationary and contains a persistent long-term trend. Furthermore, the Ljung-Box Q-statistics were significant at all lags ($p < 0.001$), indicating the presence of substantial serial correlation. Although quarterly seasonality was investigated, the autocorrelation function did not exhibit pronounced spikes at the seasonal lags of 4, 8, 12, and 16 quarters. Consequently, the series appears to be characterized primarily by trend persistence rather than strong seasonal fluctuations

4.4 Relationship between Food imports and GDP

Variables	Imports	GDP
Imports	1.000	0.966
GDP	0.966	1.000

Table 4: Results of correlation coefficient

The correlation coefficient is 0.966 which is very high and positive, this means that GDP is a strong predictor of food imports. As GDP increases, food imports also tend to increase. This is because household income increases, consumer demand for good and services increases as well as imported food products.

4.5 Forecasting

4.5.1 Testing for stationarity after the first differencing.

Dickey-Fuller test for unit root			Number of observations=11	
Interpolated Dickey-Fuller				
	Test statistic	1% critical value	5% critical value	10% critical value
Z(t)	-10.406	-3.505	-2.889	-2.579
MacKinnon approximate p-value for Z(t) = 0.000				

Table 4 Results for ADF test after differencing

Table 4 presents the results of the Augmented Dickey–Fuller (ADF) test after the first differencing of the food imports series. The test was conducted to determine whether the differenced series was stationary, which is a prerequisite for fitting an ARIMA forecasting model. The ADF test statistic was -10.406, which is more negative than the 1%, 5%, and 10% critical values of -3.505, -2.889, and -2.579, respectively. In addition, the MacKinnon approximate p-value was 0.000, which is less than the 5% level of significance ($p < 0.05$). Therefore, the null hypothesis of a unit root (non-stationarity) is rejected in favor of the alternative hypothesis that the series is stationary. This indicates that the first differencing successfully removed the non-stationarity from the food imports series, making the data suitable for ARIMA model estimation and forecasting.

4.5.2 Model specification.

The autocorrelation function.

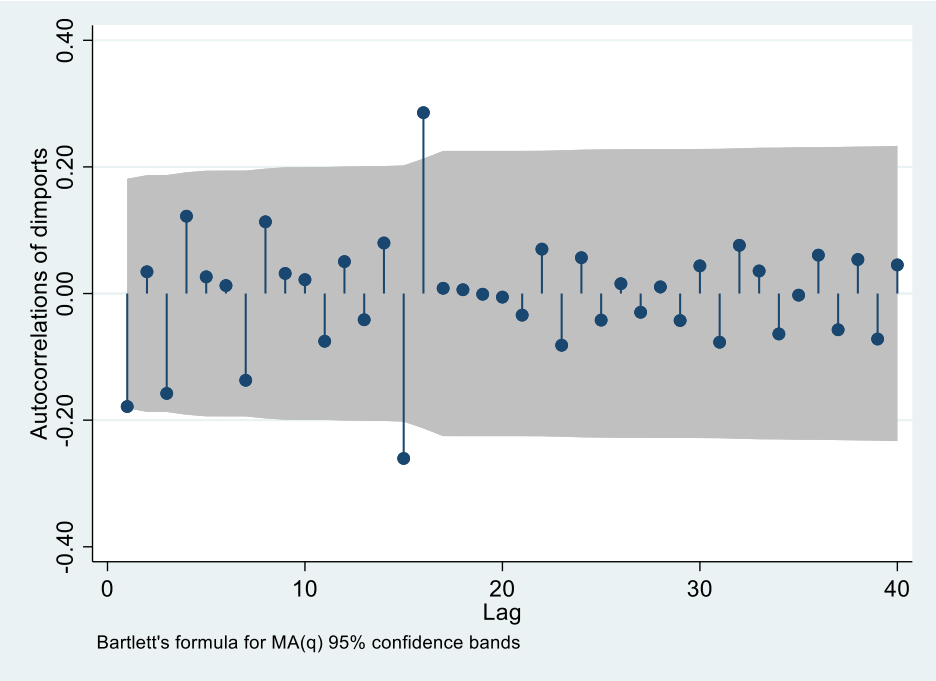

Figure 3 Autocorrelation function

To specify the Moving Average (MA) order for the model, we examine the Autocorrelation Function (ACF) plot of the differenced imports. The ACF plot displays the correlation between the series and its lagged values against a 95% confidence interval.

Upon inspection, the autocorrelations for the initial lags are statistically insignificant, as they remain within the shaded Bartlett's confidence bands. Although a single significant spike appears at Lag 16, the absence of significance in the preceding lags (1 through 15) suggests that there is no standard Moving Average pattern present.

However, a series of ARIMA models have been run and the AIC and BIC have been compared and that is how the model has been specified.

The partial autocorrelation function.

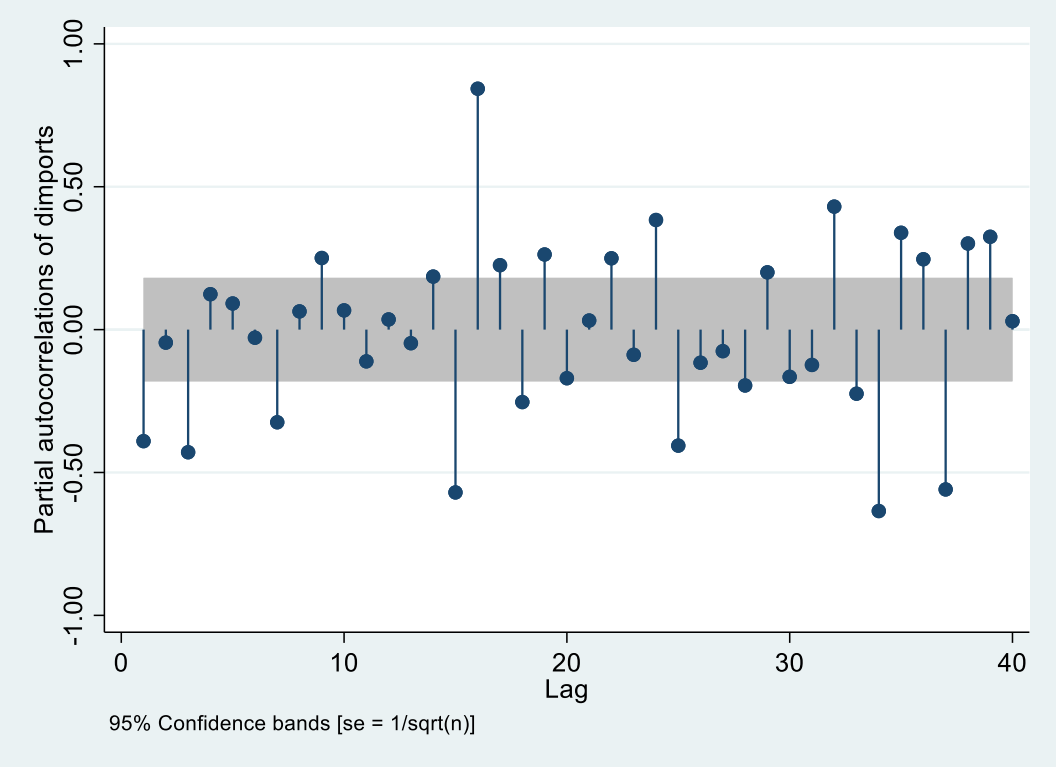

Figure 4 The partial autocorrelation function

To determine the Autoregressive (AR) order, p, we analyze the Partial Autocorrelation Function (PACF) plot. Unlike the ACF, the PACF controls for intermediate lags, providing a clearer picture of the direct relationship between the series and its past.

The plot reveals significant partial correlations at the earliest lags, specifically Lags 1 and 2, which drop sharply but remain significant through Lag 4. However, a series of ARIMA models have been run and the AIC and BIC have been compared and that is how the model has been specified.

4.5.3 Parameter Estimation.

D.dimports	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Constant	91.865	149.628	0.61	.539	-201.4	385.131	
L	-.381	.112	-3.40	.001	-.601	-.162	***
L	-1	479.891	-0.00	.998	-941.568	939.568	
Constant	25400.598	6095507.7	0.00	.498	0	11972376	

Mean dependent var	1839.473	SD dependent var	36130.500
Number of observations	116	Chi-square	11.974
Prob > chi2	.	Akaike crit. (AIC)	2695.870

Table 5 Results of ARIMA model

The first "L" row shows a coefficient of -0.381. This represents the first lag of the autoregressive component. The intercept 91.865 is not significant

4.5.4 Diagnostic tests

Normality test of the residues

Shapiro wilk W test for normal data					
Variable	Observation	W	V	Z	Prob>z
Error1	116	0.99643	9.127	4.523	0.7231

Table 6 Shapiro Wilk test for residues

The Shapiro Wilk test was conducted to determine whether the model residuals are normally distributed. The results indicate that the residuals have a W statistic of 0.99643, which is very close to 1, suggesting that they closely follow a normal distribution. Furthermore, the p-value (Prob > z) is 0.7231, which is greater than the 0.05 significance level. Therefore, the null hypothesis of normality cannot be rejected. This implies that the residuals are normally distributed, satisfying the normality assumption required for the forecasting model.

Portmanteau test for white noise

Portmanteau (Q) statistic	8.4306
Prob>Chi2(12)	0.5823

Table 7 Portmanteau test for white noise

The Portmanteau test was performed to determine whether the residuals are independently distributed (white noise). The test produced a Q statistic of 8.4306 with a p-value of 0.5823. Since the p-value is greater than 0.05, the null hypothesis that the residuals are white noise cannot be rejected. This indicates that there is no significant autocorrelation remaining in the residuals, meaning the model has adequately captured the underlying time-series structure.

The white noise test

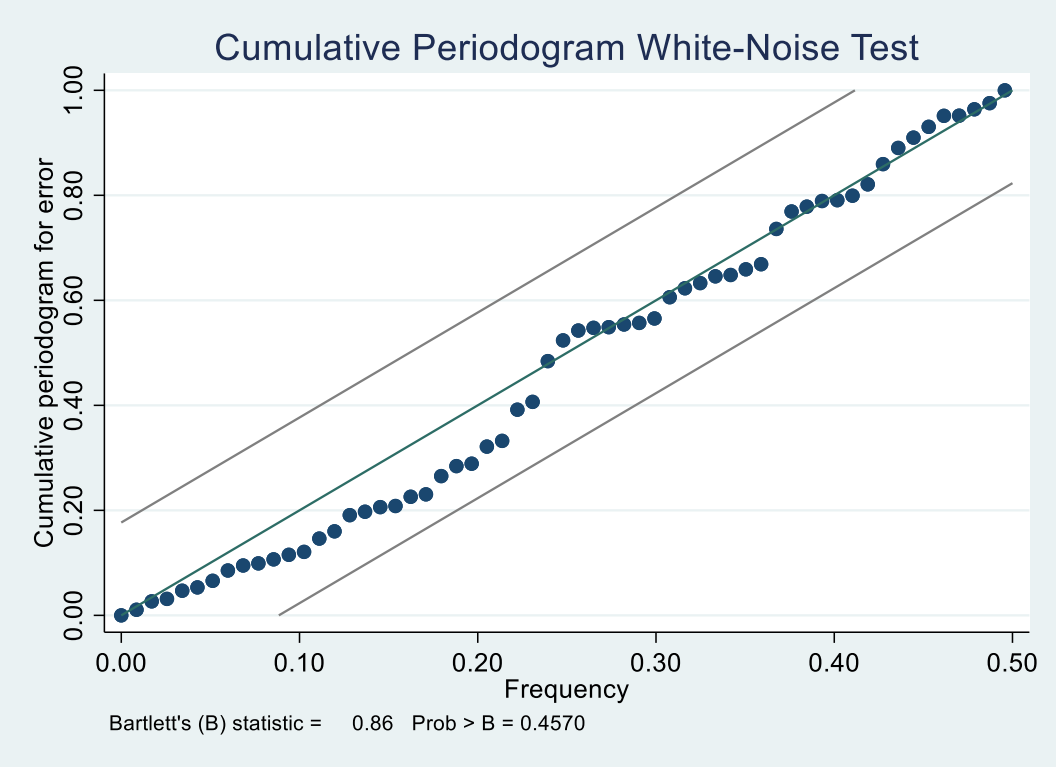

Figure 5 White noise of the residues

This graph shows a much better story for the analysis. It represents the Cumulative Periodogram for the residuals, which is exactly what should be tested.

The dots here follow the diagonal reference line very closely. Most importantly, the entire path of the dots stays inside the confidence bands (the two outer parallel lines). This indicates that the frequencies of the residuals are distributed evenly, which is the hallmark of randomness.

In econometrics, we typically use a significance level of 0.05. Since your p-value (0.4570) is much higher than 0.05, you fail to reject the null hypothesis. The Conclusion: The null hypothesis that the series is white noise holds true.

This means that the ARIMA model has successfully extracted all the predictable structure from the meat imports data. There is no significant autocorrelation left over.

4.6 Discussion

The findings are discussed in relation to the specific objectives of the study, offering insights into how well statistical modeling aligns with the forecast of food imports in Uganda from 1996 to 2025. This approach helps to assess the effectiveness of the models used and their relevance to the

study's goals, providing a comprehensive understanding of the factors influencing the trends in the food imports in Uganda.

The line graph illustrates the trends in various food import components over the years in the study. The data reveals a significant overall increase in the value of food imports characterized by distinct patterns among the different categories. This line graph illustrates the trends in various food import components over a thirty-year period, from approximately 1995 to 2024. The data reveals a significant overall increase in the value of food imports, characterized by distinct patterns among the different product categories.The most striking feature of the graph is the massive surge in Cereals and cereal preparations. For the first decade (1995-2005), this category remained relatively low and stable. The turning point started around 2005-2008, cereals began a steep, upward trajectory. Following 2020, there is a sharp spike followed by a dramatic peak nearing the 600,000 mark. This suggests an increasing reliance on imported grains, likely driven by shifts in domestic demand or changes in global commodity prices. Sugars, sugar preparations and honey experienced a steady rise beginning around 2008, peaking near 2012 before stabilizing at a higher plateau than its pre-2000 levels. Vegetables and fruits follow a gradual upward trend, showing consistent growth over the last two decades, reflecting a diversifying gap in local seasonal production. The remaining categories, including Meat and meat preparations, Dairy products, Beverages, and Oil seeds, occupy the bottom portion. The widening gap between cereals and all other categories suggests that the import bill is heavily weighted toward basic caloric staples. This pattern often points to a country that is transitioning its consumption habits or facing challenges in domestic grain production.

From the residual diagnostic test which shows white noise, the model has adequately captured the systematic information in the data. Therefore, the forecasts generated by the model can be considered reliable within the sample characteristics.

Short-Term Forecast: The significant AR(1) term suggests that; A large increase in imports in one period is likely to be followed by a smaller increase or even a decline in the next period. The series tends to adjust back toward its long-run path rather than continue moving in the same direction indefinitely. This indicates a degree of mean reversion in food imports.

Long-Term Forecast; Because the autoregressive coefficient (-0.381) is less than one in absolute value, the effect of shocks gradually diminishes over time.

Forecasts converge toward the long-run average growth rate of imports. The influence of past shocks becomes weaker as the forecast horizon increases. Long-run forecasts become relatively stable. The estimated ARIMA model was used to forecast Uganda's food imports. The residual diagnostics confirmed that the residuals were white noise, indicating that the model successfully captured the underlying structure of the series. The AR(1) coefficient of -0.381 was statistically significant ($p = 0.001$), suggesting that changes in imports exhibit a mean-reverting behavior whereby increases in one period tend to be followed by adjustments in subsequent periods. Since the absolute value of the autoregressive coefficient is less than one, shocks to imports dissipate over time, causing forecasts to converge toward the long-run trend. The model therefore provides a reasonable basis for short-term forecasting of food imports, although forecast uncertainty increases as the forecast horizon extends.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECCOMENDATIONS

5.0 Introduction

This study aimed to forecast the food imports of Uganda from 1996 to 2025 using statistical methods. It draws conclusions based on the discussions from chapter four and provides recommendations.

5.1 Summary of findings

This study examined the trends and patterns of food imports over the study period using descriptive and time-series analytical techniques. Descriptive statistics, including the mean, standard deviation, minimum, and maximum values, revealed considerable variation in the volume and value of food imports across the years, indicating fluctuations in import demand and supply conditions.

The Shapiro Wilk normality test was conducted to assess whether the variables were normally distributed. The results informed the selection of appropriate statistical methods for subsequent analyses by identifying variables that satisfied or violated the normality assumption.

The Augmented Dickey–Fuller (ADF) test was employed to determine the stationarity of the time-series data. The findings established whether the food import series exhibited a unit root or was stationary, thereby ensuring the validity of the trend analysis and minimizing the risk of obtaining spurious results.

Overall, the analysis demonstrated that food imports experienced notable fluctuations during the study period, reflecting the influence of factors such as domestic food production, population growth, exchange rate movements, trade policies, and changes in international market conditions. The findings highlight the importance of strengthening domestic agricultural production, improving food security strategies, and implementing sound trade policies to ensure a stable and sustainable food supply while reducing excessive dependence on imports.

5.2 Conclusion

5.2.1 Model Evaluation.

The residual diagnostic results indicated that the residuals are white noise, meaning that they are random and contain no significant autocorrelation. Consequently, the null hypothesis that the residual series is white noise cannot be rejected. This result is important because it demonstrates that the ARIMA model has successfully captured the systematic patterns present in the food imports data. The absence of residual autocorrelation indicates that little useful information remains unexplained by the model.

5.2.2 Forecasting the food imports

The ARIMA model developed for Uganda's food imports was found to be adequate and reliable for analyzing and forecasting the series. The model evaluation results showed that the AR(1) parameter was statistically significant, indicating that past changes in imports have a significant effect on current import levels. Furthermore, the residual diagnostic tests confirmed that the residuals were white noise, implying that the model successfully captured the underlying patterns and dynamics of the data.

The absence of significant autocorrelation in the residuals suggests that no important information was left unexplained by the model. In addition, the stationarity condition was satisfied, indicating that shocks to food imports are temporary and diminish over time. Consequently, the model can generate stable and dependable forecasts, particularly in the short and medium term.

Overall, the findings demonstrate that the ARIMA model is suitable for forecasting Uganda's food imports and can serve as a useful tool for policymakers, researchers, and planners in making informed decisions regarding food security, import management, and economic planning. The model's forecasts can help anticipate future import requirements and support the development of strategies aimed at ensuring a stable and sustainable food supply in Uganda.

5.3 Recommendations

The increasing trend in food imports suggests a growing dependence on external markets to meet domestic food demand. To address this challenge, the government should prioritize policies that enhance domestic agricultural production through increased investment in irrigation, improved seed varieties, mechanization, agricultural research, and extension services. Support should also

be provided to smallholder farmers by improving access to affordable credit, quality inputs, and reliable markets. Additionally, investments in storage facilities, transportation infrastructure, and value addition should be strengthened to reduce post-harvest losses and improve the competitiveness of locally produced food. These measures will help reduce the country's reliance on food imports, improve food security, create employment opportunities, and contribute to sustainable economic growth.

The absence of significant seasonality in quarterly food imports suggests that import demand remains relatively consistent throughout the year rather than being concentrated in specific quarters. Based on this finding, policymakers should focus on developing long-term food import and supply strategies instead of relying on seasonal interventions. Continuous monitoring of food demand, domestic production, and international market conditions should be strengthened to ensure a stable and efficient food supply throughout the year. Furthermore, efforts to increase domestic agricultural production should be sustained across all seasons to reduce dependence on imports and enhance national food security. Maintaining adequate strategic food reserves and improving supply chain management will also help the country respond effectively to unexpected changes in food demand or disruptions in global markets.

The strong positive correlation between GDP and food imports ($r = 0.966$) suggests that economic growth is associated with increased demand for imported food. Therefore, policymakers should ensure that economic growth is accompanied by increased investment in domestic agricultural production to meet rising food demand. Improving agricultural productivity through enhanced irrigation, mechanization, access to quality inputs, and extension services will help reduce reliance on food imports as incomes and consumption increase. Additionally, policies that promote value addition and strengthen local food supply chains should be implemented to ensure that economic growth translates into greater domestic food production rather than increased dependence on imported food products.

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