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Is there a potential market for locally produced cheese in DR Congo, Burundi, and Rwanda?

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Master of Science in Economics

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by

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Abstract

This study investigates the market potential for locally produced cheese in three African countries namely the Democratic Republic of Congo (DRC), Rwanda, and Burundi. We utilized three models Binary, Multinomial, and Mixed Logit to analyze the market potential and consumer preferences in each country based on data collected through questionnaires administered to 100 respondents in each country.

Our findings indicate that there is a potential market for locally produced cheese in the DRC, while Rwanda and Burundi consumers appear to prefer cheese imported from other African countries. We also discovered that the attributes that influence consumer choice of cheese vary within each of these countries. For instance, in DRC, consumers showed a preference for hard cheese, while those in Rwanda and Burundi preferred imported cheese attributes such as flavor and texture.

Furthermore, our analysis revealed that price and origin were significant factors influencing consumer preferences for cheese in all three countries. Based on these findings, we recommend that producers and policymakers focus on improving the quality and variety of locally produced cheese to meet the varying preferences of consumers in each country.

Additionally, measures should be taken to reduce the cost of production and distribution to make locally produced cheese more affordable and accessible to consumers. This study provides valuable insights into the market potential for locally produced cheese in DRC, Rwanda, and Burundi and can help guide decision-making for producers and policymakers in the dairy industry.

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1. Introduction

Cheese is a dairy product which is made up of fermented milk by draining off the excess liquid (Microbe Safari, 2020). It is a popular dairy product that has being in existence for consumption around the world for centuries. All ages enjoy this food because it is so adaptable and can be used in so many different dishes. Demand for locally produced cheese around the world has increased as consumers become more aware of the origins of their food and the effects that imported goods have on the environment (Ritchie, 2020).

The global trend of valuing locally produced food, including cheese, has been on the rise in recent years (United State Department of Agriculture, 2015). However, it remains unclear if this trend holds in developing countries, particularly in the African regions. According to a report by McKinsey & Company in 2018, the trend of "local sourcing" is on the rise in Africa, with consumers increasingly interested in knowing where their food comes from and supporting local businesses. If this trend holds, then there could be a potentially untapped market for local cheese producers in the Democratic Republic of Congo (DRC) to sell in Burundi, and Rwanda.

The choice of these three countries is based on their geographical proximity. There are major constraints to smallholders' dairy market development in Burundi such as inadequate access to markets, low productivity, poor quality of milk, limited access to inputs, and weak institutional support (Ouma et al., 2020). The potential for small-scale cheese production in these countries is of particular interest, given the potential economic benefits for local producers and the possibility of contributing to food security in the region.

Small scale cheese production has been part of the traditional food culture in many regions in East Africa, including, Burundi, and Rwanda (Lokuruka, 2016). Historically, cheese was made using traditional methods, such as using natural rennet and aging the cheese in caves or other cool places. However, with the advent of industrialization and mass production, many small-scale cheese producers were unable to compete with larger industries due to technology (Licitra et al., (2019)

There are more than 130 million people living in these DRC, Rwanda, and Burundi (worldmeter, 2022). These areas are renowned for having rich soil and an agrarian friendly climate, which may

be advantageous for making cheese of a high caliber (OECD/FAO, 2016). The potential market for locally produced cheese in these nations has, however, received little research. According to a 2016 study by the United States Agency for International Development (USAID), demand for dairy products is rising in south sub-Sahara Africa of which DR Congo, Rwanda and Burundi are no exceptions, but most of it is for liquid milk and there is little demand for processed dairy goods like cheese.

The cheese market in these countries comprises of imported cheeses from other African countries and Europe, which may be perceived as a great height of quality than locally produced cheese (Mcbain, 2021). However, local producers have the advantage of being able to produce fresh and sustainable products that could appeal to environmentally conscious consumers. There is consistence growing of trend towards supporting local businesses, McKinsey & Company (2018), which could work in favor of local cheese producers. There are challenges for local cheese producers in DR Congo, Burundi, and Rwanda however, there could be potential market for locally produced cheese. For a robust market base, there is the need to promote their unique qualities, leveraging the growing trend towards local sourcing, and offering competitive pricing, local producers could establish a niche in the market and build a loyal customer base.

In the past few decades, Rwanda's milk production industry has advanced significantly, which has had a great impact on its economy. This is due to significant government efforts to strengthen the livestock industry, including but not limited to the Girinka program's distribution of cows to the poor (Rwanda Ministry of Agriculture and Animal Resource, 2021). Plovnick (2015), noted that while cheese is not traditionally part of African delicacy, the abundance of cattle, goat, and the cool climate of the Masisi Mountains (Switzerland of Africa) in DR Congo make this region an ideal place for cheesemaking. Rwanda and Burundi import some of its cheese from Europe and neighboring African countries (Lokuruka,2016).

English et al. (2016), point out that the size of the cheese industries in Rwanda is relatively small, which indicates that there is potential for growth and development in the sector. However, the demand for local cheese has grown, with restaurants and markets in big cities upping their orders (Foulds, 2015). Over 120 local farmers in DRC have the desired goal of expanding into the global

market, and this is becoming more achievable as their cheese begins to travel far and wide (Mcbain, 2021).

1.1 Problem Statement

There are major debates on ethical considerations with regards to food production and food choice behavior among people in recent times which has received more attention due to the quality and the resultant food scares among consumers (Brunsø et al., 2002). Burundi and Rwanda have a significant dairy industry, which remains underdeveloped, with many challenges such as, lack of modern farming practices, inadequate infrastructure, and limited access to international markets (Bingi, & Tondel, 2015). These countries have not been able to take full advantage of the growing global demand for cheese, which could offer them great economic relief (Foulds, 2015).

While a great deal of studies has emerged to highlight the importance of livelihood diversification in local terms as a relevant tool to reduce poverty through various agriculture activities in some African countries as Alobo-Loison (2015) indicated. Empirical evidence on how cheese production in DR Congo, Burundi, Rwanda as a source of livelihood for individuals and households remains limited. Based on this research gaps, the study sought to analyze the following key questions:

> ➢ Are individuals willing to pay more or less for locally produced cheese relative to imported cheese in DRC, Rwanda and Burundi?
> ➢ Which of the cheese attributes has the strongest influence on consumer preference? Are these the same in DRC, Rwanda and Burundi?
> ➢ What influences the consumption of local or imported cheese in the DRC, Rwanda, and Burundi?

This study seeks to examine the potentials for cheese making as a source of livelihood diversification for the people of DR Congo, Burundi, and Rwanda. This study will take into consideration the influence on consumers and also determine the willingness to pay for local cheese.

1.2 General and Specific objectives

The aim of the study is to determine the potential willingness to pay and viability of locally produced cheese in DRC, Rwanda and Burundi. It is also to identify opportunities for small-scale

farmers and producers to enter the market and contribute to the local economy, while also addressing issues of food insecurity and malnutrition.

This research is aimed to investigate if there is a significant difference in the willingness to pay more or less for imported cheese and locally produced cheese among individuals in the DRC, Rwanda, and Burundi. Consumers in these countries may have willingness to pay for either imported or locally produced cheese, which may be influenced by factors such as taste, texture, price, and cultural background. By examining this, the research can provide insights into the market potential for imported and local cheese in these countries which may facilitate the decision-making process for cheese producers and policymakers.

To investigate if is a significant variation on the attributes in the types of cheese commonly consumed in DR Congo, Burundi, and Rwanda. The study aims to examine the types of cheese that are commonly consumed in DR Congo, Burundi, and Rwanda. Through the research, we expect to gain a comprehensive understanding of the factors that constitute consumers' cheese preferences and the key drivers/ attributes behind cheese sales and consumption in these regions. Some of the tributes we expect to drive demand are price, texture, and origin of cheese. Our report will contain detailed insights into the preferred type of cheese that is most preferred by consumers.

It is hypothesized, adoption of western cultural influences consumers in DR Congo, Burundi, and Rwanda. They are more likely to be influenced by western culture in their cheese consumption behavior. This will likely lead to a greater preference for western-style cheeses, such as cheddar or mozzarella, as well as a higher willingness to pay for imported cheese brands. Insights on the most common western cultural influences on consumer behavior and preferences will be examined. Family and doctor influences on consumers will also be analyzed.

1.3 Structure of the thesis

The second chapter of the thesis provides exploratory analysis of factors that influence willingness to pay for local cheese and the preference among consumers and review relevant literature and theories concerning the study. This is done to guide to provide context to the analysis in subsequent chapters. The third chapter provides theoretical Background and Literature review of willingness to pay. The fourth chapter provides an in-depth review of methods and application of the data that

was collected. This thesis is based on a field survey conducted by site technicians who share the dataset with us. The fifth chapter analyze willingness to pay using the appropriate models, which are logit model, mixed logic, and multinomial logic models. Marginal Welfare Measures are calculated respectively. It also outlines the usefulness of the models in this context, and also discusses results from the models, whilst the final part contains concluding remarks of consumers preference and willingness to pay.

2. Related topics

2.1 Introduction

This chapter contains the study area, broader diary market in Africa, and the cheese market. Production and consumption of cheese in the countries under study, cheese revenue forecast. We looked at the market overview as well as the trade channels that facilitate the trade flow among these three countries.

2.2 Study Area

2.2.1 Democratic Republic of Congo (DRC)

DRC is a developing country in Central Africa with a population of over 100 million (worldometer, 2023). DRC relies on imports of food in the international market to meet the food demand of the growing population, as it has constantly been battling with domestic crisis such as civil wars and corruption which hinders food production (Eric et al., 2017). DR Congo and other developing countries around the world depends heavily on agricultural products for livelihood most especially those living in the rural regions (Gollin, 2010).

DRC being considered as one of the most populous countries in Africa with a high poverty rate, nearly three in four people survive on less than $1.90 per day (World Bank,2023). The lack of formal economic opportunities combined with political conflicts and instability is pushing the country into deep poverty (Fiske & Shackel, 2015). However, those living in good climatic areas good for cattle and goat rearing, for instance (Switzerland of Africa), could take advantage of this opportunity to reduce poverty among individuals and households (Opportunity International, 2022).

Poverty in the DRC is largely attributed to the lack of employment opportunities and food insecurity (world bank, 2017). However, the cheese production sector has the potential to alleviate some of these challenges. Cheese production provides a source of income for small-scale farmers, who can sell their milk to local cheese makers. This not only creates employment opportunities in the dairy sector but also generates income for farmers, helping to reduce poverty levels.

Congolese cheese producers began their careers in cheesemaking when the UN Food and Agriculture Organization (FAO) organized a program to train locals all the necessary skills to be a good cheesemaker (Smith, 2021). This program has help increased the varieties of cheese produced in Congo. Aftermaths of the training made Congolese channel their energy to work at the factories started by the Belgian monks, producing various dairy products. The industry was developing at fast rate when the war broke in the late 1990s where cheesemakers were forced to leave the Masisi Mountains (Switzerland of Africa) due to war that destroyed the factories. It was not until November of 2013 that the Congolese army conquered the M23 rebels after receiving military assistance from U.N. troops. Many Congolese who were displaced by the war have begun returning home to continue cheese production business (Culture, 2015). The growing interest in cheese making by locals is gradually helping to minimize poverty among households and individuals (Bingi & Tondel)

Cheese is produced from fresh milk of cows and goat in DR Congo. There are many breeds of cattle in DR Congo, a dozen of Swiss Brown and Friesländer breed of cows which can provide 400 liters (106 US gallons) of milk a day, could be used to make the popular local cheese in the hills of Masisi (Plovnick,2015). The hill of Masisi is where most of the local cheeses are produced in DRC (Smith, 2021), this is due to the prevalence of tsetsefly throughout most parts of the country. The production facilities have glazed tiles, and the tub which is made of metal that is used to ferment the milk for cheese production. Some dairy farmers produce their cheese in bathtubs that stand in wooden sheds. All these methods ensure the cheese is produced under hygienic conditions (Raupp, 2015).

2.2.2. Rwanda

Rwanda is a landlocked country located in East Africa, bordered by Uganda to the north, Tanzania to the east, Burundi to the south, and the Democratic Republic of Congo to the west. Despite being a predominantly agricultural country, with agriculture being the main source of income for over 70% of the population, the dairy industry in Rwanda is relatively underdeveloped (Klapwijk et al, 2014). Rwanda's dairy industry has faced various challenges, including inadequate infrastructure,

low productivity, and limited access to finance, inputs, and technology, among others (Rwirahira, 2009).

Cheese production in Rwanda is mainly done on a small scale, and there are few large industrial cheese producers in the country. The country's cheese industry is still in its infancy stage, with the majority of cheese being imported. With an increasing demand for cheese products in the country, there is a need to explore the potential for locally produced cheese (Kamana et al., 2017).

Despite the challenges facing the dairy industry, Rwanda has made progress in increasing milk production in recent years, with milk production increasing from 2010 to 2020, Rwanda's milk production increased by 65%, from 478,000 metric tons to 789,000 metric tons in 2019, according to Rwanda ministry of Agriculture and animal resources (2020). This increase in milk production presents an opportunity for the development of the cheese industry in Rwanda. However, there is a need to explore the market potential for locally produced cheese to improve the livelihood of the people. Currently, CAVABON limited is one of the leading Small and Medium dairy products manufacturers in Rwanda. This production center is located in Karongi Rwanda (AgriProFocus, 2020).

2.2.3 Burundi

Burundi is located in East Africa and shares borders with DRC and Rwanda. Cheese production is a growing industry in Burundi, with both small scale and industrial producers operating in the market (Makoni et al., 2014). Small-scale cheese producers operate in rural areas and use traditional methods to produce cheese. These producers use milk from local cows to make cheese (Ouma, et al., 2020). The cheese is typically made using simple tools such as pots, molds, and cheesecloths. These producers primarily sell their cheese in local markets and to neighboring communities. Industrial cheese producers operate in urban areas such as Bujumbura and use modern methods to produce cheese. These producers use milk from large-scale dairy farms to make cheese. The cheese is produced using automated machinery, and the production process is highly standardized. The producers primarily sell their cheese in supermarkets and to large food companies (Chase & Grubinger, 2014).

Cheese production volumes in Burundi are relatively low, and the industry is still developing (Makoni et al., 2014). Small-scale producers typically produce cheese on a small scale, producing enough cheese to sell in local markets and to neighboring communities (Ouma et al., 2020). Industrial producers, on the other hand, produce cheese on a larger scale, but the total production volume is still relatively small compared to other countries. Burundi currently exports only a small amount of cheese, and most cheese produced in the country is consumed domestically (Keringingo, et al, 2018).

Burundi has experienced high levels of food insecurity, poverty, and inequality since the early 1990s due to recurrent socio-political tensions that frequently devolved into violent conflict (Vervisch et al., 2013). Burundi continues to be a fragile state despite progress toward economic recovery (Specker, 2010). Over half of children are stunted, which is the highest rate in the world, and nearly one in two households experience food insecurity (World Health Organization, 2020) About 11.2 million people, or more than 70% of the population, live on less than US$1.9 per person. The estimated poverty rate in rural areas is 69%, where 95% percent of the poor reside. Small scale subsistence farmers make up most of the poor group (World Bank, 2017).

Cheese production can provide job opportunities for small-scale farmers and processors, who can then sell their products locally. This can help boost the local economy and provide income for families who are struggling to make ends meet. Additionally, cheese is a nutritious food that can contribute to improving the diets of people in Burundi, where malnutrition is a serious issue (May & Lemons, 1969).

2.2 Broader Diary Market Trend in Africa

According to FAO (2018), Imports of dairy products in sub-Saharan Africa countries have increased tremendously since 1960. It rose in value from US$ 43 million in 1960 to US$ 680 million in 1980. It is reported that sub–Saharan African countries spent approximately 5% of their total revenues from agricultural export on imports of dairy products (Rakotoarisoa et al., 2011). Two thirds of the total dairy imported is made up of dried and condensed milk (von Massow, 1989). This indicates that there is dependency on imported cheese to meet population demand.

These African countries Togo, Congo, Ghana, Ivory Coast, Liberia, Nigeria, Sierra Leone, and Benin has less than 20 kg milk consumption per caput but import more than 50% of their requirements to meet market demand (von Massow, 1985). They are highly dependent on imports of dairy products. However, Ghana meets at least 80% total calorie requirement of its populations. Dairy imports do not, therefore, appear to play a crucial role in overall human nutrition in Ghana (World Bank, 1983). DR. Congo imported US$348m wealth of cheese and curd during 2020 from Rwanda, according to the United Nations COMTRADE database (2021).

2.3 The Cheese Market in DRC, Rwanda and Burundi

The two main factors promoting the market's expansion in Rwanda and Burundi is the rising demand for foods high in protein and the expanding knowledge of the advantages of dairy foods, (Lokuruka, 2016). Other significant elements that influence the market growth include changing lifestyles, westernization, rising demand for value added goods, an increase in the number of Quick Service Restaurants (QSRs) and an increasing population in DRC, Rwanda, and Burundi (Levard & Gabagambi ,2012). Improved distribution channels, a greater emphasis on innovative packaging from manufacturers such as the gouda cheese in DRC, an increase in the availability of cheese in supermarkets, and shifting consumer tastes and preferences all contribute to market value growth in these countries (Data Bridge Market Research, 2022).
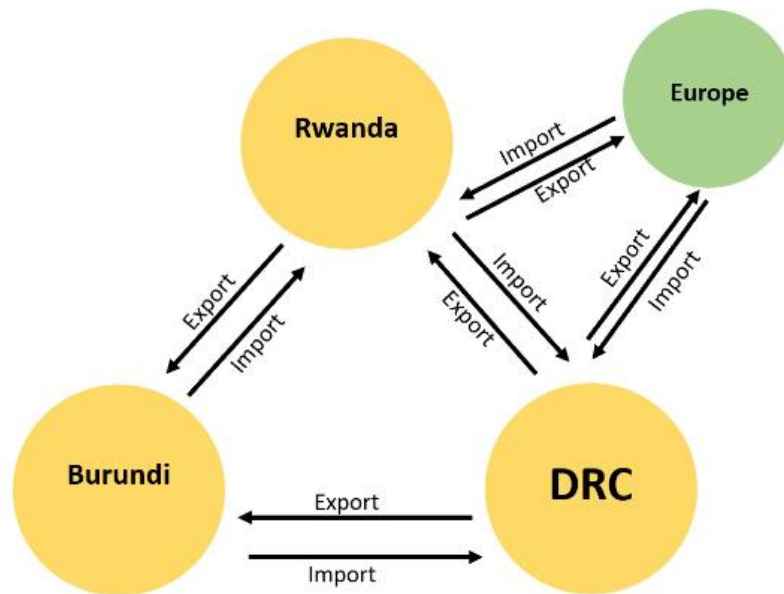
Figure 1. Diagram showing the trade flows among the countries.

These countries trade among themselves as shown in figure 1. For instance, in 2022 Rwanda imported $4.29m value of cheese from Greece and exported $1.59m of cheese to Greece (Trade Economics, 2023). DRC and Burundi are net importers of cheese even though they are both producers of cheese (OEC, 2021). In 2020, DRC exported $23.5k value in cheese, making it the 118th biggest exporter of cheese in the world. At the same year, cheese was among the most exported product in DRC. The main destination of DRC cheese are Slovakia, France, South Africa, and Burundi. In 2020, DRC imported $2.29M in cheese, becoming the 152nd largest importer of cheese in the world. Also, cheese was the 348th most imported product in DRC. South Africa, Belgium , France , Netherlands , and Morocco are the main importer of cheese to DRC (OEC, 2021). The average tariffs associated with the import of cheese is 18% in DRC (OEC, 2021). According to Trade Economics (2023), in 2022, DRC exported $14.4m in Cheese. At the same year, cheese was the 471st most exported product in DRC. Some of the export destination are Burundi ($1.32m), Rwanda ($1.5m) and Europe(over $5m). Burundi imports most of its cheese from Rwanda and DRC, and also Europe (OEC, 2023).

Rwanda agricultural sector constitutes over 33% of total GDP which employs about 70% of the total population (FAO,2023). This shows how the agriculture sector is vital to the government,

(KPMG, 2016). Cheese, the bye product of the livestock sector is increasingly becoming an integral part of the DRC and Burundi economy especially those in the deprived areas as a source of livelihood (Union, 2013). DRC percentage of livestock to the agricultural GDP is 9%, this sector is largely undeveloped, with small numbers of cattle, goats, and sheep. The livestock population is estimated to be around seven million, of which 60% are goats, 14% sheep, 11% cattle and 15% for others. (FAO, 2005). In 2021, Burundi agriculture sector contributed 28.66% to GDP and about 80% of the population are into farming and other agriculture related activities such as cheese making. (Statista, 2021).

2.4 Selected indigenous varieties of cheese in Africa.

Table 1.Indigenous variety of cheese

Name	Country	Raw materials	Characteristics	Shelf life
Mashanza	DRC	Cow milk	Soft white and ball shaped, no rind with big eyes, slightly sour taste.	Less than 7 days
Amata	Burundi	Cow milk	Soft and slightly sour taste	Less than 7 days
Ikivuguto	Rwanda	Cow miik	Soft white cheese, slightly salty and sour and close texture	Less than 7 days
Wagashi	Mali, Niger, Burkina Faso, Ghana, and Mauritania	Cow milk	No rind, white with small eyeholes, slightly sour and salty	3 days out of brine, 14 days in brine
Eshabwe ***Okubuturwa*** ***Bongo***	Uganda	Cow milk	Hard, yellowish, smoked rind with small eyeholes, slightly acid and taste sour	2 - 3 days or 4 - 5 days in cool water
Karish	Egypt	Cow or a mixture of cow and buffalo milk	Soft fresh white cheese	7 - 11 days, immersed in whey

Source: McSweeney et al. (2004, 2017) and Nyamakwere et al. (2021)

2.5 Consumption and Production

The debate over the years has been the potential of local cheese, which can be processed using local resources with little or no machinery to produce quality local cheese, (Nyamakwere, et al., 2021). This is frequently overshadowed by the emphasis on economic challenges facing small-scale farmers, (Omemu et al., 2014). According to Cornelisse and Hyde (2017), processing of cheese by small-scale farmers guaranteed a better income than the sale of raw milk. Cheese has been processed for many years at household level, most of these skills have been advanced and commercialized to meet the demands of urban population. (Beukes et al., 2001). Currently, there are Projects in Rwanda which is aimed at rebuilding the outmoded practices in cheese making, especially in the rural communities to improve production which could potentially enhance good income and nutritional status according to Rwanda ministry of Agriculture (2016).

According to data from the Food and Agriculture Organization of the United Nations (FAO, 2021), milk production in Rwanda, Burundi, and the Democratic Republic of Congo (DRC) has increased tremendously over the last decade. The increase can be attributed to the government's initiatives to support dairy farming, including the One Cow per poor family program, which gives cows to at-risk households to improve their nutrition and income. The government has also helped farmers by improving breeding programs, offering veterinary services, and facilitating credit access. Even though there has been an increment in the production of milk in Rwanda over the years, they still manage to import $100K wealth of milk from other African countries, Europe, and United Arab Emirates. (WTIS, 2020). This could be attributed to the preference for foreign goods by some locals (Uwamariya, 2021).

Milk production in Burundi increased by 38% from 317,000 metric tons in 2010 to 438,000 metric tons in 2018. The rise can be attributed to the government's initiatives to support the dairy industry by offering farmers incentives and funding infrastructure projects like milk collection facilities and processing plants. In order to increase milk production, the government has also encourage the use of better breeds and feeding techniques (Mkwizu et al., 2020). In 2019, Burundi exported 9960kg of milk to Rwanda valued at $579k. (WITS, 2020).

In the DRC, milk production increased by 28% between 2010 and 2020, from 1,182,000 metric tons to 1,511,00 metric tons. The rise can be attributed to the government's initiatives to advance the dairy industry by supporting farmers through enhanced breeding programs, veterinary services, and credit availability (Ochieng, 2018). To aid farmers in accessing markets and boosting their income, the government has also made investments in infrastructure, such as milk collection facilities and processing facilities (FAO, 2021).

2.6 Cheese Revenue Forecast

DRC Revenue in the cheese segment amounts to US$4.15m as of March 2023 (Statista ,2023). DRC cheese market revenue is expected to grow annually by 5.67%. Revenue is expected to hit US$28m by the end of 2023. In volume, DRC Cheese segment is expected to show a volume growth of 2.8% in 2024 (Statista ,2021). In 2022, DRC cheese segment contributed about 0.007% to GDP (world bank,2022). Burundi revenue in the Cheese segment amounts to US$1.37m as of March 2023. The market is expected to grow annually by 5.84%. Revenue is expected to hit US$29.96m by the end of 2023. Burundi GDP in 2021 is 2.78 billion out of which US$1.1m is made from cheese export, (world bank, 2022). Rwanda revenue in the diary sector is expected to show an annual growth rate between of 24.85% from 2023 to 2027, with resulting projected market volume of $2.1m by 2027 (Statista ,2023).

2.7 Market Overview and Dynamics/ Cheese demand

According to the International Food Policy Research Institute (2021), There is growing concern in most African countries of the consumption of locally produced products to foster the growth of local industries of which DRC, Burundi, and Rwanda are not exempted. The government of most African countries are worried about the increase in consumption of imported products (Sacko &Mayaki, 2022). An initiative was lunched some years back in Ghana to encourage the consumption of locally produced goods as a mean to revive local industries to tackle unemployment in the various sectors through government subsidies to local producers, according to Oxford Business Group (2022). Africa has a huge deposit of natural resources that can help reduce the poverty rate, however lack of capital is impeding development in the continent (IFC,

2023). With the good climatic condition devoid of tsetse flies, DRC, Burundi and Rwanda will be capable of producing more livestock for cheesemaking for local and international market. The government of Rwanda is investing more capital into the agriculture sector as a form of loan to interested individuals in other to increase productivity for export (Rwanda Ministry of Agriculture, 2016). Generated income from cheesemaking is booming that individuals and institutions are doubling their investment to take a niche in the international market (Africa Business, 2021). More especially to be able to satisfy the domestic market.

The cheese market is experiencing considerable growth owing to the existence of many nutrients in cheese which include higher level of vitamin E, and iron that are gaining attention of customers that are very particular of their health.

2.8 Trade Channels

The cheese trade channels among Burundi, DRC, and Rwanda depend on variety of factors such as the types of cheese being produced and the demand for cheese in each country. Burundi, DRC, and Rwanda are all located in the Great Lakes region of Africa, which has a long history of dairy production and conflict (Mpangala,2004). However, cheese production in these countries is generally limited, and the majority of dairy production is focused on milk production (Kalibwani, 2018). As a result, cheese trade flow among these countries is relatively small compared to other jurisdictions. With limited quantities of cheese being produced and traded, any cheese trade does involve small-scale producers and local markets, according to (Rwanda Agriculture and Animal Resource,2016).

The large-scale export-oriented production is limited, majority of cheese traded among these countries is fresh or soft cheeses, such as cottage cheese, cream cheese, or feta cheese Ouma et al., 2020). These types of cheese are relatively simple to produce and can be made using traditional methods that are well-suited to small-scale production. While there may be some opportunities for cheese trade among Burundi, DRC, and Rwanda, it is likely that trade flow would be relatively limited and focused on local markets (English et al.,2016)

According to the Rwanda Ministry of Agriculture and Animal Resources (2021), demand for dairy products within Rwanda remains relatively low, with per capita consumption estimated at around 20 liters per year. This means that Rwanda has a surplus of milk, which is expected to continue growing in the coming years. While this surplus represents a challenge for local producers, it has created an opportunity to explore new markets particularly in neighboring countries such as the DRC, Burundi, and Uganda.

Rwandan is noted for high quality dairy product which makes it well-suited for producing high-quality dairy products such as cheese (Rwanda Agriculture and Animal Resource,2016). Rwandan producers have invested in modern processing techniques, such as Ultra-High Temperature (UHT) processing, which helps to preserve the quality and freshness of dairy products over longer periods of time for possible export to Europe and other African countries (Traide, 2019). Rwandan UHT milk and cheese have established markets in the DRC, Burundi, and Uganda. These products are appreciated for their quality and freshness, as well as their affordability compared to imported products (Lokuruka, 2016).

The DRC is the largest cross-border export market for goods from Rwanda because it has a high concentration of urban areas close to the border with that country. The DRC now consumes 70% of Rwanda's formal exports and 80% of its informal exports after expanding at an average rate of 50% since 2002, according to (Traide, 2019). Informal exports are the trades that happen between these countries that are not reported. The market potential for cheese in the area is estimated by the Rwanda Ministry of Trade and Industry (MINICOM) to be $1.1m in North Kivu and $1.2m in South Kivu, with $387k in Goma and Bukavu alone. There are roughly 800,000 people living in Goma in North Kivu and 1 million in Bukavu in South Kivu, Rwanda ministry of Agriculture (2021). Between Rwanda and the DRC, there are two main crossing points at Gisenyi/Goma and Cyangugu Rusizi/Bukavu. Boats are used for informal trade across lake Kivu. This latter route is particularly crucial for livestock trade because it allows traders from the DRC to transport animals back across the lake after they are frequently sold at small markets along the lakeshore in Rwanda (Rwanda Agriculture and Animal Resource, 2016).

3. Theoretical Background and Literature review

3.1. Individual Preference and Demand

The foundation of this theory, according to Broadway and Bruce (1984), is the idea that people are the best judges of their own welfares and that welfare conclusions can be drawn about everyone by looking at how they choose between various bundles of goods and services. If someone chooses bundle A over bundle B, then A must exhibit a significant level of welfare. The cardinal utility function of the classical utilitarians is not the same as this preference function. It is impossible to add or in any other way compare the ordinal utilities of different people because there is no standard unit of measurement for them. Let's now consider a person whose utility is solely a function of private goods that can be purchased and sold in markets. To simplify the explanation and notation assume that preferences (or the utility function) are predetermined and remain constant. Given a set of predetermined prices for these goods and fixed monetary income M, it is assumed that the person will choose the product quantities that will maximize his utility. The maximization problem can be expressed as:

maximize $U = U(x)$,

subject to $$\sum_{J=i}^{j} P_j x_j = M$$

where (X) $= \left(x_i \cdots x_j \cdots x_J \right)$ is quantity of vectors. The solution to this problem leads to a set of ordinary, also known as Marshallian, demand functions $x_j = x_j(P, M)$.
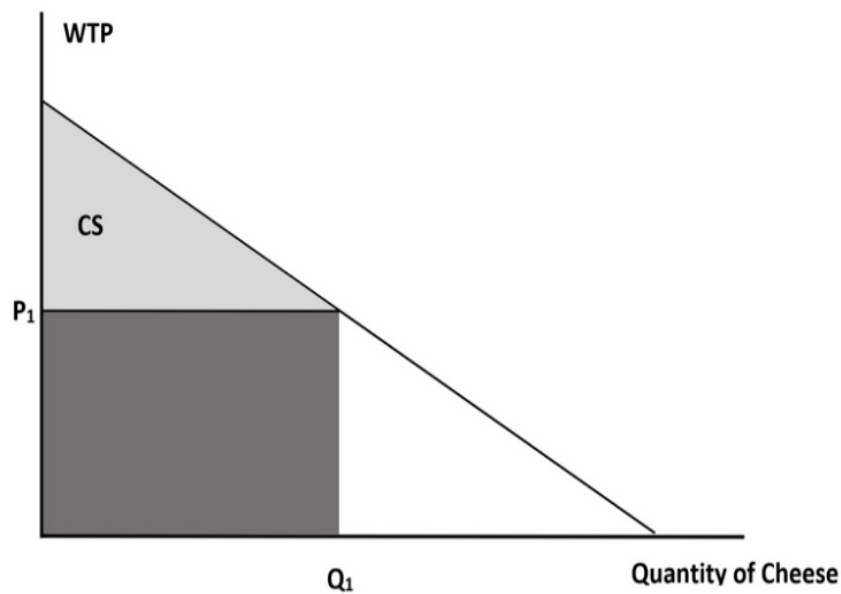
Figure 2. Demand function and willingness to pay

Another way to look at this in relation to WTP is what an individual pays for a product. The consumer surplus is associated with the consumption of a good. This consumer surplus can be measured as shown on the demand curve for cheese in Fig. 2. For each level of quantity, the curve gives the maximum WTP for an additional unit of cheese. If the price of the cheese is P_1 the individual will demand Q_1 and the amount paid is the area shaded in light gray, but the total value is the sum of the shaded regions.

3.2 Willingness to Pay

Willingness to pay (WTP) describes the maximum amount of money that an individual is willing to give up or pay to obtain a particular good or service. It is a measure of the value that an individual places on a good or product, and this is influenced by factors such as income, preferences, and availability of substitutes (Hanemann,1991). It is necessary to consider demand function when estimating willingness to pay. Demand function describes the relationship between the quantity of goods that consumers are willing to pay for and the price of goods. It shows the quantity demanded

at different levels of price, and it is usually depicted as a downward-sloping curve as shown in figure 2. The relationship between WTP and the demand function is that as WTP increases, the quantity demanded of a good or product also increases, and as WTP decreases, the quantity demanded of a good or service also decreases. In other words, the willingness to pay for a good affect the demand for that particular good, (Breidert, 2007).

When individuals decide to pay for local cheese, their choices are constrained by their (disposable) income. In practice, income should correspond to the amount of money they are willing to pay for locally produced cheese, since income determines consumers purchasing power. When preference surveys are conducted to determine WTP, it is expected to have a positive effect on WTP (Carson et al., 2001). Whether people use the good in question is another determinant closely related to the economic concept of value of money. If an individual does not use the good in question, the connection between the good and the individual's well-being is the information the individual has about the good (Carson et al.,2001).

According to Lancasters theory (1966), consumers do not just make decisions based on the utility or satisfaction they receive from a particular good or service, but rather from the characteristics that the product possesses. These characteristics are known as "attributes," and they can be physical, functional, or even symbolic. It continued that consumers evaluate the utility of a product by analyzing its attributes and assigning a value to each one. The overall utility of the product is then calculated as the weighted sum of the values of each attribute. All this informs the consumers of the economic value and use of the product (Sobotko,2019).

WTP measures the value the consumer attributes to the benefits due to the consumption of particular commodity in monetary units. In making choices, WTP will be a measure proportional to the subjective value the consumer attributes to a desired product. The buyer will prefer to purchase goods from the collection of goods for which their WTP will exceed the purchase price to the large extent and also the price of other products (Wertenbroch & Skiera, 2002, p. 228). The consumer purchasing power is the measure of how much he can buy with a fixed amount of money.

3.3 Literature Review: Preference and Willingness to Pay

Discrete choice experiment (DCE) is an effective technique for eliciting consumer preferences and willingness to pay (WTP) for various food product attributes, including the product's origin. DCE is useful because it allows researchers to directly estimate consumers' WTP for specific attributes of a product. It also allows us to elicit consumers' choices in hypothetical market scenarios (Viney, 2002)

When it comes to food products, origin can be a crucial factor that affects consumers' purchasing choices because they may prefer locally sourced goods or goods from particular areas or nations (Ryan et al., 2003). For instance, consumers may prefer locally sourced products because they believe they are fresher, more environmentally sustainable, and support local producers (Brown, 2003). On the other hand, consumers may be willing to pay more for foreign-sourced products if they are associated with higher quality, exotic flavors, or cultural significance (Estifanos,2003).

Perceive responses to the taste and smell of foods helps people to determine food preferences and consumption behavior, that is some consumers make preferences based on how familiar they are with the taste of product (Drewnowski,1997). However, in some situations perceived responses alone do not predict food consumption habits. These are largely influenced by a range of genetic formation of the food, physiological and other valuable variables. Sex, age, growth, eating disorders, and other pathologies of eating behavior could also have effect on food preferences (Kristen et al.,2016). Choice of food is also linked to population and social diversity, most importantly income (Steptoe et al.,1995)

Uwamariya(2021), evaluated the elements affecting Kigali city residents' preferences for fruit salad quality and awareness of origin labeling. The author used 360 randomly chosen fruit salad consumers to gather data using semi-structured questionnaires. Consumption of fruit salads was described using descriptive statistics, and the factors affecting consumer awareness of origin labeling were evaluated using a binomial logit. In addition, a choice experiment methodology and multinomial logit were employed to ascertain consumer preferences for various aspects of fruit salads.

According to the study, fruit salads are generally not labeled or certified in Rwanda and are only occasionally eaten. The factors that affect consumer awareness of origin labeling include

residential area, point of purchase, label reading, and educational level. Customers preferred organic fruit salads and vendor health inspections favorably. Fruit salads with fats, vitamins A, and C were also favorites. Also, consumers preferred private certification and imported fruit salads over domestic fruit salads. This is because consumers are willing to pay a premium price for fruit salads that were imported since they were perceived to be of higher quality, safer, and had proper certification and labeling.

Overall, the study offers valuable policy recommendations for the health and nutrition sectors to adopt measures that will increase consumption of local foods by taking into consideration the various attributes.

Laizer et al. (2018), study set out to find out what factors affect consumer preferences and spending on rice in Tanzania's Kilimanjaro Region. 230 people were randomly sampled from the population for study. It was found that majority of the participants preferred domestic rice over imported rice. According to the findings, aroma ranked as the most significant characteristic, followed by taste, cleanliness, and price. The price of alternatives, their quality, and household size all had a significant impact on consumers' preferences for domestic or imported rice, according to the logistic regression analysis. An OLS analysis revealed that rice expenditure was significantly influenced by rice price, income, consumption frequency, and household size.

Udomkun et al. (2018), sample survey of 309 consumers from three different communities in Bukavu, DRC, to analyze the impact of socio-demographic characteristics on consumers' purchasing decisions and WTP for meat products. Logistic regression analysis was performed to determine purchasing decisions and WTP among respondents. The outcome suggested that over 50% of the respondents were not satisfied with local meat products in the market because of the high price, low quantity and unhealthiness.

Gyau, et al. (2014) investigated the main issues affecting honey production and marketing in Kinshasa, DRC. This survey consists of producers and sellers of honey of which 12 consumers were interviewed to validate the factors identified as influencing the choice of honey. The study revealed that about 98% of consumers prefer local and just a slight percentage prefer imported honey. Previous studies do not take western influence of desired cheese into consideration to estimate the impact on choices and willingness to pay for preference cheese in DRC, Burundi, and Rwanda. This is clearly a study gap which will be addressed in this paper.

4. Methodology

4.1 Introduction

To Identify the potential market for locally produced cheese in DRC, Burundi, and Rwanda, it is important to estimate the willingness to pay for the various category of cheese in the local market. We will investigate the extent to which western life culture influences their choice of cheese. Decision-making processes are deemed crucial to meeting customer satisfaction objectives (Nisel, 2001). From the above, we can identify the key attributes of cheese that, in our opinion, are likely to influence the choice of cheese. The attributes considered include price, hard, cow and origin of the cheese/imported. The attributes were identified using quantitative method that is, a Likert-scale was created to analyze the frequency of participants response to cheese bought. Consumers have three alternatives to choose from among the types of cheeses.

4.2 Data collection

The research is solely based on primary data collected by collaborators in early 2022 (DRC) and February and April 2023(Rwanda and Burundi). A cross-sectional survey was conducted in three distinct countries, namely Bujumbura (Burundi capital), Kigali (Rwanda capital), and Bukavu (main city in South Kivu province in DRC), with a sample size of 100 respondents per country, to assess their cheese preferences. Respondents were interviewed at local supermarkets in these 3 cities when observed that they were buying cheese. They were all selected on a voluntary basis and prior informed consent was sought orally.

Ideally, the sampling method used should be random from urban population, not just people buying cheese at the local supermarket, as this provides the most representative sample of the population. It is a trustworthy method of gathering data where each person in a population is chosen at random, just by chance. Random sampling is considered the gold standard for sampling as it ensures that every member of the population has an equal chance of being selected at random (Acharya et al., 2013). Random sampling is desirable in many research studies because it helps to minimize sampling bias, which can occur when the sample is not representative of the population. Due to limited funds and availability, it is difficult to use this ideal sampling method. We have opted to use other non-probability such as convenience and purposive sampling methods because it will

expand current sampling method to improve its accuracy and reliability. Random samples have some limitation, that is, it can be more time-consuming and costly, it could also lead to non-response bias. (Taherdoost , 2016).

We employed convenience sampling methods to collect our data. This technique is less time-consuming and cost-effective than random sampling. It is useful for exploratory or preliminary research when a researcher is unsure of the population's characteristics. However, samples may not be representative of the population as individuals are selected based on their availability or willingness to participate in the research program. This could result in bias on sample if certain groups are not available or willing to participate than others.

4.3 Survey Instrument

The DRC survey data was completed using a questionnaire with the assistance of an on-site Congolese technician and a French speaking professor in early 2022. Burundi and Rwanda were collected by collaborating students from these two countries. The questionnaires were originally in English but were translated to respondents in French in DRC and Burundi, but not in Rwanda.

4.4 Discrete Choice Experiment

Our data is a Discrete Choice Experiment (DCE). DCE is a survey-based method used to measure how people value different product or service features (Dawoud, 2019). This involves presenting participants with a series of hypothetical scenarios that describe different products or services that vary in terms of their attributes and levels. Participants are then asked to choose their preferred option from the set of alternatives presented. The key characteristics of a DCE include the alternatives presented in an experiment, which are the different product options that vary in terms of their attributes and levels.

The questionnaires were structured to include questions that required yes or no answers and multiple-choice questions. Questions that involve scales answers were also included to take note of high response answers. Some of the questions in the questionnaire include age, sex, household size, occupation, sequence purchase of cheese, purchase amount and others. The attributes were price, type of cheese (hard or soft), type of milk (cow or goat) and origin (local, imported from neighboring African country, imported from Europe). The variables were renamed to hard, cow

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and import_ africa, import_europe, to reflect the coding in the data. The attributes included in the choice experiment were selected on the basis of what information is available to consumers in the supermarkets and informal conversations with consumers conducted by collaborating students in DRC. The price attribute refers to the cost of the cheese product being evaluated. This was measured in local currency but converted to USD for comparison purposes. Cow and hardness levels refer to the type of milk used in making the cheese and the firmness of the cheese respectively. Appendix (1) contains the experimental design for further clarification.

The consumers were presented with three alternatives, each of which has 5 attributes. One advantage of DCE is that it provides more detailed information for decision making process, compared with other stated preference methods. Designing and analyzing DCE is more complicated than employing other methods such as stated preference (Petr et al., 2021).

4.5 Attributes and Attributes levels

Table 2. Attributes and levels

Attributes	Levels
Cow	0(goat milk),1(cow milk)
Imported	1(Europe) 2(Africa)
Hard	0(soft),1(hard)
Price	[0.8, 1.4, 2.0, 2.6], but only assigned if imported is 1,2. It is also assigned [8.0, 10.0] for hard imported cheese.

4.6 Model Justification

We chose Mixed Logit Model (MIXL) because they are more flexible than Latent Class Models (LCM). LCM is a finite mixture model that assumes that the population is composed of several distinct subgroups or latent classes, each with its own set of preference parameters for the attributes of a product of the unobserved subgroups (Vermunt, 2010). MIXL allows for continuous variation in preferences across individuals. In other words, MIXL models assume that individuals have different preferences for the attributes of the choice alternatives, but these preferences are not confined to discrete classes. This means that MIXL models can capture more nuanced and complex patterns of heterogeneity in the data than Latent Class Models (LCM).

4.7 Binary, Multinomial and Mixed Logit Model

According to Train (2009) The MNL (Multinomial Logit) is based on the assumption that the utility of a particular choice can be represented as a linear function of a set of attributes, and that the probability of choosing that option is a function of its utility relative to the utilities of all other options. It continued that MIXL (Mixed Logit) model is a more flexible version of the MNL model that allows for unobserved preference heterogeneity among individuals. It allows the coefficients of the attributes to vary across individuals and incorporates a probability distribution over the coefficients, resulting in a wider range of possible outcomes.

In regression when the number of independent variables is more than 1, as in our case, the logistics equation is given as:

$$f(z) = \frac{e^z}{e^z+1} = \frac{1}{1+e^{-z}} \tag{1}$$

where f (z) is the probability of whether a consumer chooses local cheese, cheese imported from other African countries or cheese imported from Europe, this is confined between 0 and 1. The variable z is a measure of the total contribution of all the independent variables used in the model and is referred to as the logit. The variable z is usually defined in terms of utility.

$$U = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots\ldots + \beta_k x_k + \varepsilon \tag{2}$$

where β_0 is the intercept and $\beta_1, \beta_2, \beta_3 \ldots \beta_k$, are the regression coefficients of $x_1, x_2, x_3 \ldots x_k$, respectively. The intercept consists of the value of z when the values of all independent variables are 0.

4.8 Multinomial (Conditional) Logit

When using multinomial logistic regression, the sample size must be carefully considered, and outliers must be looked for. Simple correlations between the independent variables should be used to assess multicollinearity. Additionally, it is possible to evaluate for multivariate outliers and for the exclusion of outliers or influential cases using multivariate diagnostics (i.e., standard multiple regression).

We assume that the error terms are distributed independently and identically, which may not be true in practice. This means that the errors in the model are assumed to be uncorrelated and have the same variance. In practice, this assumption may not be true as there may be systematic differences in the errors across different alternatives. For instance, we may have differences in the error terms if we fail to capture the relevant aspect into our utility function.

We assume that there is no correlation between the unobserved factors that influence choices, which may be unrealistic in some cases. This means that the model assumes that there are no hidden factors that affect the choice of cheese that are correlated across the different alternatives. In practice, this may be unrealistic as there may be some unobserved factors that affect the choice of cheese and that are correlated across the different alternatives. However, in this case, we may assume that there is no correlation between the unobserved factors that influence choices as we do not have any specific information that suggests otherwise.

One limitation is the IIA property of the model, which assumes that the choice alternatives are independent of each other, which may not always be the case. For example, the availability of imported cheese may affect the demand for local cheese. Additionally, the model assumes that the effect of each variable on the choice probabilities is constant across all individuals, which may not be true in practice.

When analyzing different subgroups of the population, the Multinomial Logit Model does not account for taste heterogeneity or individual-specific preferences, which may result in biased and inaccurate results. The model as follows:

From equation (2)

$$U_{nit} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 \ldots\ldots\ldots + \beta_k x_k + \varepsilon_{nit}$$

$$= v_{n_{it}} + \varepsilon_{nit}$$

$$p_r\left(y_i | v_{n_{it}}\right) = \frac{exp(v_{nit})}{\sum_{i=1}^{j} exp\,(v_{njt})} \quad, \qquad j \neq i \tag{3}$$

4.8.3 Mixed Logit Models

The multinomial logit (MNL) model is a widely used technique for modeling discrete choice behavior. However, it makes several assumptions that may not hold in real practice, such as the independence and identical distribution of error terms and the absence of correlation between unobserved factors. The mixed logit (MIXL) model was introduced to address this problem.

The MIXL model is a flexible and powerful extension of the MNL model that allows for more realistic assumptions about the distribution of error terms and the correlation between unobserved factors. In the MIXL model, the error terms are assumed to be distributed. This allows for more flexibility in modeling the distribution of error terms and allows for the correlation between the error terms.

MIXL model allows for observed and unobserved heterogeneity. The inclusion of unobserved heterogeneity in the MIXL model is important because it allows for the identification of individual-level preferences that are not explained by observed variables. These preferences can have important implications for policy and marketing decisions, as they can reveal underlying patterns in consumer behavior that may not be available in our data.

In the context of the choice between imported cheese, cheese from other African countries, and local cheese in DRC, Rwanda, and Burundi, the MIXL model could be used to estimate the probabilities of choosing each alternative, while accounting for both observed and unobserved heterogeneity. Observed heterogeneity could be included in the model through variables such as price, cow, and origin, while unobserved heterogeneity could be accounted for by assuming that

the parameters of the model vary randomly across individuals. While in the multinomial logic model, the estimated preference parameters are fixed, mixed logic model assumes random parameters, and this allows preferences to vary across respondents (Brownstone & Train 1998).

We use the attributes in cheese preference namely cow, hard, price, import_africa, and import_europe to fit in to the mixed logit model. Mixed logit probabilities are considered the integral of logit probabilities over a density of parameters.

$f(\beta)$ is a density function. v_{nit} is the observed portion of the utility, which depends on the parameters t. If utility is linear in t, then $v_{nit} = t'v_{ni}$. In our case, the mixed logit probability takes its usual form as:

$$p_r(y_i|v_{n_it}) = \int \prod_{t=1}^{T} \frac{exp(v_{nit})}{\sum_{j=1}^{J} exp(v_{njt})} f(\beta) \, d\beta \tag{4}$$

4.8.4 Marginal Welfare Measures

WTP defined as the amount of income a person is willing to give up for a certain improvement of an attribute or a combination of attributes, so that the overall change in utility could result to zero. Similarly, WTA is the minimum amount of extra income required to compensate for a certain deterioration of an attribute of a commodity. WTP and WTA are based on microeconomic theory and correspond to the Hicksian welfare measures (Freeman et al. 2014, p. 68). Marginal Rate of Substitution (MRS), between non-monetary and monetary attributes of an estimated utility function depends on the specific functional form of the utility function. MRS can be expressed as the ratio of the marginal utility of the non-monetary attribute to the marginal utility of the monetary attribute:

$$MRS = \frac{MU_{cow}}{MU_{price}}$$

Here, MU_{cow} is the marginal utility of the non-monetary attribute, and MU_{price} (monetary) is the marginal utility of the monetary attribute. The MRS indicates the rate at which an individual is willing to trade off one unit of the non-monetary attribute for a change in the monetary attribute while maintaining the same level of utility. It is important to note that the utility function is calculated irrespective of the marginal utility form of the non-monetary and monetary attributes.

4.9 Model Specification

In the specification of the mixed logit and multinomial logit models used for the analysis, five attributes were included as explanatory variables, namely price, cow, hardness of the cheese, cheese imported from Europe and cheese imported from other African countries. The attributes give us good assessment of their respective impacts on consumer preferences and choice behavior. Our alternatives are three namely import from Europe and import from other African countries and local. Locally produced cheese was chosen as the base variable and import from Europe and cheese imported from other African countries were included as additional explanatory variables.

This methodology enables the evaluation of the effect of imported cheese from diverse regions on consumer preferences and choice behavior. By introducing imports from Europe and other African nations as explanatory variables, the models provide meaningful insights into the competitive dynamics of the cheese market. The inclusion of imported cheese as additional explanatory variables also permits an assessment of how price differentials between imported and locally produced cheese could influence consumer preferences and choice behavior. As such, this approach holds significant potential for shedding light on the determinants of market outcomes and informing strategic decision-making. An individual draws of 500 Halton random draws were used throughout the analysis.

In order to measure the impact of consumer behavior such as social media and others on cheese choice, there is a need to run the binary regression model. This is because we are interested in understanding the type of influence affecting the choice between buying and not buying cheese by consumers, but not necessarily the alternatives.

 MNL can do the same, however, binary logit models are relatively easy to interpret to non-statistician. Our dependent variable is the choice of the respondents, represented as a binary indicator variable that takes a value of 1 if the respondent chose either of the two cheese

alternatives or 0 if they chose not to buy cheese . The model includes several predictor variables, including exposure to foreign TV, exposure to national TV, family members' influence, influence of friends, exposure to social media, and consulting a doctor.

The data was analyzed using Stata version 17.0. Statistical descriptions were computed to indicate the characteristics of the respondents and how distinct the attributes that affect the consumer's choice of cheese (high or no impact). We continue by an in-depth analysis using the logit model, taking into consideration the key consumer characteristics or the independent variables. Some of the commands are cmset, cmlogit and cmcmixlogit. Appendix (2) contains the complete do file for replicating purposes.

4.9.1 Model Assumption

In the mixed logit model, the dependent variable is choice which takes 0 and 1 values a. We assume the independent variables are normally distributed. Problems arise when the price coefficient is assumed to follow a normal distribution (or a distribution with support over zero). In such cases, not only do you have a cost parameter that goes against economic theory, but the moments of the WTP distributions are undefined. In the case of a normally distributed cost parameter would result to an infinite mean. The fixed cost parameter ensures that WTP distributions have defined moments. Fixed cost parameter is an unrealistic assumption and may bias other parameter estimates. We decided to keep the cost parameter which is price fixed because it makes the calculation of WTP straight forward.

5. Analysis and discussion of results

5.1 Introduction

In this section, we will explore the results of the binary, multinomial and mixed logit models to assess the potential market for locally produced cheese. The models were used to identify key factors that influence consumer preferences for cheese and market share of different types of cheese in DRC, Rwanda, and Burundi. The results and analysis of data acquired for the context of this research is presented in both tables and charts.

In DRC, there were 65 males (65%) and 35 females (35%) with an average age of 36 years answering the questions for the household, average family size is 3. Females (67) representing 67% and 33 males representing 33% with an average age of 37 years and average family size of 3 were our respondent in Rwanda. In Burundi 80 females and 20 males are the respondents, average age is 42 and family size is 4.

5.2 DRC Multinomial and Mixed Logit Model

Table 3. Descriptive statistics

Attributes	Observation	Mean	Standard deviation	Minimum value	Maximum value
Cow	3,600	0.3333	0.4714	0	1
Hard	3,600	0.2778	0.4479	0	1
Price	3,600	2.756	3.4809	0	10
Import Europe	3,600	0.1667	0.3727	0	1
Import_Africa	3,600	0.1667	0.3727	0	1

The descriptive statistics table 3, shows the mean and standard deviation values of five attributes with 3,600 observations each. The attributes Cow and Hard have higher variations around the mean, while Price, Europe, and Africa have lower variations.

Table 4. DRC Choice shares

Alternatives	F req.	Percent	Cum.
Europe	411	34.36	34.36
Africa	408	34.11	68.48
Local	377	31.25	100.00
Total	1,196	100.00	

Table 4 displays the frequency and percentage of each alternative chosen by the respondents. Among the three alternatives, Europe was chosen by 34.36% of the respondents, while Africa was chosen by 34.11% of the respondents. The local alternative was chosen by 31.25% of the respondents.

Table 5 presents the outcome of multinomial and mixed logit model DRC and below comprises of the analysis.

Table 5. DRC Multinomial and Mixed Logit Model

CHOICE	MNL		MXL	
Prize	-0.0480*	(-2.17)	-0.0550*	(-2.19)
Cow	0. 232**	(2.77)	0.179	(1.69)
Hard	0. 241**	(2.86)	0.273*	(2.49)
Import Europe	0.159	(1.31)	0.199	(1.49)
Import Africa	0.0113	(0.07)	-0.258	(-1.03)
/Norma1				
Sd (cow)			0.957* * *	(8.16)
Sd (hard)			0.662***	(5.13)
Sd (Import Africa)			0.503*	(2.44)
Sd (Import Europe)			1.663* **	(8.23)
AIC	2588.322		2426.801	
Loglikelihood	1289.161		-1204.4	
N	1,196		1196	
t statistics in parentheses				
*p<0.05,	* * p<0.01	*** p<0.001		

From table 5, all the explanatory variables in MNL model are significant with the exception of import from other African countries and import from Europe. This means that imports may not have a significant effect on the choice of local cheese. The coefficient for price is -0.04, which implies that a 1% increase in price will result in a 0.04% decrease in the log-odds of consumers choosing locally produced cheese over imports. This suggests that price may be a key factor in the decision-making process of consumers in DR Congo when it comes to purchasing cheese products. On the other hand, the coefficient for cow is 0.23, indicating that the presence of cow milk in cheese products increases the probability of consumers choosing locally produced cheese by 23% compared to other alternatives. This could be due to the preference of consumers for cheese made from locally available sources, such as cow milk. The coefficients for hard import Europe and

import Africa are 0.24,0.16 and 0.01, respectively. These suggest that the presence of imported cheese from Europe or Africa may decrease the likelihood of consumers choosing locally produced cheese by 16% and 1%. This implies that consumers may have a preference for locally produced cheese over imported alternatives if it has more of the imported attributes. Also, the coefficient for import Africa is 0.01, indicating that the presence of imported cheese from Africa has a marginal effect on the likelihood of consumers choosing locally produced cheese.

The coefficients suggest that price, the source of milk, and the presence of imported cheese may all have a significant impact on the potential market for locally produced cheese in DR Congo as well as the consumers choice of cheese in the multinomial logit model. Producers may want to consider these factors when developing marketing strategies and pricing their products to effectively compete in the local and international and local market.

5.2.1 DRC Mixed Logit Model

In the mixed logit model in table 5, only price and hard are significant. However, the standard deviation is significant indicating that respondents are split. Some prefer imported from Africa relative to local and some prefer local relative to imported from other places in Africa. The coefficient for the price variable in the model is -0.05. This indicates that there is an inverse relationship between the price of cheese and the probability of it being chosen. In percentage terms, this means that for every 1% increase in the price of cheese, the probability of it being chosen decreases by 5%.

The coefficient for the cow variable is 0.18, indicating that the presence of cows has a positive effect on the probability of locally produced cheese being chosen. This could be due to the fact that cows are a primary source of milk, which is the main ingredient in cheese. In percentage terms, this means that the probability of locally produced cheese being chosen increases by 0.18% with a unit increase in cow milk in local cheese.

The coefficients for the variables are 0.27 and 0.19 for hard and Europe, respectively. These coefficients indicate that the presence of imported cheese from Europe has a positive effect on the probability of it being chosen over locally produced cheese. This means that a unit increase in the

presence of imported cheese from Europe and hard, will result to the probability of 0.27 and 0.19 of locally produced cheese being chosen over imported cheese respectively. The coefficient for the import variable from Africa is relatively small at -0.26, indicating that its effect on the probability of choosing imported cheese from Africa over locally produced cheese is minimal compared to imports from Europe.

In all, these coefficients suggest that price and imports from Europe and Africa are significant factors that influence the market for locally produced cheese in DR Congo. The presence of cows also has a positive effect on the probability of locally produced cheese being chosen.

From the results of the multinomial logit regression and mixed logit regression models for the potential market for locally produced cheese in DR Congo, we see that the coefficient values for the explanatory variables are different in each model. The coefficient for import Africa in the mixed logit regression is negative, unlike in the multinomial logit regression where it is positive but small.

When we consider the coefficients in percentage terms, we can see that the mixed logit regression model shows a higher impact of each variable on the market for locally produced cheese than the multinomial logit regression model. For instance, a 1% increase in the price of cheese in the mixed logit regression model would lead to a 5% decrease in log-odds of choice of cheese, while the same increase in price in the multinomial logit regression model would result in only a 4% decrease in choice of cheese. Similarly, a 1% increase in the unit of cow milk used to produce cheese would increase selection by 23% in the multinomial logit regression model, while the mixed logit regression model shows an increase of 17%.

The mixed logit regression model provides more detailed information about the potential market for locally produced cheese in DR Congo. The model considers the heterogeneity of consumer preferences and allows for a more realistic estimation of demand for cheese. However, both models suggest that local production of cheese is a viable alternative to imported cheese in DR Congo, as the coefficients for hard import Europe and import Africa are positive in both models, indicating that consumers are willing to pay for locally produced cheese.

5.3 Rwanda Multinomial and Mixed Logit

Table 6. Descriptive statistics

Attributes	Observation	Mean	Standard deviation	Minimum value	Maximum value
Cow	3,600	0.3333	0.4714	0	1
hard	3,600	0.2778	0.4479	0	1
price	3,600	2.7556	3.4809	0	10
Import_Europe	3,600	0.1667	0.3727	0	1
Import_Africa	3,600	0.1667	0.3727	0	1

Table 6 provides descriptive statistics for five attributes with a sample size of 3,600. The attributes Cow and Hard are binary with means of 0.3333 and 0.2778, respectively. The attribute Price has a higher mean of 2.7556 with a maximum value of 10, while Europe and Africa are similar with binary means of 0.1667 and standard deviations of 0.3727.

Table 7. Rwanda choice shares

Alternatives	F req.	Percent	Cum.
Europe	523	50.43	50.43
Africa	514	49.57	100.00
Total	1,037	100.00	

Table 7 shows the frequency and percentage distribution of two alternatives - Europe and Other Africa. Out of the total 1,037 respondents, 523 (50.43%) preferred Europe while 514 (49.57%) preferred other African countries.

Table 8 present the result of multinomial and mixed model and variables used in the analysis for Rwanda.

Table 8. Rwanda Multinomial and Mixed Logit Model

CHOICE	MNL		MXL	
Alt				
Price	-0. 190***	(-5.05)	-0.235***	(-8.48)
Cow	1.516***	(8.54)	1.758***	(9.85)
Hard	0.410***	(3.38)	0. 491* **	(3.18)
Import Europe	2.571***	(11.54)	2.839***	(13.67)
Import Africa	1.637***	(16.83)	1.831***	(12.71)
Normal				
Sd (cow)			1.032***	(5.99)
Sd (hard)			0.834***	(4.44)
Sd (import_Europe)			0.700*	(2.41)
Sd (import_Africa)			0.00089	(0.01)
AIC	1215.14		1183.376	
Loglikelihood	-602.57013		-582.6882	
N	1,037		1,037	
t statistics in parentheses				
***p<0.05, * * p<0.01 *** p<0.001**				

The coefficients in table 8 shows the explanatory variables and also provide insights into the factors that may influence consumer preferences and purchasing behavior in Rwanda. As the cheese price increases by one unit, the log-odds of choosing the local alternative over other alternatives decreases by 0.19, while holding all other factors constant. Similarly, the log-odds of choosing the local alternative over the imported Africa alternative decreases by 0.19 for a one-unit increase in price, while holding all other factors constant. This indicates that price is an important factor in determining consumer behavior in Rwanda. Local producers may need to consider pricing strategies to compete with imported cheese brands.

The positive coefficient for cow (1.516) indicates that consumers in Rwanda prefer cheese made from cow's milk. 1% increase in the proportion of cheese made from cow's milk is associated with a 152% increase in the likelihood of consumers choosing locally produced cheese over imported cheese. This suggests that local producers could benefit from promoting the use of locally sourced dairy products in their cheese production.

The positive coefficients for hard (0.410), import from Europe (2.571) and import from Africa (1.637) suggest that consumers in Rwanda may have established preferences for specific types of imported cheese. 1% increase in the proportion of imported cheese from Europe or Africa is associated with a 250% or 164% increase, respectively, in the likelihood of consumers choosing imported cheese over locally produced cheese. This indicates that local producers may need to consider offering alternative cheese varieties or promoting the unique qualities of locally produced cheese to compete with imported brands.

In conclusion, the multinomial logit regression analysis results suggest that there is potential for a market for locally produced cheese in Rwanda. Local producers may need to consider pricing strategies and promoting the use of locally sourced dairy products, while also differentiating their products from established imported cheese brands to compete in the market.

5.3.1 Rwanda Mixed Model

From the MIXL in table 8, we can deduce that consumers have a strong preference for cheese made from cow's milk, and a unit increase in the proportion of cheese made from cow's milk is associated with a 1.76 increase in the likelihood of consumers choosing locally produced cheese over imported cheese. Imported cheese from Europe and Africa are preferred by consumers in Rwanda, a unit increase in the proportion of imported cheese attributes from Europe or Africa is associated with a 2.84 or 1.83 increase in likelihood of consumers choosing locally produced over imported cheese. Thus, local producers may need to offer alternative cheese varieties or differentiate their products from established imported cheese brands to compete in the market. The AIC for the MNL and the MIXL are 1215.14 and 1183.37 respectively. The MIXL is smaller than the MNL AIC. This is because MIXL allows for more heterogeneity in the population than MNL.

Both models produced similar outcomes. However, there are differences in the coefficient values. In particular, the coefficients for cow, hard, import Africa and import Europe are positive and statistically significant in both models, suggesting that these variables have a positive effect on the likelihood of choosing locally produced cheese. The estimated standard deviations are significant with the exception of import from other African countries. This shows that there is a substantial unobserved heterogeneity in the data.

The coefficient for price is negative statistically significant in the MNL models, indicating that consumers are less likely to choose locally produced cheese if it is priced higher than other alternatives. The magnitude of these coefficients is larger in the mixed logit regression model, which suggests that the impact of these variables on consumer choice may vary more widely.

Overall, both models suggest that there is potential for a market for locally produced cheese in Rwanda. However, the mixed logit regression model suggests that individual preferences for the explanatory variables may vary more widely than assumed in the multinomial logit regression model. This implies that it may be important to consider individual preferences when designing marketing and pricing strategies for locally produced cheese in Rwanda. Differentiating products from imported cheese brands, offering alternative cheese varieties, and promoting the unique qualities of locally produced cheese can also help local producers compete in the market.

5.4 Burundi Multinomial and Mixed Logit Model

Table 9. Descriptive statistics

Attributes	Observation	Mean	Standard deviation	Minimum value	Maximum value
Cow	3,600	0.3333	0.4715	0	1
hard	3,600	0.2778	0.4479	0	1
price	3,600	2.7556	3.4809	0	10
Import_Europe	3,600	0.1668	0.3727	0	1
Import_Africa	3,600	0.1667	0.3727.	0	1

Table 9 shows the descriptive statistics of five attributes with a sample size of 3,600 observations each, revealing that Cow and Hard are chosen about one-third and one-fourth of the time on average, the average price level is moderate, and Europe and Africa have the same level of importance.

Table 10.Choice shares

Alternatives	F req.	Percent	Cum.
Europe	350	42.07	42.07
Africa	482	57.93	100.00
Total	832	100.00	

Table 10 displays the frequency and percentage of the two alternatives (Europe and Africa) in a dataset of 832 observations. Among the two alternatives, Europe was chosen 350 times, representing 42.07% of the sample, while Other-Africa was chosen 482 times, representing 57.93% of the sample.

Table 11. Burundi Multinomial and Mixed Logit Model

Choice	MNL		MXL	
Prize	0.0352	(1.26)	-0.0918	(-1.34)
Cow	0.624* **	(4.97)	1.458* **	(4.11)
Hard	1.851* **	(7)	7.487* **	(5.41)
Import Europe	1.324* **	(17.53)	2.345* **	(7.17)
Import Africa	1.436* **	(11.63)	2.202 ***	(6.08)
/Normal				
Sd (Import Europe)			0.826	(1.62)
Sd (Import Africa)			0.165	(0.39)
Sd (cow)			1.530***	(4.44)
Sd (hard)			6.694* **	(5.08)
AIC	862.4093		552.1914	
Log likelihood	-426.2047		-266.0957	
N	832		832	
t statistics in parentheses				
*p<0.05, * * p<0.01 *** p<0.001				

The multinomial logit regression model produces coefficients of 0.04, 0.62, 1.85, 1.32, and 1.44 for the explanatory variables price, cow, hard, import Europe, and import Africa, respectively. The positive coefficient for cows indicates that consumers are more likely to purchase locally produced cheese made from cow milk. Similarly, the positive coefficients for hard, import Europe, and import Africa suggest that consumers are more likely to purchase local cheese if it is hard and has the dominant of imported cheese attributes. This result is likely wholly driven by the fact that

everyone chose to buy cheese regardless of the price. The coefficient for price is positive but small, which indicates that price may not have a significant impact on consumer choice.

5.4.1 Burundi MIXL

The mixed logit regression model in table 11, produces coefficients of -0.09 1.46, 7.49, 2.35, and 2.20 for the explanatory variables price, cow, hard, import Europe, and import Africa, respectively. The positive coefficients for cow, hard, import Europe, and import Africa indicate that consumers are more likely to purchase locally produced cheese made from cow milk, hard cheese, and imported cheese from Europe and Africa. The size of the coefficient for hard cheese and imported cheese is much larger in the mixed logit model compared to the multinomial logit model, which indicates that these factors may have a stronger impact on consumer choice in the mixed logit model.

The price in the MNL model is positive, which is something unusual and violates economic principles (Weatherly et al., 2014). After exploring our data, we realized that some respondents did not choose any of the alternatives/ cheese presented to them. However, this is more likely related to the fact that none chose the buy no cheese option. It was highly speculated that those who have made a choice are willing to pay at market rate price. According to World Food Program (2021), this could also be due to the fact that cheese is seen as a luxury or novelty item in Burundi. However, in a mixed logit model, price is fixed of which there could be due some presence of unobserved heterogeneity. This means that the preferences and willingness to pay for cheese may vary across individuals due to factors that are not directly observed in our data.

From the results from the two models, we can see that the mixed logit regression model provides more detailed information about the potential market for locally produced cheese in Burundi. The mixed logit model accounts for the variation in consumer preferences and allows for a more realistic representation of consumer choice. The price in the mixed logit model is fixed, this suggests that price may have a more significant impact on consumer choice than indicated by the multinomial logit model. The larger coefficients for hard cheese and imported cheese in the mixed logit model indicate that these factors may have a stronger impact on consumer choice than in the multinomial logit model.

Based on these results, we can conclude that there is a potential market for locally produced cheese in Burundi, particularly if it is made from cow milk and is a hard cheese. Consumers also prefer imported cheese from Europe and Africa, which suggests that there may be opportunities for producers to create partnerships with European and African cheese producers. However, producers must keep in mind that price may be a significant factor in consumer choice, and they must find a balance between producing high-quality cheese and keeping prices affordable for consumers.

5.5 Binary logit model

In this section we examine the significance of western influence on cheese purchase in Rwanda and Burundi and not DRC, table 14 provides details on the parameters and the significant levels.

Table 12. Descriptive statistics Rwanda

Variable	Observation	Mean	Standard deviation	Minimum value	Maximum value
Foreign TV	3,600	1.7624	0.47147	1	5
Nat. TV	3,600	2.1485	1.3380	1	5
Social Med.	3,600	3.1386	1.4628	1	5
Family Mem	3,600	4.8811	.3528	3	5
Friends	3,600	3.8416	1.0507	2	5
Doctor	3600	2.3168	1.2101	1	5

Table 12 displays summary statistics for six variables with a sample size of 3,600, showing that the variable Family has the highest agreement among respondents with a high mean and small standard deviation, while Nat. TV has the lowest mean and moderate variation in the responses.

Table 13. Descriptive statistics Burundi

Variable	Observation	Mean	Standard deviation	Minimum value	Maximum value
Foreign TV	3,600	2.19	0.9349	1	4
Nat. TV	3,600	2.73	0.9886	1	5
Social Med.	3,600	3.03	0.9323	1	5
Family Mem	3,600	2.33	1.0007	1	5
Friends	3,600	3.19	0.9349	1	5
Doctor	3,600	4.65	0.5724	2	5

The table presents summary statistics for six ordinal variables with a sample size of 3,600, where the Doctor variable has the highest mean value (4.65), suggesting it was rated the highest among the variables in the sample.

Table 14. Binary Logit model

Choice	Rwanda	Burundi
Foreign TV	.9944	1.0018
Nat. TV	.9903	.9787
Social Media	1.002	.9759
Family Members	.8774*	.9808
Friends	.9971	.9839
Doctor	.9913	.9049*
*p<0.05, * * p<0.01 *** p<0.001		

The family member variable in Rwanda indicates that the likelihood of the observed relationship between the family member variable and the choice occurring by chance is significant. In other words, it suggests that the family member variable is a statistically significant predictor of choice.

This means that there is a significant association between family member influence and the choice in our binary logistic regression model. However, it is important to note that statistical significance does not necessarily imply practical significance or causation. Therefore, further analysis and interpretation of the results are needed to determine the practical implications of this finding. In order to check the validity of the result the wald test and goodness of fit test were performed.

One way to also assess the strength and direction of the relationship is to examine the odds ratio and its confidence interval (CI) for the family member variable. The odd ratio represents the odds of the outcome variable occurring given a one-unit increase in the family member variable, while controlling for other variables in the model. A unit increase in family members influence variable will lead an increase of 0.88 odd ratio of choice of cheese. The CI provides a range of values within which the true OR is likely to lie. From table 14, the odd ratio of Foreign TV/ western is 0.99 and 1.00 for Rwanda and Burundi respectively. However, it has no influence on purchase of cheese in both countries.

According to our data collected from Rwanda the average number of family size is four (4). It is therefore not surprising that family members have influence on the choice of cheese. The choice of cheese may be influenced by family members for several reasons. Different cultures have different traditions and preferences for cheese and food, and family members may be influenced by their historical cultural background (Rozin, 1988). Cheese preferences may also be influenced by family traditions and recipes that have been passed down from one generation to another over time. Family members often share meals together, and the choice of cheese may be influenced by what others in the family are eating or what is preferred as a meal (Takeda et al., 2018). Also, family members may choose certain types of cheese based on health considerations, such as choosing low-fat cheese (Trivedi et al., 2016).

Other factors such as availability, price, marketing, and environmental factors may also have an impact on the purchase of cheese. The availability and price of certain types of cheese, being it is

local or foreign, may influence family members' preferences, while marketing campaigns or cheese placement may also alter their purchasing ability. Environmental factors such as temperature and humidity could also play a role in cheese preferences (Leclercq,, 2015). Higher temperatures can lead to faster fermentation, resulting in a more pungent and flavorful cheese. Lower temperatures, on the other hand, can slow down the fermentation process and result in a milder cheese. Social influence may also be a factor, as family members may be influenced by the cheese choices of their friends. Family members may be inclined to try new types of cheese based on recommendations from others.

In Burundi, the influence from doctors has a significant impact on choice of cheese based on our regression model and analysis in table 14. Doctors in general of which Burundi doctors are not excepted may have role in directly influencing the choice of cheese among the general population, as cheese is not traditional food in Burundi (Plovnick, 2015). However, doctors may be able to directly influence cheese consumption through their recommendations regarding dietary patterns.

For instance, doctors can promote the consumption of cheese as part of a healthy diet program. Cheese is rich in calcium, protein, and other essential nutrients that are important for maintaining good health (Miller et al., 2001). This means that doctors in Burundi educate their patients about the benefits of incorporating dairy products into their diet and provide guidance on portion sizes and types of cheese that are lower in fat and salt to ascertain good hearth status on regular bases.

We can assume that doctors in Burundi collaborated with local farmers and cheese producers to encourage the production and distribution of healthier and more sustainable cheese products. They can also advocate for policies that support local farmers and promote the consumption of local cheese.

Based on our research, the decision to buy cheese among people in Burundi is influenced by a variety of factors, including cultural traditions, economic factors, and personal preferences. However, by promoting healthy dietary patterns and advocating for sustainable food chains, doctors can play an important role in shaping the cheese choices and overall health of the population of Burundi.

5.6 Willingness to Pay (WTP)

The Willingness to Pay (WTP) for an attribute of alternative say j is the ratio of additional marginal utility of the attribute on the marginal utility of its price in the MNL model. In the MIXL it's the ratio of two distributions with a resulting mean and standard deviation. The existence of the moments of the WTP distribution in a MIXL model depends on the assumed distribution for the cost parameter. The linear form of utility is the ratio of the attribute coefficient to the price coefficient. It is very important to estimate the WTP for the various attributes to be able to make a good judgement on the attributes. Table (15) shows the WTP for each country. The attribute estimates obtained from the analysis are numerical values in the respective local currencies and this represents the marginal utility that consumers place on each attribute.

Table 15. Willingness to Pay: Estimates are in local currency per thousand.

Attributes	Rwanda		DRC		Burundi	
	Estimate	SE	Estimate	SE	Estimate	SE
Cow	7.49	0.82	3.19	2.24	15.88	11.58
Hard	2.09	0.61	4.93	2.01	81.55	56.38
Import Eup.	12.09	1.49	3.66	2.48	25.54	19.50
Import Afr.	7.79	1.18	-4.72	3.92	23.98	18.54

The estimate of 7.49 for the cow attribute shows that consumers in Rwanda are willing to pay marginal 7.49 Rwanda Frac for cheese made from cow milk, compared to cheese made from other types of milk. This suggests that cow milk is the most preferred type of milk for cheese production in Rwanda. In terms of texture that is hardness, consumers in Rwanda are willingly to pay additional 2.09 Rwanda Frac just to have their cheese in a hard form. The estimates for import Europe and import Africa indicates that consumers in Rwanda are willing to pay more for cheese that is imported from Europe (12.09) than cheese that is imported from other Africa countries (7.79).

In line with DRC survey the cow attribute has a positive estimate, which means that consumers are willing to pay more for cheese made from cow's milk. Hard attribute also has a positive estimate, which indicates that consumers are willing to pay more for hard cheese compared to other textures like soft cheese. Import from Europe has a positive estimate, which suggests that consumers are willing to pay more for cheese that has the present of imported Europe attribute compared to import African. The negative estimate of import Africa means that consumers are not willing to pay as much for cheese that has Africa attributes compared Europe and locally produced cheese.

Burundi, the high estimate for the hard attribute suggests that consumers in Burundi highly value the texture of cheese, which could be because hard cheese is generally considered to have a longer shelf-life span and easier to transport and store than softer cheese. This information can be used by businesses to develop and market high-quality hard cheeses that cater for the preferences of Burundian consumers. The positive estimates for import from Europe and other African countries suggest that consumers in Burundi are willing to pay more for cheese imported from these regions. Also, consumers in Burundi may prefer certain styles or flavors of cheese that are not commonly produced locally.

In chapter 2, according to OEC (2021) we observe that the DRC is currently exporting cheese to Burundi. This is a noteworthy finding, especially when examining the relationship between export prices and willingness to pay (WTP) in the Burundian market. The current export price for DRC 100g cheese is $4, converting into the local currency is about 10,000 Burundian Franc and the price for 100g local cheese in DRC is 2,500 Congolese Franc (Selina Wamucii, 2023). By comparing the export prices to the WTP in Burundi, it is observed that WTP is higher in Burundi. This indicates the market dynamics and competitiveness of the DRC's cheese products in the region. This information can help guide the decision-making process for cheese producers and exporters in the DRC, as they seek to expand their market share and increase profitability.

However, it is important to note that there may be other factors beyond export prices and WTP that influence the export of cheese products from the DRC to Burundi. For example, differences in trade policies, regulations, and transportation costs could all affect the competitiveness of DRC cheese products in the Burundian market. Therefore, a comprehensive analysis of the export

market dynamics and a thorough understanding of the factors affecting trade relationships between the two countries are necessary to fully understand the complexities of the export market for cheese products.

The willingness to pay estimates is consistent with the (OEC, 2021) report about trade flows between the three countries which include Burundi and Rwanda as the destination of DRC cheese. Comparing the WTP estimates among the three countries we could observe that the WTP estimates are higher in Burundi and Rwanda compared to DRC.

5.7 Predicted Choice of Cheese

Table 16. probability table

Alternatives	DRC	Rwanda	Burundi
Import Europe	0.34***	0.42***	0.38***
Import Africa	0.33***	0.47***	0.57***
Local	0.32***	0.09***	0.04***
*p<0.05,	*** p<0.001	* * p<0.01	

In order to know the preferred choice of consumers, we need to use predictions based on the estimated probabilities generated by an MXL model. We compute the margins to get the average predicted probabilities for the different alternatives. We assume the model is based on random or otherwise representative sample; these are the expected proportions in the population. The estimated probabilities of DCR for local cheese, Imports from Europe and imports from other African counties are 0.34, 0.33, and 0.32, respectively. To understand what these probabilities mean, we can interpret them as the probability of a consumer choosing each alternative, given a set of independent variables included in the MIXL model. The estimated probabilities can be

interpreted as the probability of a consumer choosing each alternative, given the price, cow, hard, imports from Europe, and imports from other African countries.

Based on the estimated probabilities provided, it is observed that the difference in the probabilities of choosing each alternative is relatively small, with the highest probability being 0.34 for imported cheese, followed closely by 0.33 for imports from other African countries, and 0.32 for local cheese. This suggests that consumers in DRC may not have a strong preference for any particular alternative, and the choice may perhaps depend on other factors not captured by the MIXL model. We continued further to estimate probabilities to generate predictions of the choice of consumers based on the independent variables included in the model. Price was chosen to help in the prediction process. We then compare this probability to the predicted probability of choosing imports from Europe or imports from other African countries. The result obtain was that imported cheese is preferred by consumers in DR Congo.

In Rwanda, the result indicates that consumers in this market prefer imported cheese, with a higher preference for cheese from other African countries compared to Europe, and a lower preference for local cheese. The probabilities are 0.42, 0.47 and 0.09 for imports from Europe, imports from other African countries and local cheese respectively. Based on this information, we can infer that consumers in in Rwanda value a wider variety of cheese options and are more likely to choose imported cheese from different countries rather than only consuming local cheese. The higher probability of choosing imported cheese from other African countries compared to Europe suggests that consumers may value the cultural or geographical proximity of cheese from other African countries, which may influence their choice.

In Burundi the output suggests that consumers in this market have a strong preference for imported cheese, with a higher probability of choosing cheese imported from other African countries (0.57) compared to Europe (0.38). The low probability of choosing local cheese (0.04) indicates that consumers in this market do not have a strong preference for locally produced cheese. These results suggest that factors such as taste, quality, and variety are important determinants of consumers' cheese preferences in this market. Consumers may be willing to pay more for imported cheese due to perceived higher quality or to have access to a wider variety of cheese options.

These results suggest that the independent variables included in the model are significant predictors of the alternatives. However, to verify the validity of the model we considered the limitations and assumptions of the model and also evaluated the statistical significance of the estimated probabilities, which give as a good significant value. Additionally, the goodness of fit of the model was used to determine its overall accuracy in predicting the choice alternatives.

6. Summary, conclusion, and recommendations.

6.1 Introduction

In this chapter, we summarize and conclude the entire results, and give the necessary recommendations based on the analysis. This includes an explanation of the importance of the results and approaches used in meeting the expectations of the study. Limitations of the study are also discussed in this chapter.

6.2 Summary of the findings

The analysis conducted in this study aimed to investigate the potential market for locally produced cheese in the Democratic Republic of Congo (DRC), Rwanda, and Burundi. Through the use of binary, multinomial and mixed logit models, several key findings emerged that shed light on the cheese market in these countries.

In relation to the first research question, which examined if individuals are willing to pay more or less for locally produced cheese relative to imported cheese in DRC, Rwanda and Burundi; Our findings reveal that consumers in Burundi and Rwanda are willing to pay higher prices for both imported and local cheese. Consumers in DRC are also willing to pay higher prices for imported cheese, specifically the cheese from Europe.

This means that there is limited potential for high price for locally produced cheese in DRC, Rwanda and Burundi. Producers in DRC could capitalize on this to make profit from cheese export. The preference for cheese from other African countries by consumers in Rwanda and Burundi is potentially due to the perception of greater similarity in taste and quality between African countries or the desire to support local or regional producers. All the above findings present an opportunity for local producers in DRC to capture a share of the market by producing high-quality cheese for export that meets consumer preferences. This result is in line with our expectation.

The second research question sought to identify which of the cheese attributes has the strongest influence on consumers' preferences and if these were the same in DRC, Rwanda and Burundi.

Specifically, the hardness of cheese is the most significant attribute affecting consumer preferences in the DRC and Burundi cheese market. In contrast, Rwanda origin(imported) is the most important attribute. The reason for this could be that hard cheese has a longer shelf life, is more versatile in cooking, and is considered to have a richer taste than soft cheese. Therefore, producers in these countries should focus on producing hard cheese to cater for consumer preferences. The findings here correlate to our first research question observations result, that consumers are willing to pay higher prices for imported cheese.

Finally, the analysis examined what influences the consumption of local or imported cheese in Rwanda, and Burundi. It was revealed that the factors that influence the decision to buy cheese vary by country, with family members having the most significant influence on choice of cheese in Rwanda and doctor's advice having the greatest impact in Burundi. In Rwanda this could be because cheese is often consumed as part of a shared meal or a social gathering, and the preferences of family members may have a significant impact on which cheese is selected. Burundi consumers place high value on the health benefits such as the protein content, potential calcium and vitamin D content in their foods. This will ultimately prompt them to seek guidance from healthcare professionals when making decisions about cheese purchase.

The use of the MNL and MIXL models provided a robust framework for understanding the potential market for locally produced cheese in DRC, Rwanda, and Burundi, and the attributes that influence consumers' choices and willingness to pay for cheese. The findings of the analysis can help guide local cheese producers and policymakers in making informed decisions about the future production and marketing of locally produced cheese in these countries.

6.3 Conclusion

Based on our findings, it can be concluded that there is a potential market for locally produced cheese in DRC, Rwanda and Burundi. The finding that consumers in Burundi and Rwanda are willing to pay higher prices for imported than local cheese suggests that there may be an opportunity for local cheese producers in DRC to capture a share of the market by producing high-quality cheese that meets consumers expectations.

Hard cheese as one of the significant attributes is aged longer than soft cheese, resulting in a drier texture and a more pronounced flavor. The differences in the factors that influence cheese choices in Rwanda and Burundi suggest that marketing efforts for locally produced cheese may need to be tailored to each country's specific context and consumer preferences. In Rwanda, where family members have the most significant influence on cheese choice, marketing efforts may need to focus on promoting cheese as a family-oriented food. In Burundi, where doctor's advice has the greatest impact, marketing efforts may need to focus on highlighting the health benefits of cheese.

6.4 Recommendations

The local industries need expansion through investment. This may involve investing in the production process, improving the quality of the raw materials, and ensuring consistency in the final product. To promote the consumption of locally produced cheese, marketing efforts should be tailored to meet the specific preferences of consumers in each country. For example, in Rwanda, where family members have the most significant influence on cheese choice, marketing efforts should be family oriented. In Burundi, where doctor's advice has the greatest impact, marketing efforts should focus on highlighting the health benefits of consuming cheese.

To encourage local consumption, given the limited demand for locally produced cheese, policymakers should take steps to encourage local consumption. This may involve promoting the health benefits of cheese or developing local recipes that use cheese as a key ingredient.

To expand the market for locally produced cheese, there is the need for collaboration between international partners and local producers, that is by working together both partners can identify and address the challenges facing the industry. For example, local producers may be able to learn from the production processes of international cheese producers and also identify export opportunities.

In all, the production and marketing of locally produced cheese in DRC, Rwanda, and Burundi will require a comprehensive approach that takes into account the specific context and preferences of each country. By focusing on the production of high-quality local cheese, tailoring marketing efforts to meet consumer preferences, encouraging local consumption, and collaborating with

international partners, local producers can build a sustainable market for locally produced cheese in these countries.

6.5 Limitations of the study

The limited scope of the study presents certain limitations that should be taken into consideration when interpreting the results. First, we only interviewed people who already consume cheese. Investigating the number of people who consume cheese in the cities of DRC, Rwanda and Burundi is an important factor. Also, the study focused on a few people (100 respondents per site) and a few selected cities in DRC(Bukavu), Rwanda (Kigali), and Burundi (Bujumbura), and did not cover other cities that may have different consumer preferences and cheese consumption patterns. It would be beneficial to expand the sample size and include more diverse cities and regions to obtain a more comprehensive understanding of the market for locally produced cheese.

However, due to the limited availability of funds, the study was only able to collect data from the selected cities. The study was also partially limited by time constraints, which have prevented us from collecting more extensive data on the studied variables.

Additionally, the study did not include questionnaires in DRC that specifically addressed the influence of Western culture on cheese preferences. This is an important factor to consider as the cultural influence of western countries on DRC may impact consumer preferences for cheese.

6.6 Recommendation for future studies

Investigating the number of people who consume cheese in the cities of DRC, Rwanda and Burundi would provide valuable information for future research. Knowing the extent of cheese consumption in these cities would help to identify potential market opportunities for local producers. This information could be used to develop targeted marketing strategies and to inform production decisions, such as the amount and types of cheese to produce.

7. References

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8. Appendix

1. Experiment Design

;alts = alt1, alt2, sq

;rows = 12

;eff = (mnl, d, fixed)

;cond:

if(alt1.imported = 3 and alt1.hard = 1, alt1.prize = [8.0, 10.0]),

if(alt2.imported = 3 and alt2.hard = 1, alt2.prize = [8.0, 10.0]),

if(alt1.imported = [1, 2], alt1.prize = [0.8, 1.4, 2.0, 2.6]),

if(alt2.imported = [1, 2], alt2.prize = [0.8, 1.4, 2.0, 2.6])

;model:

U(alt1) = b_prize[-0.0001]   * prize[0.8, 1.4, 2.0, 2.6, 8.0, 10.0] +

    b_imported.dummy[0 | 0]   * imported[1, 2, 3] +

    b_cow[0] * cow[0, 1] +

    b_hard[0] * hard[0, 1]/

U(alt2) = b_prize   * prize +

    b_imported * imported +

Appendix 2: Stata Commands

Stata Code

*label define Altenatives 1 "imported" 2 "exported" 3 "local"

*cmset id ct alt

*cmchoiceset

*cmtab, choice(choice)

*cmtab gender, choice(choice) column

*cmsummarize prize, choice(choice) stats(p25 p50 p75) format(%5.1f)

*gen import_europe =0

*replace import_europe=1 if imported ==1

*gen import_africa=0

*replace import_africa= 1 if imported ==2

*gen local =0

*replace domestic=1 if imported ==3

Multinomial Logit Model

*cmclogit choice prize cow hard import_europe import_africa, base(3) nocons

Mixed Logit Model

*cmxtmixlogit choice prize, random(hard cow import_africa import_europe)

*cmxtmixlogit choice prize, random(hard import_europe import_africa cow) lcinvariant(none) nonrtoleranc startvalues(randomid, draws(500) technique(bfgs)

Willingness to pay

*wtp cow hard import_africa import_europe

Binary Logit Model

Changing variables from string to numeric

*destring influenced_foreign_tv,replace

*destring influenced_national_tv,replace

*destring influenced_social_media,replace

*destring influenced_family_members,replace

*destring influenced_friends,replace

*destring influenced_doctor,replace

Binary test result

*sum influenced_foreign_tv influenced_national_tv influenced_social_media influenced_family_members influenced_friends influenced_doctor

*logit choice influenced_foreign_tv influenced_national_tv influenced_social_media influenced_family_members influenced_friends influenced_doctor, vce(robust)

*logistic choice influenced_foreign_tv influenced_national_tv influenced_social_media influenced_family_members influenced_friends influenced_doctor, noconstant

Goodness of fit test

*estat gof,

*estat classification, all

Predicted Probabilities

Margins