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DETERMINANTS OF MILK AND MILK PRODUCTS IMPORT IN ETHIOPIA

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DEVELOPMENT ECONOMICS

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DECLARATION

I, the undersigned, declared that this thesis is my original work prepared under the guidance of my advisor Maru Shete (PhD and Associate professor) and has not been presented for a first degree or master's degree in any other university, and that all source of materials used for this thesis have been duly acknowledged.

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ENDORSEMENT

This thesis has been submitted to St. Mary University, school of Graduate Studies for examination with my approval as a university advisor.

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Advisor Signature

St. Mary University, Addis Ababa May, 2019

APPROVAL SHEET

As members of board of examining of the final MA thesis open defence, we certify that we have read and evaluated the thesis prepared by Yohannes Mehari under the title "DETERMINANTS OF MILK AND MILK PRODUCTS IMPORT IN ETHIOPIA" we recommend that this thesis to be accepted as fulfilling the thesis requirement for the Degree of Master of Arts in Development Economics

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ACRONYMS AND ABBREVATIONS

ADB	African Development Bank
ATA	Agricultural Transformation Agency
AYIB	Ethiopian Origin Cottage Cheese
BOFED	Bureau of Finance and Economic Development
CPI	Consumers Price Index
CSA	Central Statistics of Ethiopia
DDA	Doha Development Agenda
DDGS	Distilled Dry Grains
EAC	East African Countries
EADRAC	East African Dairy Regulatory Authority
ECA	Ethiopian Custom Authority
ECDPM	European Centre for Development Policy Management
EDRI	Ethiopian Development Research Institute
EOI	Export Oriented Industrialization
ETB	Ethiopian Birr
EU	European Union
FAO	Food and Agricultural Organization
FAOSTAT	Statistical data from Food and Agricultural Organization
FDP	Fresh Dairy Products
FTA	Free Trade Agreement
GAIN	Global Alliance for Improved Nutrition
GDP	Gross Domestic Product
ICPALD	IGAD Centre for Pastoral Areas and Livestock Development
IGAD	Inter- Governmental Authority on Development

ILG	Import Led Growth
IMF	International Monetary Fund
ISI	Import Substitution Strategy
LME	Liquid Milk Equivalent
LT	Litre
MoR	Ministry of Revenue
NAFTA	North American Free Trade Agreement
NEB	National Bank of Ethiopia
OECD	Organization for Economic Cooperation and Development
RTA	Regional Trade Agreement
SAP	Structural Adjustment Program
SMP	Skimmed Milk Powder
SNV	Netherland's Development Organization
SPS	Sanitary and Phytosanitary
TBT	Technical Barrier to Trade
TGE	Transition Government of Ethiopia
UHT	Ultra High Temperature
UNCTAD	United Nations Conference on Trade and Development
US	United States of America
USD	United States Dollar
VAT	Value Added Tax
WTO	World Trade Organization

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ABSTRACT

This study was designed to analyze socio-economic, trend and policy factors affecting milk and milk products import in Ethiopia using data obtained from different sources and looking into import demand and supply response functions. Due to unavailability of the required data in the country as a whole and in international organizations, the research was done for the years 1993 through 2017. There has been very few publications relevant to milk and milk products import into Ethiopia. Although import influenced by many different variables, this study is concerned with only few determining variables such as milk consumption and milk supply. The study analyzed the import data in relation to the international price, milk production, real gross domestic product per capita and human population numbers. To estimate the general regression equations of the related variables in the study, STATA 14 software was used. The data were checked for its homoscedasticity and found heteroskedastic. To remove the heteroskedastic effect the data were computed by adding and dropping different variables. Variance Inflation Factor (VIF) was used at every steps of adding and dropping variables. The process of adding and dropping variables terminated once the VIF point attained to below 10. Finally Breusch-Pagan test was used to check the heteroscedasticity and the data found to be homoscedastic. The optimum lag length was selected. After lag selection ADF and Johansen Cointegration tests were employed. Since all study variables cointegrated at first difference VECM model was employed in order to investigate the long run and short run associations. Robustness of the model was checked. For every percent increase in milk and milk products price, the quantity of milk and milk products imported decreased to 1.28 percent. A one percent increase of per capita income reduced milk and milk product import by 0.34 percent. The analysis revealed that import price have significant effect in reducing milk and milk products import than population, local milk production and per capita income. Granger causality test used to identify the direction of associations. The Granger causality test confirming unidirectional cause coming from the milk and milk product import to the local milk production and jointly all variables also affect the local milk production. The Granger causality test concluded that the milk and milk products import highly affected milk producers though the magnitude is not known and beyond the scope of this research which needs further investigation. Milk and milk products import negatively affected milk producers that demanded policy makers to take an action to uplift producers from the prevailing problem.

Key words: Dairy, Ethiopia, Import, milk and milk products import

CHAPTER ONE

1 INTRODUCTION

1.1 Background of the Study

The import of a nation can be influenced by the domestic national income, consumption preference of the society, exchange rate, domestic price inflation and other factors (Arega, 2016). Endogenous growth models indicate that import pave a way for long-run economic growth since it can provide domestic firms with access to the required intermediate and foreign technology (Dechassa *et al.*, 2017).

Countries ought to use trade barriers to limit their imports from and exports to the international market. But as time goes on, and when free trade becomes the most important element among the nations, the role of trade barriers becomes insignificant and devaluation is the main means of influencing the nation's competence in the international market. Devaluation in today's world is one of the best successful policies in making export goods cheaper and import goods expensive so that the country's export will be encouraged whereas its import will be discouraged. However, devaluation actually doesn't lead the Ethiopian import demand to decrease. For example, according to a study by Medina (2015) a 1 % devaluation of the Ethiopian currency may lead the nation's import to increase by about 0.36 %, showing that exchange rate is not one of the determinants of import for Ethiopian economy.

Increases in income and population are expected to increase the consumption of milk and milk products. In developed countries, per capita consumption of milk solids is projected to grow from 22.2 kg in 2015-17 to 23.1 kg in 2027, compared to an increase from 10.6 kg to 13.5 kg in developing countries (OECD-FAO, 2018). China, Algeria, Indonesia, Brazil and Russia are the world's largest milk and milk products importing countries having a share of 86% of total world import (Sagar and Paramasivam, 2016).

Milk production growth in Ethiopia is slow. Although the total amount of milk produced in the country has increased, the per capita milk consumption has declined from 26 liters in 1980 to 22 liters per annum in 1993 and then to 19 liters per annum in 2000 (SNV, 2009). For some time, the average per capita consumption of dairy products has been estimated at around 20 liters (Jelle *et al.*, 2015) and will approximately increase to 27 lt per capita in 2020 (Land O'Lakes, 2010). The average expenditure on milk and milk products by Ethiopian household's accounts for only 4% of the total household food budget (Gezu and Zelalem, 2018). As the

country's economy grows and the population continues to grow from its current level of nearly 100 million inhabitants, milk and milk products import is expected to continue growing as demand outpaces local production capacity.

Ethiopia produced 3.3 billion liters of milk in 2011/2, worth $1.2 billion, and imported an additional $10.6 million of dairy products (Abebe *et al.,* 2016). Ethiopia produced 3.1 billion liters of cow milk and 179.66 million liters of milk from camel (CSA, 2017). Ethiopia become a net importer of milk products with an import bill rising from US$ 5.6 million in 2005 to US$ 7.6 million in 2014 (Ruerd *et al.,* 2017). The Government of Ethiopia plans to almost double domestic milk production between 2015 and 2020 (Jelle *et al.,* 2015). Supermarkets are becoming important agents of change in the urban food retailing system in Ethiopia. While the dairy processing industry based in Ethiopia accounts for a 17% market share, dairy imports have an 8% market share in Addis Ababa (Gian et al., 2010).

Despite fresh dairy products demand is much greater than for processed products, higher transport and storage costs of fresh products generally limit such trade (OECD-FAO, 2018). Ethiopia has close proximity to large regional consumers of milk such as Sudan and Kenya, as well as to the Middle East markets. Considering the importance of dairy products, both for human consumption and as a means of income generation, it is key issue required to investigate the impact of milk and milk product import on the economy of the country, Ethiopia.

1.2 Statement of the Problem

Milk and milk products are considered as high risk goods in production, consumption and trade. The risks are that milk products pose threats to animal health and food safety. To limit the transfer of risk, dairy trade is subject to a considerable amount of regulations (Gezu and Zelalem, 2018). Growing expenditure on milk and milk product imports poses an additional burden on a country's balance of payments and tends to weaken its currency.

In Ethiopia while milk and milk product supply is lagging, the demand for milk products is increasing. Constrained by cows' genetics, nutrition, and health, producers are not able to keep up with the demand. As a result, imports have increased in recent years, which consist primarily of processed milk, including cheese and milk powder (81% of imports). The price elasticity of demand for milk products that Ethiopia is importing is inelastic. So, there might not be a

significant change in the volume of import of the nation even if there is a change in the price of the products. Furthermore, since population is increasing very rapidly (it was 57 million in 1995, 86 million in 2013 and now more than 100 million), imports of milk products are taken place in bulk quantity (Medina, 2015).

According to a 2018 debt sustainability analysis, with a public debt–to-GDP ratio of 61.8% at the end of June 2018, Ethiopia remains at high risk of debt distress (ADB, 2019). Ethiopia imports a significant amount of milk and milk products; decreasing this will reduce foreign currency spending on imports (Jelle *et al.*, 2015). The country's foreign exchange reserves were estimated at less than two months of import coverage, below the IMF recommended minimum of three months (GAIN, 2016). Gross official reserves of the country remained low, at 2.5 months of imports in 2016/17 and 2.1 months in 2017/18 (ADB, 2019). Therefore, if Ethiopia is to meet the expected increase in demand for certain agricultural imports, it will need to, among other things, increase its exports (GAIN, 2016).

There are no import restrictions or import quotas in the country. However, the strict foreign exchange control regimes administered by the National Bank of Ethiopia discourage imports (Dechassa *et al.*, 2017). Compared to domestic pricing policies of fresh milk production, tariff policies would have a relatively mild effect on reduction in imports (Sachintha and Jagath, 2014). There is a considerable number of published literature on the theory of international trade and food policy. However, there has been very few publication on dairy imports into sub-Saharan Africa in general and Ethiopia in particular. This study attempts to fill the gap. This study analyzed milk and milk products import trend for the last 25 years (1993 through 2017) in Ethiopia and examine their impact on the economy of the country considering data obtained from different sources (Ministry of Agriculture, Ministry of Finance, Ministry of Revenue, Ministry of Trade and Industry, Central Statistics Agency and FAO statistics) and looking into import demand and supply response functions.

1.3 Objective of the Study

1.3.1 General objective

The general objective of the study is to examine the determinants of milk and milk products import in Ethiopia.

1.3.2 Specific objective

To identify Socio-economic, trend and policy factors affecting milk and milk products import in Ethiopia.

1.4 Significance of the Study

The role of milk have paramount importance in having healthy, strong and productive society. Milk and milk products endowed with essential nutrients that are necessary in improving the nutritional status of the society. In view of this there is high demand of dairy products in the country. To fulfill the dairy product demand the government of Ethiopia highly depends on import which is confronted with a chronic shortage of foreign exchange. Considering the importance of dairy products, both for human consumption and as a means of income generation, bearing in mind the difficulty in getting the hard currency, it is important to investigate the causes and effects of this development to look in to local solutions.

1.5 Scope and Limitation of the Study

This study was designed to analyze milk and milk product import trend in Ethiopia for the last 40 years, 1977 through 2017, and examine their impact on the economy of the country using data obtained from different sources and looking into import demand and supply response functions. Due to unavailability of the required data in the country as a whole and in international organizations the scope of the study covers 25 years, from the year 1993 through 2017. Although import influenced by so many different variables, this study is concerned with only few determining variables such as milk consumption and milk supply. Therefore, the study analyzes the import data in relation to international price, real gross domestic product per capita, milk supply and human population number. This study will have its own shortcomings from which the availability and the accuracy of data take the priority.

1.6 Organization of the Thesis

This study was sub divided into five chapters. Beginning with the introductory chapter that focuses on the statement of the problem, highlights the objectives of the study and the significance as well as the scope of the study. The second chapter is dedicated to review of relevant literatures. Chapter three describes the methodology employed in the study. Chapter four presents the analysis of the results and discussion. At last, chapter five forwards the concluding remarks and recommendations.

CHAPTER TWO

2 REVIEW OF LITRATURE

2.1 Theoretical Review of Literature

2.1.1 Basic concepts and definitions

Import demand function specification and estimation rely on microeconomic consumer demand and production theory. Import demand function postulates that economic activity positively correlates to import demand whereas relative prices negatively correlate to import demand. The current estimation uses a similar specification with economic activity variable specified as real gross domestic expenditure (Visu, 2000). A country's gross domestic product does not represent a nation's entire economy. The kinds of economic output that are included in GDP are broad, but what GDP excludes can also be quite significant (ICPALD, 2013). In an open economy, import is a major component of trade contributing to economic growth. To design a comprehensive trade policy, stability of import demand function in an economy is essential (Muhammad *et al*., 2017).

The Ethiopian customs valuation methods, which are laid out in Articles 89 - 100 of the Customs Proclamation and in the Customs Duty Paying Value Determination Directive No. 111/2015, have been designed in line with the WTO Agreement, though Ethiopia is not yet a WTO member. Ethiopian Revenue Custom Authority recognizes six different customs valuation methods. The default method (Method 1) is the transaction value method. Alternative valuation methods are: Method 2: Transaction value of identical goods; Method 3: Transaction value of similar goods; Method 4: Deductive value; Method 5: Computed value; Method 6: Fallback method. The application of methods is strictly hierarchical. In any case, the default method constitutes the starting point. Only if it is impossible to apply in the specific case, the Method 2 will be tried, and so on (ERCA, 2017).

Definitions

Import: An import is a good or service transported into one country from another. The word "import" originates from the word "port" since goods are often shipped via boat to foreign countries. Countries are most likely to import goods and services that their domestic industries cannot produce as efficiently or cheaply as the exporting country. Free trade agreements and tariff schedules often dictate which goods and materials are less expensive to import. Economists and policy analysts disagree on the positive and negative impacts of imports. Some say that continued reliance on imports reduced demand for products manufactured

domestically, and thus can hobble entrepreneurship and the development of business ventures. Proponents say imports enhance the quality of life by providing consumers with greater choice and cheaper goods; the availability of these cheaper goods also help to prevent rampant inflation. https://www.investopedia.com/terms/i/import-export-prices.asp

CIF: Cost-Insurance-Freight. CIF-trade values include the transaction value of the goods, the value of services performed to deliver goods to the border of the exporting country and the value of the services performed to deliver the goods from the border of the exporting country to the border of the importing country. Import values are mostly reported as CIF.

FOB: Free-On-Board. FOB-trade values include the transaction value of the goods and the value of services performed to deliver goods to the border of the exporting country. Export values are mostly reported as FOB.

RGDPC: Real GDP per capita is a measurement of the total economic output of a country divided by the number of people and adjusted for inflation.

Dairy products/Milk and milk products: Dairy products, milk products or lacticinia are a type of food produced from or containing the milk of mammals, primarily cattle, water buffaloes, goats, sheep, camels, and humans. Dairy products include food items such as yogurt, cheese, and butter. A facility that produces dairy products is known as a dairy, or dairy factory.

2.1.2 International Trade theory

In the 17th and 18th centuries trade was seen as a nation's prime source of wealth and "Mercantilism" was the prevailing economic theory of that time. Mercantilists had the belief that international trade benefits only the exporting nation. According to that theory, a nation's welfare was determined by its accrued wealth; any consumption that conveyed income to other countries was bad. Mercantile rulers sought to minimize imports and maximize their nation's exports, often by acquiring export-generating colonies and limiting imports through tariffs, quotas, or outright bans. As economists and political leaders in the late 18th century saw prospects of mutual gains through trade, worldview began to shift. The use of quotas worldwide has declined as members of the WTO agreed to phase them out entirely in the 1980s (Catherine and Philip, 2016).

Mercantilism model seems to have gone; however, trade in primary agriculture is still protected through export quotas, subsidies, tariffs and other forms of trade distortions by various governments in the world, especially the advanced economies have heavily hurt Sub-Saharan Africa, which typically depend on primary agricultural products export (Nahanga, 2015). There are two schools of thought for import restrictions: 'Trade pessimists' are inward looking but favor protection policies and import substitution, whereas 'trade optimists' advocate free-trade policies (Muhammad *et al.,* 2017).

Absolute advantage trade theory was coined by Adam Smith, the father of modern economics, and who was the first person that advocated free trade. He describes absolute advantage as the process by which an individual or country can produce a particular product at a lower cost than another or in the other country. Hence, a country that trade beyond its national border should focus in producing goods that it has an absolute advantage over another (Nahanga, 2015). To address some issues that were not answered in the absolute advantage theory, the theory of comparative advantage was promoted by David Ricardo. Based on the theory, countries trade with each other in goods and services because of the concept of differentials in the natural resources, financial capital, human capital and technical capabilities endowment of nations. Some countries are more endowed in resources than others, many countries that are adequately blessed with good resources may not have the ability to manage and channel them to their advantage, hence, denying them the opportunity of achieving the necessary growth, development and good standard of living for their community (Adeleye *et al.,* 2015).

According to classical trade theory, free trade is a win-win game for both exporting and importing countries. Free trade leads to efficient resources allocation, enhances specialization, increases production, and provides consumers with more choices and higher levels of consumption utility. There are many reasons a country will implement trade policies to restrict exports or imports though free trade is beneficial. For example, trade policies can protect domestic production, raising incomes of interest groups, support vulnerable groups, ensure industrial security and food safety, increase environmental quality, influence terms of trade, safeguard the health of people, animals and plants, etc (Hongjun *et al.,* 2016). Neoclassical development theories dictate that more rapid population growth led to low per capita income. The share of agricultural contribution for GDP declines with increasing in population (Mekuriaw, 2018).

The significance of international trade stems from the fact that no country can produce all goods and services which people require for their consumption largely owing to resources differences and constraints. As a result, this trade relationship suggests that economies need to export goods and services in order to generate revenue to finance imported goods and services which cannot be produced domestically (Adeleye *et al.,* 2015). Although high production costs and operational efficiency considerations, trade liberalization is commonly blamed by Caribbean milk producers for the huge contraction in the size of domestic dairy industries in all Caribbean dairy producing countries. For instance, in Trinidad and Tobago local milk production dropped from 52% of consumption to 27% between 2000 and 2010. Jamaican dairy sector recorded a decline in annual output of milk of approximately 63% since trade liberalization in 1992, mainly because of the inability of the local industry to compete with dairy products imports (especially milk powder), which "enjoyed massive producer and export subsidies at origin" (Carlisle *et al.,* 2016).

Economic growth could be driven from growth in imports and considered as import-lead growth (ILG). Endogenous growth models show that imports can be a channel for long-run economic growth because it provides local firms with access to needed intermediate and foreign technology (Dechassa *et al.,* 2017). However there have been very few studies conducted on the effect of import on economic growth or ILG hypothesis (Maimuna and Nahid, 2017). The total impact on the economy is not easily quantified, but comparing the value of net imports of milk and milk products with total export revenues would be one method to show the burden placed on the balance of payments.

Economic theory presumes that population growth, increased volume of production, rise in per capita income and increase in volume of imports result in an increase of the volume of consumption (Maitah and Smutk, 2012). Trade has become more influenced by strategic decisions of large international dairy companies and regional developments (OECD-FAO, 2012). Countries were used trade barriers to limit their imports and exports from and to the international market. However, nowadays devaluation became successful policy in making exported goods cheaper and imported goods expensive so that the country's export and import will be encouraged and discouraged respectively (Medina, 2015).

The position of trade in goods relative to domestic economic output has weakened significantly in developing and transition economies. In developing economies, trade openness, measured

as the ratio between the average of import and exports of goods to GDP, decreased from 31 per cent in 2006 to 22 per cent in 2016. In transition economies the rate fell from 27 to 22 per cent. Trade openness of developed economies has been relatively low. After a peak in the year 2011, in 2016 the rate amounted to 19 per cent, the same level as in 2006 (UNCTAD, 2017). At present trade balance became one core component of national income of countries on which every nation have open economy and foreign interaction. Depending on the trading and economic power of the nation, it can be positive or negative (Arega, 2016).

2.2 Empirical Literature Review

2.2.1 Import demand functions and its determinants

1 Determinants of milk import

In many countries government is involved in enhancing dairy product consumption. Public promotions for awareness raising on the nutritional value of dairy product (iconic campaign 'got milk' in the U.S., 'operation flood' in India or The Netherlands 'the white motor' campaign) (Ruerd *et.al*, 2017). The most important factors affecting the consumption of dairy products is the increasing trend in availing the alternative choice of food and increased health, nutrition and diet concerns. Dairy products remain among the agricultural commodities for which production and consumption exhibit the highest growth rates (OECD-FAO, 2012) in that consumption of dairy products in the world has been rising over the past decades (Guillaume, 2015).

Trade liberalization together with high production costs and operational efficiency give rise to big contraction in the size of domestic dairy industries in all Caribbean dairy producing countries: Local milk production fell from 52% of consumption to 27% between 2000 and 2010 (Trinidad and Tobago); Jamaican dairy sector recorded a drop in annual milk output of approximately 63% since trade liberalization in 1992, principally because of the inability of the local dairy industry to compete with dairy products imports (mainly powdered milk), which "enjoyed massive producer and export subsidies at origin" (Carlisle *et al.,* 2016). Whereas, (Christopher and William, 2016) pointed out that as world GDP rises and consumers' preferences for different types of dairy products expanded, global dairy production is expected to continue to increase in the near future.

Regional differences in the consumption of dairy products is affected by their income status. OECD countries are expected to keep their dominant position in cheese consumption,

sustaining a 75% share of total world use. On the other hand, more than 80% of global whole milk powder consumption occurs in non-OECD countries, and this share is expected to grow to 85% by 2018 (OECD-FAO, 2009). Reflecting the structure of household expenditures the weight of the food component in the CPI varies across countries significantly. The share of food in the CPI ranges from 10% to 20% in high income countries and 40-60% range in the low and middle income countries (*ibid*). The average expenditure on dairy products by Ethiopian household's accounts 4% of the total household food budget (Gezu and Zelalem 2018). Despite the country, Ethiopia, is deficit in milk production VAT becoming a factor for the lack of competitiveness in meeting consumer demand (Land O'Lakes, 2010). Milk quality concerns also made some consumers to reduced local milk consumption and switched to purchasing imported dairy products (Jelle *et al.,* 2015).

The per capita milk consumption has dropped from 26 liters in 1980 to 22 liters per annum in 1993 and then to 19 liters per annum in 2000 (SNV, 2009). For some time, the average per capita consumption of dairy products has been estimated at around 20 liters (Jelle *et al.,* 2015). The current 17 lt per capita demand for dairy products will approximately increase to 27 lt per capita in 2020 (Land O'Lakes, 2010). Based on the Ethiopia livestock sector analysis estimates Shapiro *et al.* (2017) milk consumption is projected to raise by 127% from about 5 billion liters in 2013 to 11 billion liters in 2028.

2 Domestic prices

Growth of dairy sector could be hampered by low demand and low prices and/or by high transaction costs that can reduced both the price received by producers and their incentive to generate surpluses. Any surplus is convoyed to market as long as the price received compensates the effort involved. The higher the price gained and the lower the cost of selling that milk, the higher the motive to take more milk to the market (Staal *et al.,* 2008). There have been cases where local dairy processing plants have eased collecting fresh milk from producers for economic reasons and sell reconstituted milk from cheap milk powder and butter oil imports however industrially processed dairy products made in Ethiopia are consistently cheaper than imported ones. The dairy processing industry based in Ethiopia accounts for a 17% market share while dairy imports have an 8% market share in Addis Ababa. Price differences may play a role in explaining the limited penetration of industrially processed dairy products in the Addis Ababa market. For instance, the price of one liter of pasteurized milk is 36% higher than the

price of one liter of raw milk. Similarly, the price of 1 kg of traditional fermented butter is 18% lower than the price of 1 kg of pasteurized and packaged butter (Gian *et al.,* 2010).

In 1993 the then Shola (now lame dairy) plant's intake was one-sixth of its installed capacity. Since then, milk prices paid to producers were progressively increased and reached ETB 1.50 per liter in 2003. New private dairy processing plant, Sebeta Agro Industry, emerged late 1991 and offered producers up to ETB 2.00 per liter of raw milk, stimulated competition and helped expand the formal market (Staal *et al.,* 2008). The dairy processors are quite competitive in their purchasing practices of raw milk. Prices generally range from ETB 4.50 to 5.00 per liter. The price further decreases in areas far from the collection center to account for additional transportation costs. The margins on fluid milk are 10-15% and on cheese and yogurt the range is 25 - 35%. The retail price of pasteurized fluid milk ranges from ETB 9.80 to ETB 11.00 per liter. Mama Dairy produces UHT, and the product sells for an average price of Birr 20 per lt (Land O'Lakes, 2010). In December 2013 the average farm gate price for cow milk was ETB 10.5, for camel milk it was ETB 8.25 and for butter ETB 116.6/kg (Shapiro *et al.,* 2017).

3 International price

Grassland based milk production which is much more subject to adverse weather conditions has been increasingly satisfied when international import demand increased. At the same time international prices also depict high price fluctuations (Weber *et al.,* 2012). Excellent pasture conditions in Oceania and parts of Latin America stimulated high returns in global supply response and eventually caused prices to decline in the second half of 2011. For the years 2012 through 2021 prices in real terms are expected to average between 6% (cheese) and 30% (butter) higher compared to the average levels of the previous decade. Cheese imports are favored by relatively lower cheese prices as cheese is increasingly consumed as an ingredient in fast food type products (OECD-FAO, 2012).

The U.S. dairy industry has exhibited increased price Volatility. Volatility has increased from 16.5% in 1980–1985, 32.5% witnessed over 1990–1995 to 67.3% in the 2005–2010 period. Since 2005 milk supply is becoming more responsive to milk and feed price variations (Marin *et al.,* 2012). The price peak starting in 2007 has its origin to a higher extent in insufficient global supply and to a lesser extent in EU policy changes. Main causes were low stock quantities of butter and skimmed milk powder around the world, especially in the EU

and decreasing production quantities in Oceania and South America due to unfavorable weather conditions. The recovered supply and the reduced demand for milk products – not only because of the high prices but also due to the financial crisis – caused the sharp price decline in 2009 again (Weber *et al.*, 2012).

International dairy commodity prices increased during the year 2016, in particular for fat-based products, following sharp declines from their 2013-2014 highs that caused from a shrinkage in demand and excess supply. Unfavorable weather conditions suppress the 2017 milk supply for some major exporters, thereby putting increasing pressure on prices. Both in 2016 and 2017 world supply growth lagged behind the demand growth (OECD-FAO, 2018). However, the declines in imports from China and Russia have created a surplus in supply, leading to significant downward pressure on global prices (Matthew, 2016).

The strong US dollar has put United States dairy exports at a competitive disadvantage compared to other exporters, particularly the EU and New Zealand (Matthew, 2016). To maintain a balance of foreign exchange, imports have to be offset by equivalent exports. Imports may pose severe problems if a country faces an increasing dependence on imported food at a time of acute or latent shortage of foreign exchange. The empirical results from South Africa, Visu (2000) suggest that the exchange rate policy does not have any major influence in curbing unnecessary imports. Similarly Medina (2015) revealed that devaluation doesn't lead the Ethiopian import demand to decrease and a 1% devaluation of the Ethiopian currency seems to lead the country's import to increase by 0.36% which means that exchange rate is not one of the determinants of import for Ethiopian economy.

The exchange rate of the Ethiopian Birr had been fixed at 2.07 Birr per US$ for about twenty years, until 1992. During this period, the Birr was increasingly overvalued and negatively affected the Ethiopian economy especially the external balance. The Transitional Government of Ethiopia undertook reform measures in managing the exchange rate. In October 1992, the Birr was devalued from 2.07 to 5 Birr per US$ and allowed to be progressively adjusted through auction system (Mulu and Alekaw, 2017).

The value of imports slightly increased to USD 11.5 billion in 2012/13 from USD 11.1 billion in the preceding year which is an annual increase of 3.7%. With imports rising faster than exports, the trade deficit worsened to USD 8.4 billion in 2012/13, from USD 7.9 billion in the

previous year. Without quantitative import restrictions the strict foreign exchange control regimes of the National Bank of Ethiopia discourage imports (Dechassa *et al.,* 2017). Ethiopia's foreign exchange reserves were recently estimated at less than two months of import coverage which is below the minimum standard of three months recommended by IMF (GAIN, 2016). Gross official reserves remained low, at 2.5 months of imports in 2016/17 and 2.1 months in 2017/18 (ADB, 2019). Decreasing imports will reduce foreign currency spending (Jelle *et al.,* 2015).

4 Gross domestic product

Contribution of the dairy sector to the national Gross Domestic Product was significant. It has 40% share in the agricultural GDP and 12–16% in the national GDP (Jelle *et al.,* 2015). Ethiopian total growth of GDP per capita between the years 1961 and 1999 was 17% compared to 37 and 56% in Sudan and Kenya, respectively. Gross domestic product per capita increased at an average annual rate of 3.3% between 1993 and 1999 (Staal *et al.,* 2008). Gross domestic product in Ethiopia averaged $14.35 Billion from 1981 until 2013, reaching $ 46.87 Billion in 2013 and a low record of $7.27 Billion in 1981. Gross domestic product in Ethiopia was worth $46.87 billion in 2013 that represents 0.08 percent of the world economy (Dechassa *et al.,* 2017).

Based on the National Bank of Ethiopia (2016) report Ethiopian economy registered 8 percent growth in the year 2015/16 and its import to GDP ratio was dropped to 23.6 percent from 26.8 percent a year ago. Moreover, National Bank of Ethiopia (2017) report indicated that, after recovering from challenging macroeconomic and weather conditions of the previous year there was a 10.9 percent growth in 2016/17. Nominal GDP per capita increased to USD 863 depicting 7.8 percent improvement over the previous year. Ethiopian economy is estimated to grow 11.1 percent in 2017/18 (*ibid*). The total monetary value of the milk based on the average farm gate price is projected to be $2.8 billion, which was 6.9% of the country's GDP in 2013 (Shapiro *et al.,* 2017). The contribution of the dairy sector to GDP is estimated to increase from ETB 28 billion in 2014/15 to ETB 52.9 billion in 2019/20 (Jelle *et al.,* 2015).

Livestock products are much more sensitive to changes in incomes, compared to cereal and oilseed markets, particularly in the short run, consistent with generally higher income elasticity for milk products and longer production processes for many of the livestock products (OECD-FAO, 2009). As incomes and human population grows, and diets become more globalized,

more milk products are anticipated to be expended in developing countries. In developed countries, per capita consumption is projected to raise from 22.2 kg in 2015-17 to 23.1 kg in 2027 in milk solids, compared to an increase from 10.6 kg to 13.5 kg in developing countries. However, there are significant regional differences amongst developing countries, where predominantly fresh milk products are consumed; this contrast with developed countries, where consumer preferences tend towards processed dairy products (OECD-FAO, 2018).

The regional dairy product consumption differences are affected by their income profile. OECD countries are expected to keep their dominant position in cheese consumption, sustaining a 75% share of total world use. Correspondingly, more than 80% of global WMP consumption occurs in non-OECD countries, and this share is expected to rise to 85% by 2018 (OECD-FAO, 2009). Ethiopia has a long tradition of dairy consumption and the increase in incomes is therefore anticipated to lead to an increase in dairy consumption as well (Jelle *et al.,* 2015). Individual's dairy products expenditures rises proportional to the rise in their income. The highest expenditure group (10% of the Addis Ababa market), consumes 38% of the milk. On the other hand, 61% of the population who are in the lowest expenditure group, consumed only 23% of the milk. Workers in the lowest income class would have to work 2.71 hours for one kg of milk, 27 hours for one kg of butter, and five hours for one kg of cottage cheese ("*ayib*") (Land O'Lakes, 2010).

5 Human population

Population growth will decline over the next decade, down to 1.1% per year on average. However, around 77 million people a year will be added to world population over the next ten years, roughly 7.5 billion people in 2018. Much increase is expected from Africa (more than 2% per year on average), while the population in Europe is not expected to increase much during the next decade (OECD-FAO, 2009).

Based on OECD/FAO (2012) estimate world milk production increased by about 100% over the last 50 years. With global population increase at 123%, average milk production per capita has dropped over this same period. As Ethiopia's economy continues to grow and as the population grows from its current level of nearly 100 million, agricultural product imports are expected to continue growing as demand leave behind the local production capacity (GAIN, 2016). Based on human population growth projections, if per capita consumption of dairy

products increases 5% per year until 2020, the national consumption of milk would be 3.2 billion liters (Land O'Lakes, 2010).

Ethiopia is among the least urbanized countries in Africa while the most urbanized country is Gabon followed by Libya and Congo (Mekuriaw, 2018). Ethiopian urban population although increased from 7 to 14 million between the year 2000 and 2006, only 19% of the large Ethiopian population (73 million) was living in urban areas by 2006 (Gian *et al*, 2010). Based on Land O'Lakes (2010) estimate per capita milk consumption of Ethiopia in 2020 would increase to over 27 liters per capita. Urban consumers would need an increase of 148% over current consumption which is equivalent to an additional 364 million liters of milk. The preferences of the younger population are more flexible, especially on social, cultural and religious norms. The impact of the fasting days on the younger population milk consumption habits could be much less than at the present time (*ibid*).

6 Policy

Interest in global dairy trade has been intensified because of the massive impact that domestic and international policies have had or are anticipated to have on the global trade and domestic supply. Significant examples are the negotiations in the proposal made by the world trade organization (WTO) during the Nairobi ministerial in December 2015 in effort to help stabilize world dairy prices by abolishing export subsidies over the next four years (Gezu and Zelalem 2018); the agreement on the application of Sanitary and Phyto-Sanitary (SPS) measures and the agreement on Technical Barriers to Trade (TBT) (OECD-FAO, 2012) and devaluation (Medina, 2015). In Sri Lanka a marked increase in milk powder imports is seen after the country adopting open economic policies in 1977 (Sachintha and Jagath, 2014).

European milk exports are expected to drop especially because of reforms and WTO obligations to reduce export subsidies though milk export increases. North American dairy product export is expected to remain unchanged. Even if prices remain around their current levels, they will be sufficient to achieve growth in the incomes of developing countries and stimulate export oriented production in milk producing countries at low costs (Maitah and Smutk, 2012). In Canada, the skimmed milk powder export forecasts beyond 2021 are unreliable as changes are going on in the dairy industry in reaction to the World Trade Organization Nairobi Decision. In the European Union, the release of its considerable skimmed milk powder intervention stocks may limit the rise in SMP prices (OECD-FAO, 2018). The

shape of dairy markets will continue to be influenced by the spread of multinational dairy companies which would lead to further narrowing of production and consumption differences across regions. Technological development and the spread of existing production technologies will also play an important role in narrowing the productivity gap (OECD-FAO, 2012).

To ensure dairy food safety, China has declared many SPS related domestic laws and regulations, which negatively affected dairy imports (Hongjun *et al.,* 2016). U.S. tariffs have been placed on aluminum, steel and other products from different countries, and the re-negotiation of NAFTA has changed from productive to antagonistic. Consequently, some countries have levied and are planning to levy retaliatory tariffs on U.S. products, including tariffs by China and Mexico on imports of U.S. dairy products. These tariffs will lead to a decline in U.S. dairy exports which will negatively impact U.S. dairy farmers and processors. On July 6, 2018, China instituted an array of increased tariffs on U.S. dairy imports that has recently led to significant increases in the prices paid by Chinese importers. These increases in prices paid range from 21.7 to 24.5 percent for liquid milk and whey respectively (Luis *et al.,* 2018).

Many countries have opted for regional (or bilateral) arrangements with little progress on the Doha Round negotiations (OECD-FAO, 2012). In 2006 the East Africa Dairy Regulatory Authorities Council (EADRAC) was established under the framework of the EAC Customs Union protocol as a platform to facilitate the harmonization of dairy product regulations and standards in the EAC. This Customs Union protocol enacted reduced import duties for milk products within the EAC areas (ECDPM, 2015). To recognize the effects of tariff policy, exchange rate, and economic performance changes, structural shifts, and other policy shifts, it is critically important to observe the trade elasticity in general or import demand elasticity in particular (Visu, 2000).

In Ethiopia various initiatives have been made in the preparation of livestock development related policies. However, none of these were finalized for proper enactment by the government (Abebe *et al.,* 2016). Ethiopia has no specific dairy sector policy in effect and at present it is in the process of formulating a livestock master plan that shall convoy dairy related issues (ECDPM, 2015). Over the next five years the government is not only aiming at a decrease import of dairy products, but is also working on a dairy policy that will dream in dairy products export (Jelle *et al.,* 2015).

Bigsten *et al.* (2016) as cited in (Mulu and Alekaw, 2017), in the year 1992/1993 the Transitional Government of Ethiopia (TGE) initiated a Structural Adjustment Program (SAP). Industrial restructuring that included, de-regulation, trade opening, and privatization were the strategic elements of the SAP. The trade opening reform aimed at dismantling quantitative restrictions and then step by step reducing the level and dispersion of import tariff rates. Consequently, six successive tariff reforms were implemented between 1993 and 2003, during which the maximum tariff rate was reduced from 230 percent to 35 percent, the average weighted tariff rate from 41.6 percent to 17.5 percent, and the number of tariff bands from 23 to 6 including the zero rate band. Despite measures to reduce import tariffs, Ethiopia is still characterized by higher rates of import tariff (*ibid*).

2.2.2 Determinants of supply gaps

1 Local production of milk and milk products

Sachintha and Jagath (2014), a research on milk powder import in Sri Lanka, confirmed that the elasticity with respect to the changes in local production of fresh milk (- 0.0616) was 'larger' compared to the price elasticity which was (- 0.1.813X10-5). Therefore, when Sri Lankan government wants a reduction in imports, the policies targeted at increasing domestic production would be more effective than a direct tax policy to increase import price.

Domestic milk productivity of different countries in the world declined subject to unfair market circumstances, adulteration for economic reasons, and negligence in quality control. The melamine incident in China resulted in destructive damages to the reputations of domestic milk powder brands in that the young parents lost confidence in the quality and food safety of domestically made milk powder. As a result, in China the market share of imported milk powder was rose from around 35% in 2007 to 60% in 2012 (Hongjun *et al.,* 2016). Due to trade liberalization local milk production dropped from 52% of consumption to 27% between 2000 and 2010 in Trinidad and Tobago; Jamaican dairy sector milk output declined approximately 63% since trade liberalization in 1992, primarily because of the fierce competition of the local industry with imports of dairy products (Carlisle *et al.,* 2016). Over the past four years Russia's milk production fell partially due to the unsettled payments of subsidies under state support programs (Christopher and William, 2016).

The pivotal role for milk productivity improvement depends on the prevailing local conditions of the country in question. For example, the world's largest dairy herd; artificial insemination;

improved veterinary services, feed and farmer education; the growth and success of cooperatives particularly Gujarat Cooperative Milk Marketing Federation; and increases in consumer demand and GDP were factors contributing to India's growing milk production. China's production growth was motivated by relatively low production costs stemming from the employment of small-scale farmers who utilized abundant feed resources and slack labor. The main reason for Brazil's success is the governmental support milk producers received from dairy development programs designed to increase productivity through pasture improvement and animal genetics. Brazil's increase in milk production is also partially motivated through exemption from value-added taxes on the sale of milk by producers and cooperatives (Christopher and William, 2016).

National milk production in Ethiopia for the period between 1966 to 2001 increased by only 1.6% per year and per capita production declined by 0.8% per year (Staal *et al.*, 2008). In the year 2011/2, Ethiopia produced 3.3 billion liters of milk, worth $1.2 billion, and imported an additional $10.6 million of dairy products (Abebe *et al.*, 2016). Over the last 15 years, the total volume of milk produced in Ethiopia has gradually increased from less than 1 billion liters to 3.0 billion liters in 2014/15 (Jelle *et al.*, 2015). The amount and value of dairy imports will continue to rise if improvements in domestic production and marketing of milk is not in place (Land O'Lakes, 2010). The domestic milk production is estimated to cover more than 71% of the total consumption needs representing a milk production-consumption gap of 3.2 billion liters (Shapiro *et al.*, 2017). Ethiopian Government plans to nearly double domestic milk production between 2015 and 2020. This increase will demand investments and improvements in yields of fodder crops, feeding, genetics, health, and dairy processing (Jelle *et al.*, 2015).

As the country's economy continues to grow and as the human population increases from its current level of nearly 100 million, imports of agricultural products are expected to continue growing as demand leave behind local production capacity (GAIN, 2016). Pasteurized milk, UHT and powder milk, pasteurized and packaged (table) butter, cheese (mainly cheddar, provolone, mozzarella, Gouda, feta, parmesan) and yogurt are industrially processed dairy products available in Addis Ababa markets. Powder milk and UHT are usually imported from European and Arabic countries; yogurt, pasteurized and packaged butter, and cheese can be either imported or made in Ethiopia (Gian *et al*, 2010).

2 Herd size

In many regions cow herd expansion is supposed to be more and more restricted by environmental and water constraints so that additional milk production is estimated to be increasingly coming from growth in per cow milk yields (OECD-FAO, 2009). The total herd size of milking cows in Sri Lanka (Sachintha and Jagath, 2014) has a significant positive impact on fresh milk supply. Numerically, when one more milking cow is added to the total herd in the country, the annual fresh milk supply increases by 654.023 liters. The study further revealed that when the real value of local fresh milk price increases by one rupee (Sri Lankan currency), the import amount of milk powder decreases by 18.868 tons. When a single cow starts milking, it can affect to decrease imported milk powder by 6.96 kgs.

The national herd in Ethiopia, consisting of about 55.2 million cattle, 29 million sheep and 29 million of goats, and 4.5 million camels produced about 5.2 billion liters of milk per year (Shapiro *et al.,* 2017). The Ethiopian cattle herd is predominantly for milk production. Commercial offtake rates is low, estimated at 10 – 12 percent of the national herd. The national herd is composed of mainly cows, and they are held in the herd beyond the period of maximum milk production (Land O'Lakes, 2010). While almost 100% of milk production in the United States is comes from milk cows (and about 97% in the European Union), milk cows account for only 82% in Ethiopia, 78% in Algeria, and 40% in India (OECD-FAO, 2012).

3 Imported milk and milk products

China, Algeria, Indonesia, Brazil and Russia are the world's largest dairy products importing countries covering 86% of the total world import (Sagar and Paramasivam, 2016). Asian countries, Africa and the Middle-East, consumption is growing faster than production, leading to an increase in dairy imports. In Canada, import demand is constrained by domestic dairy policies, while in Japan it is limited by an ageing population (OECD-FAO, 2018). Global dairy consumption has been on the rise progressively since 2005 except for 2009 and 2015. Global financial crisis was the main reason for dairy trade failures in 2009. In 2015, dairy trade dropped due to weaker dairy commodities demand. European Union's dairy farmers export subsidies received from their government contributed to lower international dairy prices and a weaker dairy commodities demand (Gezu and Zelalem 2018).

Global whole milk powder production continued to grow strongly in 2011 as New Zealand continued its recent strong growth trend of nearly 20% p.a. and China recovered from the

melamine-related problems. Whole milk powder (WMP) is expected to be the fastest growing product followed by Fresh Dairy Products (FDP). The market for FDP remains dynamic due to sustained expansion of the fermented products production. Food safety concerns, a growing appetite for dairy products, increasing incomes, urbanization and higher participation of women at work, are the most important factors for high milk powder imports (OECD-FAO, 2012). World WMP exports was raised by 2.5% in 2014 to 2.5 million tonnes. This compares with limited growth of 1.1% in 2013, when a milk production deficit constrained trade (Guillaume, 2015).

World milk output is projected to reach close to 827 million tonnes in 2018, up 2.0 percent from 2017 (FAO, 2018). Developing countries account for 94% of world imports of whole milk powder, 90% of skim milk powder, 51% of butter and 40% of cheese imports. In the year 2018, these shares will increase to 96% (WMP), 92% (SMP), 57% (butter) and 44% (cheese) (OECD-FAO, 2009). The per capita consumption of cheese in the United States or the European Union is above 15 kg per person, while in developing countries it is negligible and reaches 0.9 kg per person on average in 2021 (OECD-FAO, 2012).

Ethiopian dependency on dairy product imports has increased partly due to food aid, primarily milk powder. Imports reached 994,657 kg in 2008.The value of dairy product imports increased from Birr 48 billion in 2005 to over Birr 114 billion in 2010. The major import item is powdered milk and cream (Land O'Lakes, 2010). Expenditure on powdered milk accounted for 79.6%, followed by cream, 12.9% and cheese 4.3%. In the year 2011/2, Ethiopia produced 3.3 billion liters of milk worth $1.2 billion and imported an additional $10.6 million of dairy products (Abebe *et al.,* 2016). Ethiopia spent over 678.75 million Birr to import dairy products from 2006-2010 (Gezu and Zelalem 2018). Ethiopia has therefore become a net importer of dairy products with an import bill rising from U.S. $ 5.6 million in 2005 to U.S. $ 7.6 million in 2014 (Ruerd *et al.,* 2017). Ethiopia has untapped opportunity for domestic UHT production that can correct the current dairy product import dependency.

4 Policy

Domestic policies have been one of the driving forces behind milk production surpluses and the promotion of trade opportunities for some major and minor dairy commodity exporters. In countries across the globe, dairy supply policies are used for different reasons. Some countries use them to support their dairy industries to produce sufficient amounts of dairy commodities

in order to satisfy the demands of their citizens. Governments may also establish dairy supply policies to increase domestic dairy prices and farm income. For instance, government development programs in pasture improvement and animal genetics help Brazilian dairy farmers to increase their milk productivity. Brazil's increase in milk production is also partially motivated through exemption from value-added taxes on the sale of milk by producers and cooperatives (Christopher and William, 2016).

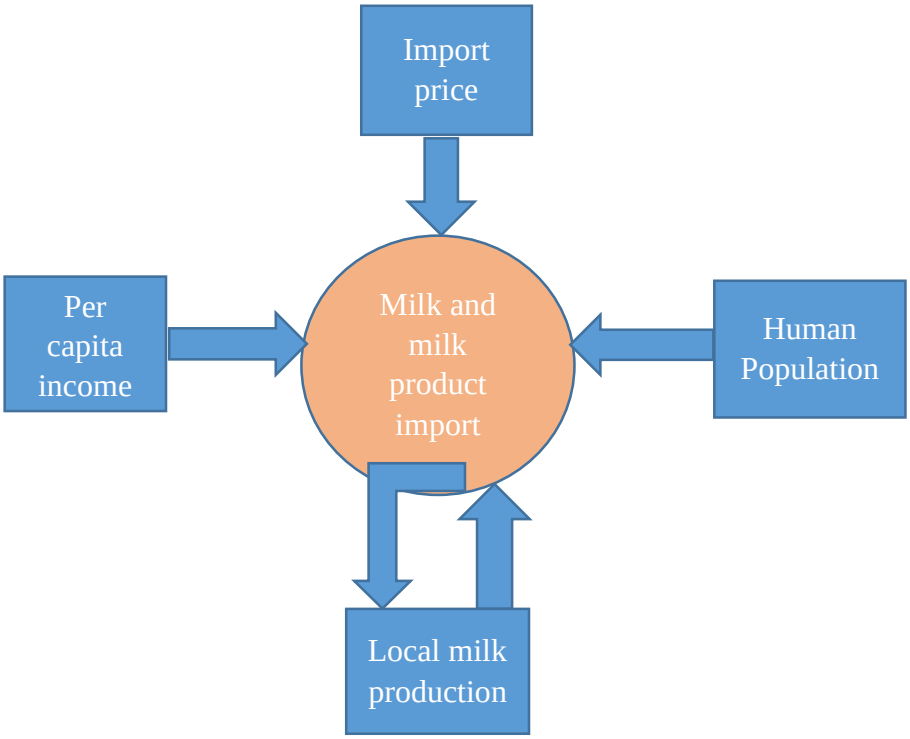
Classical trade theories revealed that free trade is a win-win game for both importing and exporting countries. Free trade leads to efficient resources allocation, increases production, enhances specialization, and provides consumers with more choices and higher levels of consumption utility. There are many reasons a country will implement trade policies to restrict exports or imports though free trade is beneficial. For example, trade policies can protect domestic production, increase environmental quality, raising incomes of interest groups, support vulnerable groups, ensure industrial security and food safety, influence terms of trade, safeguard the health of people, animals and plants, etc (Hongjun *et al.,* 2016).

Trade liberalization is widely blamed by milk producers of the Caribbean region for the shrinkage of domestic dairy industries in all Caribbean dairy producing countries. For instance, in Trinidad and Tobago local milk production dropped from 52% of consumption to 27% between 2000 and 2010. Jamaican dairy sector recorded a decline in annual milk output of about 63% since trade liberalization in 1992, primarily because of the inability of the local industry to compete with dairy products import which "enjoyed massive producer and export subsidies at origin" (Carlisle *et al.,* 2016).

The disappointing results of import substitution industrialization (ISI) strategy in the developing countries (particularly Africa and Latin America), on the one hand, and the success of export oriented industrialization (EOI) strategy of the Asian countries, on the other hand, prompted trade policy reforms worldwide starting from the 1980s. A number of developing countries including Ethiopia adopted the IMF/World Bank sponsored Structural Adjustment Program (SAP) and progressively liberalized their economies (Mulu and Alekaw, 2017). However, Ackah and Morrissey (2005) as cited in (Mulu and Alekaw, 2017) confirmed that the extensive trade liberalization and particularly tariff reduction in African countries have usually caused for an increase in imports, but export growth has often been sluggish such that in many countries the trade deficit has increased.

2.3 Conceptual Framework

This study conducted based on the conceptual framework that emanated from the above theoretical and empirical literature reviews. This research focuses on investigating the milk and milk products import trend for the last 25 years, 1993 – 2017 and its effect on socioeconomic factors in Ethiopia. The variables employed here show us their impact on the Ethiopian economy, negatively and positively, which lead us to device the necessary measures accordingly. The figure depicts how the dependent variable (milk and milk products import) influenced by the independent variables such as import price, price per capita, local milk production and human population numbers.



Source: Derived from empirical and theoretical literatures

The single arrow in the above figure indicates the presence of unidirectional causal relationship between the dependent variable which is located at the center and the independent variables - Import price, per capita income, local milk production and human population. This implies that the independent variables influence the dependent variable positively (local milk production and human population) and negatively (percapita income and import price). On the other hand Granger causality test confirming unidirectional cause coming from the milk and milk product import to the local milk production.

CHAPTER THREE

3 RESEARCH METHODOLOGY

This study was designed to analyze milk and milk product import trend in Ethiopia for the last 25 years, 1993 through 2017, and examine their impact on the economy of the country using data obtained from different sources and looking into import demand and supply response functions. There has been very few publications relevant to milk and milk products import into Ethiopia. This study attempts to fill the gap. Although import influenced by many different variables, this study is concerned with only few determining variables such as milk consumption and milk supply. The study will analyze the import data in relation to the, international price, milk production, real gross domestic product per capita and human population numbers. To estimate the general regression equations of the related variables in the study, STATA software was used. This chapter has four main sections. The first section highlights the data sources and method of collection, the second section deals with research approach (qualitative). The third section discusses hypothesis. The fourth section discusses about data analysis.

3.1 Data Sources and Method of Collection

Data was collected from different governmental and non-governmental organizations that have direct or indirect link with milk and milk products import activities. The required data was collected from organizations in two ways: Browsing the organization's website as in the case of FAO and through presenting data request letter together with data collection format especially to the governmental organizations such as Central Statics Agency, Ministry of Industry, Ministry of Revenue, Ministry of Finance, National Bank of Ethiopia and Ministry of Agriculture. Based on the organizational data management and bureaucracy style, the required data was collected in softcopy and via email as fast as with in less than ten minutes as in the case of National Bank of Ethiopia and more than two weeks in the case of Ministry of Revenue.

3.2 Research Design and Approach

This study aimed to analyze socio-economic, trend and policy factors affecting milk and milk products import in Ethiopia. This research was designed to see the causal relationship among variables. To answer the research questions posed in chapter one, quantitative data obtained from different sources (Ministry of Agriculture, Ministry of Finance, Ministry of Revenue, Ministry of Trade and Industry, Central Statistics Agency and FAO statistics) used. Due to its convenience for secondary and quantitative data, the research design employed in this study

was quantitative type of research design. The study considered 25 years dairy import and production data for the period 1993 through 2017 focusing on demand and supply functions of milk and milk products. The unit root test, co-integration test and the associated error correction mechanisms were used to investigate milk and milk products import trend of the country Ethiopia. Descriptive (tables, charts and graphs) and econometric methods of data analysis (STATA 14 software) was used.

3.3 Hypothesis

Building a statistical model have paramount importance in checking the assumptions made before conducting inference. The main purpose of modeling economic data is to test hypotheses on the coefficients, thereby exploring whether the data support an economic hypothesis or rejects it (Søren, 2014). Methods of estimation are subject to debate. To deal with problems associated with misspecification, various authors have devised better ways. Bias and errors inherent in OLS method have resulted in attempts to at least better equation specification.

The study hypothesized the following:

H0: Price of imported milk and milk products, human population, quantity of fresh whole milk production and real gross domestic product per capita don't have significant impact on the quantity of milk and milk products imported **H1**: Price of imported milk and milk products, human population, quantity of fresh whole milk production and real gross domestic product per capita have significant impact on the quantity of milk and milk products imported

Log transformation of variables simplifies the interpretation of coefficients in terms of elasticity and help in eliminating the irregularities in the data. The log transformation further helps in smoothing the series by removing the cyclical and seasonal variations and also avoiding the issue of heteroscedasticity (Ntebogang and Molebogeng, 2015.). Wen-Chi and Ángel (2015) used double-log model to estimate demand for cheese and fluid milk and for the aggregation of imported powdered milk, fluid milk, and cheese in Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua using time series data for the years 1994-2012. Similarly, as cited in (Vusi, 2000) Houthakker and Magee (1969), the use of double-logarithmic equations is preferred because "of their general superior fit and ease of interpretation", however, a linear function verified as better in the output supply function (Sachintha and Jagath, 2014).

To capture policy changes and structural shifts many studies make use of dummies. This idea is related to specification issues in that the import demand model is predisposed to bias and errors if structural shifts are not considered (Vusi, 2000). A research in Middle East and North Africa, Maitah and Smutka (2012) employed a model consists of three equations. (1) The volume of milk consumption; (2) The volume of milk imports and (3) The volume of milk supply in the Middle East and North Africa. This study used a linear model with natural logarithmic equation:

$lnTQLME_t = \beta_0 + \beta_1 lnAPIM_t + \beta_2 lnPOP_t + \beta_3 lnTQWMF_t + \beta_4 RGDPPC_t + \mathcal{E}_t$

Where:

$lnTQLME_t$……. Log of the quantity of milk and milk products imported in liquid milk equivalent in 1000 tonnes for $year_t$

$lnAPIM_t$…… Log of the average price of imported milk and milk products in USD $ for $year_t$

$lnPOP_t$……...Log of the number of Human population of Ethiopia in millions for $year_t$

$lnTQWMF_t$……Log of the total quantity of fresh whole milk production in 1000 tonnes in Ethiopia for $year_t$

$lnRGDPPC_t$….Log of the real gross domestic product per capita in $year_t$

β_0……..Intercept

β_t……..Slope

$\mathcal{E}_t$……..Error term

3.4 Data Analysis

Time-series techniques are used as the data used for modeling many economic relationships often contain a unit root. Subsequently, if this is not given due attention the model may convoy misleading results (Vusi, 2000). The advance in time-series analysis of models with unit roots has had a major impact on our understanding of the response of economic systems to shocks and econometric practice (Hylleberg *et al.*, 1990). Through variance decomposition the relative importance of shocks can be analyzed. Variance decomposition tells us the proportion of the variation in the variable that is from its own shocks and due to the shocks in other variables (Dechassa *et al.*, 2017).

Based on Ahmet (2008) it is standard to initiate analysis via observing the time-series properties of the data. Primarily, unit root tests determined the order of integration. In order to detect unit roots in data, Augmented Dickey-Fuller (ADF) test was employed. While Augmented Dickey-Fuller (ADF) test corrects for higher order serial correlation by adding lagged differenced terms

to variables in the right hand-side, the Phillip and Peron (PP) test makes the t-statistic correction of the coefficient of the lagged variable from the AR(1) regression to account for the serial correlation. Newey–West heteroscedasticity autocorrelation consistent estimate is used for this purpose. Similarly, (Agus *et al.,* 2017) study employed ADF test Relationship Between International Trade and PP to test the stationarity of each variable. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test compared with McKinnon Critical Value.

Economic growth causes imports and resultantly, imports cause economic growth in Granger sense. The relationship between import and import prices is bidirectional. Muhammad *etal.* (2017) applied the VECM Granger causality approach to detect the directional causal relationship between financial development, import demand, income, import prices and relative prices. The VECM Granger causality is most appropriate when variables are cointegrated for long-run relationship with the same level of stationarity. cointegration analysis will be applied to assess the validity of the suggested model if and only if all series have the same order of integration (Harilaos *et al.,* 2001). Ahmet (2008) analysis was based on the quarterly time series data on real export, real GDP, real investment goods import, real aggregate imports, real raw material import, real consumption goods import and real other goods import. All variables were deflated by producer price index (PPI) and were in a logarithm form.

3.4.1 Theoretical model

In this chapter the necessary information concerning the various analysis steps and their corresponding theories are briefly discussed. Before starting the actual analysis some preliminary steps concerning the time series had to be applied (Weber *et al.,* 2012).

1 Stationarity

The Time series for economic data is usually stochastic or has a trend that is not stationary, meaning the data has a root unit (Agus *et al.,* 2017). In estimating relationships between economic variables and using regression technique non-stationary variable causes several problems (Nader *et al.,* 2013). In order to be able to estimate a model, first step to do is testing the stationarity of the data (Agus *et al.,* 2017), the need to test for the presence of unit roots to avoid spurious regression. Unit root tests are used to determine stationarity properties of the data, i.e. to assess if mean is equal to a unit and that the variance is constant (Ntebogang and Molebogeng, 2015.). In simple terms the null entails that the series is nonstationary. All series

in levels reject the null in favor of the alternative and the test is reapplied in first difference form where all series accept the null hypothesis (Harilaos *et al.*, 2001). If the data used contains the root element of the unit, it will be hard to estimate a model since the data trend tends to fluctuate not around its average value unlike stationary data that have a tendency to approach its average value and fluctuate around its mean value (Agus *et al.,* 2017).

A time series is said to be stationary if the mean and auto covariance of the series do not depend on time. In other words, the correlation between a series and its lagged values has to depend only on the lag length, not on when the series started. Non stationary time series can be converted to a stationary series by differencing. If the series is stationary after constructing "d" differences then the original series is integrated of order d or I(d), respectively. A common example of a non-stationary series is the random walk $X_t = X_{t-1} + \varepsilon_t$ where ε_t is a stationary random disturbance term. This type of series will be I(1). The order of integration is the number of unit roots contained in the series or the number of differencing operations it employed to make a time series stationary (Weber *et al.,* 2012).

2 Seasonality

The integration and cointegration theory of time series is extended to cover series with unit roots at frequencies different from the long-run frequency. Seasonal series are studied with emphasis on the quarterly periodicity. It is argued that the presence of unit roots at the seasonal frequencies has similar consequences for the persistence of shocks as a unit root at the long-run frequency. However, a seasonal pattern generated by a model characterized specially by unit roots appears unlikely as the seasonal pattern becomes too contradict, allowing 'summer to become winter' (Hylleberg *et al.,* 1990). Economic price series often have a seasonal component. Price series do often not only consist of a seasonal component but also show strong trends. If this is the case, then the series called nonstationary which is not suitable for economic comparisons. This is because possible relationships between two series cannot be properly recognized and the danger of spurious regression is present. Seasonality is tested for and, if required, excluded by the Census X-12-ARIMA procedure (Weber *et al.,* 2012).

3 Lag length

The number of lags (orders) to be used in a VAR model can be determined based on Akaike Information Criterion (AIC), Hannan Quinn (HQ) or Schwarz Information Criterion (SIC)

(Agus *et al.,* 2017). Similarly, in order to select the lag length of the VAR model (Ahmet, 2008) were used, Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Information Criterion (HQ), Schwarz Information Criterion (SIC) and Sequential Modified Likelihood Ratio (LR). To test reliability of model, Sagar and Paramasivam (2016) also used Akaike Information Criteria (AIC), Mean Absolute Percentage Error (MAPE), R square, RMSE and Schwartz Bayesian Criteria (SBC). The appropriate lag structure has been indicated by the minimum value of the Akaike or Schwarz information criteria (Harilaos *et al.,* 2001). Before going through cointegration test stage, determination of optimum lag and VAR stability test should be done (Agus *et al.,* 2017).

The correlation between a series and its lagged values has to depend only on the lag length and not on when the series started so that the process generating time-invariant stationary time series (Weber *et al.,* 2012). For ADF tests a maximum lag structure of 12 will be chosen if the frequency of the data is monthly (Harilaos *et al.,* 2001). Due to the dynamic lag structure a shock to one variable does affect itself and other endogenous variables in the system. The selection of lag length determines which year selection would have significance on the current results. The Schwarz Information Criterion (SIC) has the tendency to underestimate the lag order, while including more lags increases the penalty for the loss of degrees of freedom. Akaike Information Criterion (AIC) is selected as the leading indicator to make sure that there is no remaining autocorrelation in the VAR model (Kwame *et al.,* 2013).

4 Engle and Granger's two-step procedure

Engel–Granger test is the simplest and most common method for co-integration. The Co-integration test method has two stages. (1) Test variables whether they are stationary or not. It is done by unit root tests on each variable. (2) If variables are Non-Stationary and degree of Co-integration, it is examined whether trends in these variables are associated with each other or not. This mean that the long-run relationship between these variables and the vector Co-integration is analyzed (Nader *et al.,* 2013). The Engle and Granger approach amounts to testing the residuals in terms of whether is there a unit root or not. The null hypothesis is that there is a unit root which means that variables are not co-integrated or there are no cointegrating relationships (Vusi, 2000).

Cointegration test has the advantage in that it is intuitive and easy to perform. As first step it starts estimating co-integrating regression, $x_{1,t} = \beta_1 + \beta_2 x_{2,t} + ... + \beta_p x_{p,t} + u_t$ where p is the

number of variables in the equation. In this regression we assume that all variables are I(1) and might cointegrate to form a stationary relationship, and thus a stationary residual term $\hat{u}_t = x_{1,t} - \beta_1 - \beta_2 x_{2,t} - ... - \beta_p x_{p,t}$ (In the tabulated critical values p = n). They will share a common trend and form a stationary relationship in the long run if the variables are cointegrating. Additionally, under cointegration, the residual (lagged once) can be used as an error correction term in an error correction model, and the estimated parameters can be viewed as correct estimates of the long-run steady state parameters.

The use of the Augmented Dickey-Fuller unit root tests effectively restricts short run dynamics (critical limitation of the Engle-Granger approach), such that the reaction of one variable to another variable is the same both in the short and long-run, though the model acts as if variables were in equilibrium. The prevalence of non-standard distributions to the estimators found to be another limitation of the Engle-Granger technique. Therefore, third step of the Engle-Yoo procedure is to provide correction of the first stage estimation of the long-run parameters of the model, in order to ensure that distributions return to normal distribution (Vusi, 2000).

5 The Johansen test of Cointegration

There are two well-known approaches dealing with non-stationary variables, these are the Johansen technique and Engle-Granger two-step. In order to take cognizance of certain limitations of these techniques there have been various extensions to these approaches (Vusi, 2000). Having all desirable statistical properties, Johansen's test is the superior test for cointegration. The limitation of the test is that it relies on asymptotic properties, and is therefore sensitive to specification errors in limited samples. In the Johansen test, the determination of cointegration is realized from the value of trace statistic and max Eigen statistic after preceded by finding the lag length to be known. Trace statistic and max Eigen statistic values that exceed their critical values indicate that there is cointegration in the model used (Agus *et al.*, 2017). Even though there are similarities between co-integration and unit root tests, these tests are not identical. The unit root tests are performed on single variable time series to examine whether the variable is stationary or not, while in Co-integration tests, between groups of variables which unconditionally have unit root (Nader *et al*., 2013).

6 Vector Autoregressive VAR

Vector Autoregressive is a statistical method used to analyze the relationship between several influencing variables. Vector Autoregressive (VAR) model is a quantitative forecasting approach usually applied to multivariate time series data. It is a simple regression of the equation $Y_t = \Gamma_1 X_{t-1} + \varepsilon_t$ (Agus *et al.,* 2017). Vector Autoregressive (VAR) is a multi-equation system where all the variables are treated as endogenous. There is one equation for each variable as dependent variable. Right-hand side of each equation contains lagged values of all dependent variables in the system, no contemporaneous variables VAR (P) model: $Y_t = A + B_1 Y_{t-1} + B_2 Y_{t-2} + \cdots + B_p Y_{t-p} + \varepsilon_t$ Where $Yt = (y_{1t}, y_{2t}, \ldots, y_{nt})$: an (nx1) vector of time series variables B_i (i=1, 2,…, p): (nxn) coefficient matrices εt : an (nx1) zero mean error term (white noise) (Sagar and Paramasivam, 2016).

In order to set up a VAR model there are two important assumptions that must be considered in the time series data, (1) stationary, (2) the error normality and independence. While testing, the independence of errors made in a way to make a residual plot. If $\boldsymbol{\varepsilon_t}$ point in the plot there is a clear pattern, it can be said that the $\boldsymbol{\varepsilon_t}$ is independent. The VAR model is used if there is simultaneity between several variables, and cannot differentiate between the dependent and independent variables (Agus *et al.,* 2017). The general form of the model VAR

$$y_t = c + \phi(B) y_t + \varepsilon_t$$

$$y_t = c + (\phi_1 B + \phi_2 B^2 + \phi_3 B^3 + ... + \phi_p B^p) y_t + \varepsilon_t$$

$$\varepsilon_t \sim N(0, \Sigma)$$

7 Variance decomposition

Forecast error variance decomposition or variance decomposition indicates the amount of information each variable contributes to the other variables in a vector auto regression models. Variance decomposition determines how much of the forecast error variance of each of the variable can be explained by endogenous shocks to the other variables. For example, in determining the price of stocks which of the macroeconomic factors is considered greatly before pricing (Kwame *et al.,* 2013). Variance decomposition tells us the proportion of the variation in the variable that is from its own shocks and due to the shocks in other variables. Variance decomposition measures the percentage of the forecast error variances at various forecast horizons. This procedure allows one to see the long-run percentage variation in a variable as a result of shocks to other variables. If the share of variation of a variable would be 0%, then that variable would be completely exogenous in the model (Dechassa, *et al.,* 2017).

In order to apply Gaussian maximum likelihood methods and convinced that the statistical model contains the density that generated the data the assumptions behind the model have to be checked carefully. If this is not the case, the asymptotic results obtained from the Gaussian analysis need not hold. Methods for checking vector autoregressive models include choice of lag length, tests for autocorrelation, test for normality of residuals, and test for heteroscedasticity in errors (Søren, 2014).

8 Error Correction Model

The simplest univariate modeling is Error Correction Modeling (ECM), a long term relationship between some non-stationary variables in the original data (Agus *et al.,* 2017). Variables long-run relationship estimates with time series data is readily available and doesn't have problem of spurious regression when two or more of them have a similar degree of Co-integration. However the long-run relationships between these variables will be stationary, but in this case the variables and their relationships in short term are overlooked, while these estimates in short term may have significant bias or removing dynamic factors from model is problematic in small samples. However, even if there are no such problems, short term variations should be evaluated, since long-term relationships between variables and equilibrium conditions barely is visible. Likewise, short term variables changes can gain useful information (Nader *et al.,* 2013). In a cointegration analysis the possibility of ECM is equivalent to the usual regression of known terms of independent and bound variables (Agus *et al.,* 2017).

9 Vector Error Correction Model

Vector Error Correction Modeling (VECM) is one of the modeling in the multivariate time series. The development of this cointegration is like providing new hope to achieve the formation of a stationary condition in the long run through a combination of linear variables (Agus *et al.,* 2017). In empirical practice Engle and Granger Vector Error Correction Model (VECM) is one of the most widely used time-series models. The reduced-rank regression method, introduced by Johansen, is the predominant estimation method for the VECM. Johansen's estimation method is widely used because it is a natural extension of the VAR model of Sims, it is straightforward, and it is computationally tractable (Bruce, 2018).

The primary estimation method for the VECM is called reduced-rank regression. The GMM tests for reduced (cointegration) rank are nearly identical to Johansen's likelihood ratio tests.

The asymptotic efficiency of the estimator in the GMM class relies on the assumption of homoscedasticity. When homoscedasticity fails, the reduced-rank estimator loses asymptotic efficiency but holds its interpretation as a GMM estimator. Johansen's reduced-rank estimator is algebraically identical to the generalized method of moments (GMM) estimator of the VECM, under the imposition of conditional homoscedasticity (Bruce, 2018). The VECM Granger causality is most appropriate when variables are cointegrated for long-run relationship with the same level of stationarity (Muhammad *et al.*, 2017).

3.4.2 Empirical model

1 Import demand function

Sachintha and Jagath (2014) in its import demand function, the price of milk powder imports and the local milk production were the two important treatment variables which were cooperated to assess their impacts of reducing imports by policy. Sachintha and Jagath (2014) included exchange rates and the price of milk powder imports as two different explanatory variables since the aim was to assess the impact of price of imported milk powder on milk powder demand while controlling for the effect of exchange rate. Explicitly, the interest was to assess whether tariff policies or supply side policies were more effective in curbing imports.

In order to understand the effects of economic performance changes, exchange rate, tariff policy, and structural shifts, and other policy shifts, it is critically essential to know or examine the trade elasticity in general or import demand elasticity in particular (Vusi, 2000). To look at the relative impact of imports on economic growth, Ahmet (2008) used variance decompositions (VDCs) and impulse response functions (IRFs) derived from VARs estimation.

Wen-Chi and Ángel (2015) used double logarithmic form model for demand of each dairy products. Estimating the demand function in double logarithmic form have an advantage on ease of estimation and interpretation as coefficient estimates are directly interpreted to be elasticity. Two types of demand functions (domestic demand and import demand) were specified in the study. The variables for the domestic demand functions were dictated by economics theory (income, own price, and price of related products) using the equation: $\ln Q_{it} = \beta_{0i} + \beta_{1i} \ln P_{it} + \beta_{2i} \ln Y_t + \beta_{3i} \ln CP_{it} + u_t$ where Q_{it} is per capita consumption of product *i* at time period t; P_{it} is the real price of product *i* at time period *t* in dollar of U.S. per unit; Y_t is per capita GDP at time *t* in dollar of U.S.; CP_{it} is the real cross-price of product *i* at time period t; and u_t is the error term. The import demands were assumed to be of the general

form: $\ln M_{it} = a + b \ln P_i + c \ln Y_t + d \ln CP_i + u_t$, where M_{it} is import of product i at time t in metric ton; P_i is real import price of product i in dollar of U.S. per metric ton; Y_t is real GDP at time t in dollar of U.S.; CP_i is real import cross-price of products i in dollar of U.S. per metric ton; and U_t is the error term.

Wen-Chi and Ángel (2015) used Per capita GDP and aggregate GDP for domestic and import demand estimation respectively. Demand functions were quantified as double-log-linear and were estimated using the Generalized Least Square (GLS) in SAS, version 9.1. All prices and incomes were deflated by the respective consumer price index of each country in the study. Based on Vusi (2000) the import penetration ratios for the manufacturing industry calculated as the ratio of imports to domestic demand (gross output plus imports less exports, multiplied by a 100). According to Sachintha and Jagath (2014) import demand function for milk products is specified by including local production as predictor as; $Q_{dt} = f(Q_{Lt}, Z_t)$ where, Q_{dt} is the imports of powdered milk in the year t and Q_{Lt} are the local production at year t. The Z_t term includes any other factors that influence imports of milk powder.

2 Supply response function

Based on the logic of economic theory, the relationship between supply and production volumes and imports have a positive relationship: Milk supply quantity increases when the volume of milk production and the quantity of imports increases and declines when the import price increases (Maitah and Smutka, 2012).

The identity equation show that the quantity supplied equals the quantity produced plus the quantity imported, which equals the quantity available for consumption (Maitah and Smutka, 2012). Improvement in farm management techniques, improved pasture and the application of technological knowledge to the fodder area, farm enterprise, weather condition and importantly the price paid for milk are major factors considered in supply response functions for dairy products. In order to evaluate the domestic price policy, farm gate price was specifically used as a predictor in the output supply function while a time trend is included to consider any changes in the technological knowledge to the farm enterprise (Sachintha and Jagath, 2014).

3.4.3 Tests

1 Unit Root Tests

In applied econometrics testing the order of integration is becoming standard. The way a test is performed is also depends on the motive behind the test, behind unit root tests we can find two motives. (1) Knowing the order of integration which is vital for setting up an econometric model and do inference. (2) Economic theory proposes that certain variables should be integrated, a random walk or a martingale process. The unit root test used to determine whether or not the time series variables are non-stationary. Accordingly, to make them stationary Wen-Chi and Ángel (2015) differenced all variables once. Since the first difference of the logarithm of the retail price of fluid milk in Honduras and Nicaragua and that of cheese in Guatemala and Honduras were found to be non-stationary, these variables were differenced twice.

2 Dickey –Fuller test

The Dickey-Fuller unit root test can be applied to time series with drift $\Delta X_t = \alpha + \delta X_t + \varepsilon_t$ and to time series with drift and linear deterministic trend $\Delta X_t = \alpha + \beta_t + \delta X_t + \varepsilon_t$ (Weber *et we al*., 2012). Assume that Y_t is random walk process, $Y_t = Y_{t-1} + \mu_t$, then the regression model becomes $Y_t = \rho Y_{t-1} + \mu_t$. Subtract Y_{t-1} from both sides of the equation, $Y_t - Y_{t-1} = \alpha_1 Y_{t-1} - Y_{t-1} + u_t \quad \Delta Y_t = (\alpha-1)Y_{t-1} + u_t \; \Delta Y_t = (\alpha-1)Y_{t-1} + \alpha_2 T + u_t$ where $\alpha - 1 = p_1$, Δ is change in Y_t or first difference operator and t is the trend factor, u_t is a white noise residual. $\Delta Y_t = p_1 Y_{t-1} + u_t$ With a drift we have; $\Delta Y_t = \alpha_0 + p_1 Y_{t-1} + u_t$ in practice, we test the hypothesis that $p=0$. If $p=0$, *"α"* in the equation $Y_t - Y_{t-1} = \alpha_1 Y_{t-1} - Y_{t-1} + u_t$ is equal to 1, this show us the presence of a unit root so that the series under consideration is non-stationary. In the case where $p \geq 0$, the time series is stationary with zero mean. In the case of $\Delta Y_t = (\alpha-1)Y_{t-1} + \alpha_2 T + u_t$, the series, Y_t is stationary around a deterministic trend. If $p \geq 1$, the underlying variable will be explosive. However, conducting the DF test as in $\Delta Y_t = (\alpha-1)Y_{t-1} + u_t$ or $\Delta Y_t = (\alpha-1)Y_{t-1} + \alpha_2 T + u_t$, it is assumed that U_t is uncorrelated. But in the case the error terms (U_t) are correlated, the Augmented Dickey-Fuller (ADF) is resorted to, as it adjusts the DF test to take care of possible autocorrelation in the error terms (U_t), by adding the lagged difference term of the dependent variable, ΔY_t (Emeka and Aham, 2016).

3 Augmented Dickey-Fuller test

In statistics and econometrics, an Augmented Dickey–Fuller test is a test for a unit root in a time series sample. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The augmented Dickey–Fuller statistic, (Akeyede *et al.,* 2016) used in the test, was a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence. The testing procedure for the ADF test is the same as for the Dickey-Fuller test but it is applied to the model (*ibid*).

The advantage of the Augmented Dickey-Fuller test (ADF) over the standard Dickey-Fuller test is that this test can accommodate higher-order autoregressive processes in the disturbance term (ε_t). The relating regression equation takes the canonical form: $\Delta X_t = \alpha + \beta_t + \delta X_t + {}_{j=1}\Sigma^p \delta_j \Delta X_{t-1} + \varepsilon_t$ where p is the preselected order of lags for the residuals. As the t-distribution for the t-statistic of δ is not appropriate, however, Engle and Granger have provided critical values (Weber *et al.,* 2012). The robustness of ADF unit root test is checked by applying PP unit root test (Muhammad *et al.,* 2017). Before proceeding with formally testing the model, Harilaos *et al.* (2001) first tried to determine the time series properties of stock market prices, long–term rates and earnings using the augmented Dicky–Fuller (ADF) test. The detection of a unit root in the level of each series requires first difference calculations and then these series are checked for the presence of a unit root.

In practice, Dickey-Fuller or Augmented Dickey-Fuller value with less than and greater than its critical value shows that the underlying series is non-stationary and stationary respectively. It is a good strategy to start with the model containing both a trend and a constant $\Delta Y_t = \alpha_0 + p_1 Y_{t-1} + \alpha_2 T + \sum_{i=1} \alpha_i \Delta Y_{t-i} + u_t$, since this model is the least restricted. Due to a significant p 1 if a unit root is rejected here, there is no need to continue testing. If p 1 = 0 cannot be rejected, the improved efficiency in a model without a time trend might be better. By adding the lagged difference term of the dependent variable, the ADF test adjusts the DF test to take care of possible autocorrelation in the error terms. Even though PP test take care of the autocorrelation in the error term and its asymptotic distribution is the same as the ADF test statistic, because of its easy applicability ADF is commonly used (Emeka and Aham, 2016).

4 Testing Cointegration

The term cointegration was coined by Granger as a formulation of the phenomenon that nonstationary processes can have linear combinations that are stationary (Søren, 2014). Two nonstationary time series could have a particular linear combination that is stationary: $Y_t = \alpha + \beta X_t + \varepsilon_t$ After transformation it becomes apparent that the random disturbance term ε_t is a linear combination of two integrated and nonstationary series Y_t and X_t: $\varepsilon_t = Y_t - \alpha - \beta X_t$ This implies that ε_t is integrated too. But both series are called to be cointegrated if there exist parameters of α and β so that ε_t is stationary. In the long run the cointegrated series will not drift significantly apart but in the short run deviations from the equilibrium are possible. These short run deviations from the identifiable long run relationship can be modelled with error correction models (Weber *et al.,* 2012). Integration tells us nothing about the dynamic adjustment to the long–run trend although it identifies equilibrium relationships between variables (Harilaos *et al.,* 2001).

Variables that do not cointegrate have spurious regression problem and the results therein become almost meaningless (Emeka and Aham, 2016). Once variable have been identified as integrated of order I(0), I(1), I(2) etc. is possible to set up models that lead to stationary relations among the variables where standard inference is possible. If variables have different trend processes, they cannot stay in fixed long-run relation to each other, and there is usually no valid base for inference. If you do no not find cointegration it is necessary to continue working with variables in differences instead. On the other hand, if the variables do cointegrate then we have cointegration (Emeka and Aham, 2016).

It is necessary to test and see the possibility of integration if the stationarity phenomenon is at the first difference level. The basic concept of cointegration is to see the long-term balance among the observed variables. Sometimes individually nonstationary data when linearly connected the data became stationary. It is then called that the data is cointegrated. The cointegration test will also be performed following Johansen's procedure (Agus *et al.,* 2017). Having confirmed that all series have the same order of integration, we can apply cointegration analysis to see the validity of the suggested model (Harilaos *et al.,* 2001). While there are similarities between co-integration and unit root tests, these tests are not identical: Unit root tests are performed on single variable time series to examine whether one variable is stationary or not, while in co-integration tests, between groups of variables which unconditionally have unit root (Nader *et al.,* 2013).

5 comparison of tests

Comparing different results from different test methods is a better way of testing the sensitivity of conclusions. As cited in (Vusi, 2000), Magee (1975) opts for the simultaneous-equation approach combined with the use of instrumental variables as it improved demand elasticity; For Khan (1974), a two-stage least squares method attested superior to OLS as it offered significant price elasticity of imports demand and a higher coefficient of determination. Nevertheless, it is not clear whether a method per se or other factors affect the significance of results. The choice of estimation method depends on the purpose of estimation and data availability.

Import demand elasticity estimation with respect to income and relative prices, there has been a frequent use of Ordinary Least Squares (OLS). In many respects this method has been criticized. The criticisms for this approach include its dependency on a large number of questionable assumptions and failure to deal adequately with time-series data. The shortfalls of OLS methods may result to 'spurious' and unreliable estimated outcomes. As cited by (Vusi, 2000), Maquez (1994) confirm that Full Information Maximum Likelihood performs better than OLS, and Senhadji (1997) verifies that Fully Modified (FM) estimators using the Monte Carlo methods out-perform OLS. Nevertheless, many authors have continued using the OLS approach arguing that it is relatively easier and convenient.

Different tests might advocate different conclusions. To improve the power of cointegration test, with the unique feature of generating a joint test-statistic for the null of no cointegration based on Boswijk and Banerjee, Engle and Granger, Johansen tests the so-called Bayer–Hanck test was newly proposed by Bayer and Hanck (2013) as cited in (Muhammad *et al.*, 2017). The local asymptotic power of many popular non-cointegration tests has recently been shown to depend on a certain nuisance parameter. Depending on the value of that parameter, different tests perform best. Meta tests avoid the arbitrary decision which test to use if single test results conflict. Likewise it avoids the size distortion inherent in separately applying multiple tests for cointegration to the same data set (Christian and Christoph, 2014). Studies proposed the Likelihood Ratio test for the presence of a unit root - the DF−GLS test and the Point Optimal test. Their tests, particularly dealing with deterministic components, have better power properties than the ADF test (Juan and Hernández, 2016).

CHAPTER FOUR
4 RESULT AND DISCUSSIONS

4.1 Results of Descriptive Analysis

According to the logic of economic theory, the relationship between supply and the volumes of production and imports is a positive relationship (Maitah and Smutk, 2012). Our data indicated that milk and milk product import increased 1993 through 1998 and after two years of decline, may be as a result of economic crises due to Ethio-Eritrean war, shows sharp increase at year 2000 and continue increasing after wards (Figure 4. 1). Increment of milk and milk products import may be economic growth driven, as a result of the open market created due to SAP, increased per capita income, urbanization, dairy product promotion in school milk days organized by both the governmental and non-governmental organizations, livestock products exhibitions and the new development on the flourishing food factories. Our findings was in agreement with (Shapiro *et al.*, 2017) in that for many years the per capita production and consumption of milk was in continuous decline in Ethiopia, however, since the year 2000 consumption has started to increase. Our findings also in line with (Medina, 2015) who stated that population is increasing very rapidly (it was 57 million in 1995, 86 million in 2013 and now more than 100 million) resulted bulk quantity imports of milk and milk products.

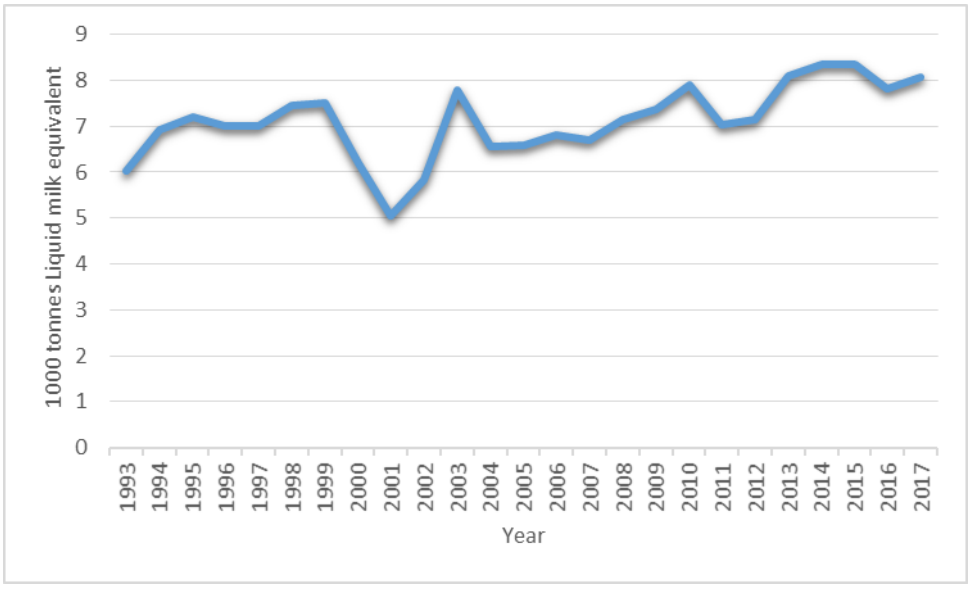


Figure 4.1 Milk and milk products import in Ethiopia for the years 1993 – 2017
Source: Author's personal calculation from FAOSTAT, MoR and NBE data

Dairy prices decline during the second half of the year 2008 due to the global economic crisis and increased supplies from major exporters as they responded to earlier price rises. In the same period, melamine contamination in China further dropping dairy demands (OECD-FAO, 2009). The graph (Figure 4.2) depicted that the value of milk and milk product import increased from its 6.3 million USD in 1993 to almost 8.7 million USD in 2003 and more than

9.5 million USD in 2015 which is higher than Ruerd *et al.* (2017) results that figure out as Ethiopia become a net importer of dairy products with an import bill rising from USD 5.6 million in 2005 to USD 7.6 million in 2014. Our finding is also less than (EDRI, 2017) who stated that Ethiopia's dairy import value tripled from its 6 million USD in 2005 to 18 million USD in 2015. This discrepancy may stemmed from source differences.

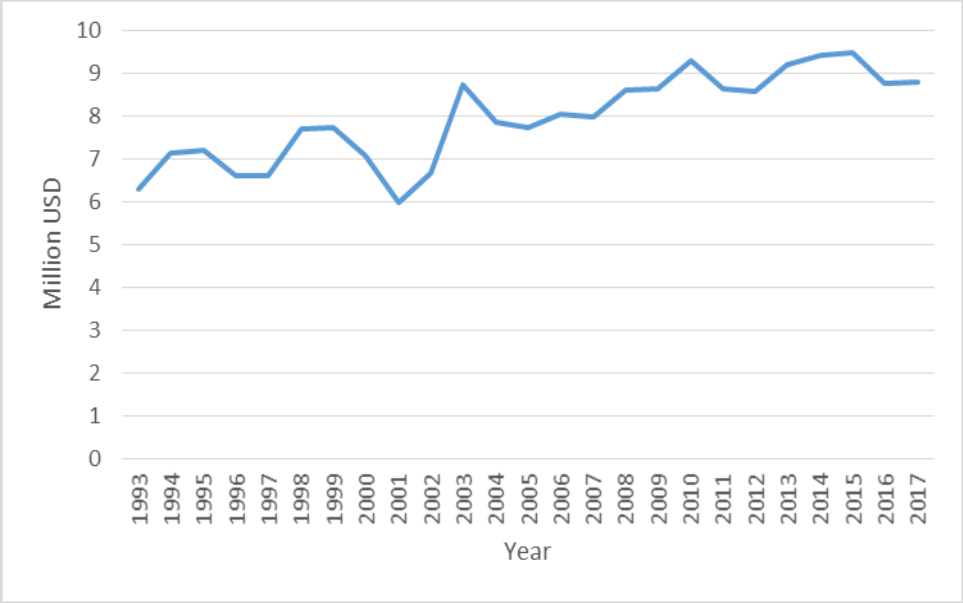


Figure 4.2 Value of milk and milk products import in Ethiopia
Source: Author's personal calculation from FAOSTAT, MoR and NBE data

Regression analysis was made. The dependent variable, Milk and milk products import, regressed against the independent variables and result ratifying the economic theory in that import price ($P<0.05$) and human population influenced milk and milk products import negatively and positively respectively. Our finding indicated that per capita income goes opposite direction with milk and milk products import this may be emanated from the fact that majority of milk and milk products imports are infant formula milk powder and the number of children in a family decreased as income and level of education increases. In one of the dairy product demand research in Central American countries Wen-Chi and Ángel (2015) reported low powder milk demand with increasing income and mentioned the less preference to powdered milk by high income groups.

Our regression analysis showed that for every percent increase in milk and milk products price, the quantity of milk and milk products imported decreased to 1.28 percent. Increasing human population increases milk and milk products import and yet it has no significant effect. A one percent increase in human population increases milk and milk products import at a rate of 2.58

percent. A one percent increase of locally produced fresh milk will resulted in 0.84 percent increase in milk and milk products import even though it has no significant effect. A one percent increase of per capita income will reduced 0.34 percent of milk and milk products import.

Our findings showed that per capita income and milk and milk products import have inverse relationships (Figure 4.3). Similar to our findings Muhammad *et al.* (2017) analysis revealed that per capita income had influenced import demand negatively and suggested import substitution policy in order to lessen the heavy import dependence and recover trade deficit. If import demand responds positively to real income, economic growth will accelerate imports which may erode foreign exchange thereby limiting faster growth of an economy (Visu, 2000).

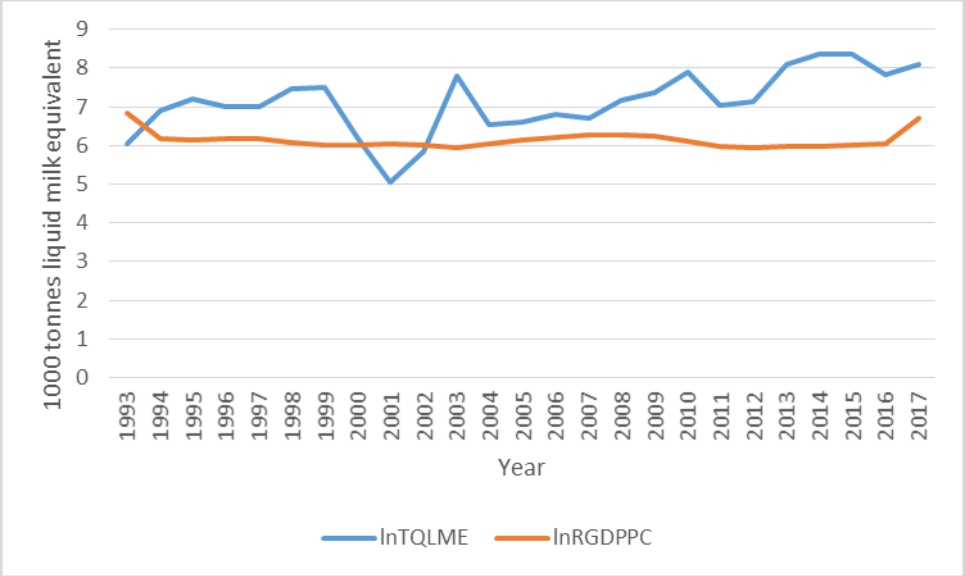


Figure 4.3 The relationship between milk and milk products import (TQLME) and personal income (RGDPPC) in Ethiopia
Source: Author's personal calculation from FAOSTAT, MoR and NBE data

Our analysis revealed that dairy products import have reverse relationship with import price (Figure 4.4). With price elasticity of (-1.28) import price have significant effect ($P<0.05$) in reducing milk and milk products import than population, local milk production and per capita income. Contrary to our findings Medina (2015) stated that the price elasticity of demand for milk products that Ethiopia is importing is inelastic. So, there might not be a significant change in the volume of import of the nation even if there is a change in the price of the products.

The significant effect of import price in reducing dairy products import coupled with the Granger causality test results obtained in this research where milk producer farmers are highly affected by milk and milk products import, policy makers should focus on import restrictions and thereby increasing milk productivity of local milk producer farmers. However, Sachintha and Jagath (2014), a research on milk powder import in Sri Lanka, confirmed that the elasticity with respect to the changes in local production of fresh milk (- 0.0616) was 'larger' compared to the price elasticity which was (- $0.1.813X10^{-5}$). Therefore, when Sri Lankan government wants a reduction in imports, the policies targeted at increasing domestic production would be more effective than a direct tax policy to increase import price.

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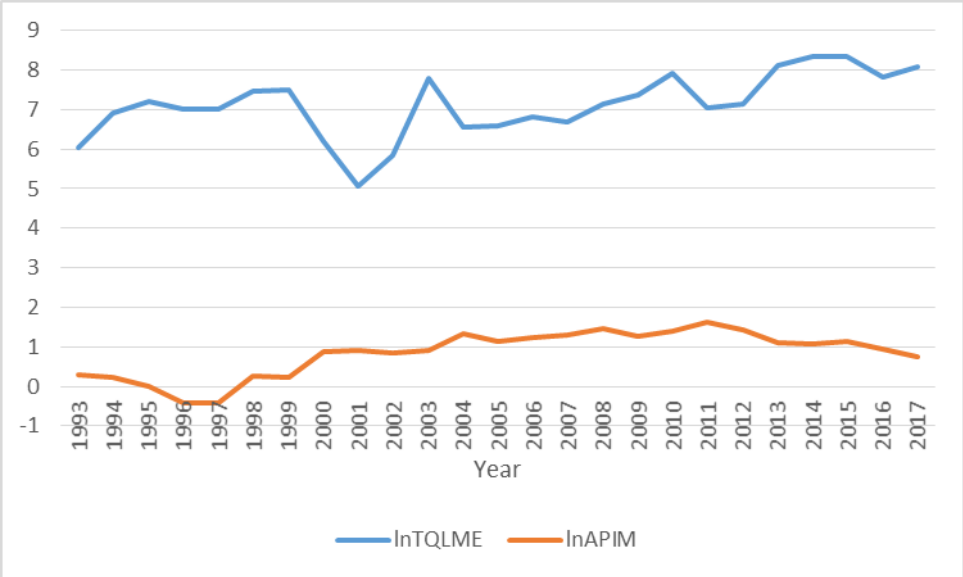


Figure 4.4 The relationship between milk products import (TQLME) and Average import price (APIM) in Ethiopia
Source: Author's personal calculation from FAOSTAT, MoR and NBE data

The cumulative milk and milk products import data for the last 25 years, 1993 – 2017, showed that milk powder, butter and ice cream accounts 57, 25 and 7 percent share of the total milk and milk products import respectively (Figure 4.5). Our findings is in agreement with Land O'Lakes (2010) stated that the major import item is powdered milk and cream. Somewhat different findings from Abebe *et al*. (2016) who stated that expenditure on powdered milk accounted for 79.6%, followed by cream, 12.9% and cheese 4.3%. Of the powdered milk products imported in Ethiopia, excluding the one imported by feed manufacturing industries, for the last 25 years (1993 – 2017) the share of skim milk powder (SMP), whole milk powder (WMP) and whey powder found to be 52, 35 and 13 percent respectively (Figure 4.6).

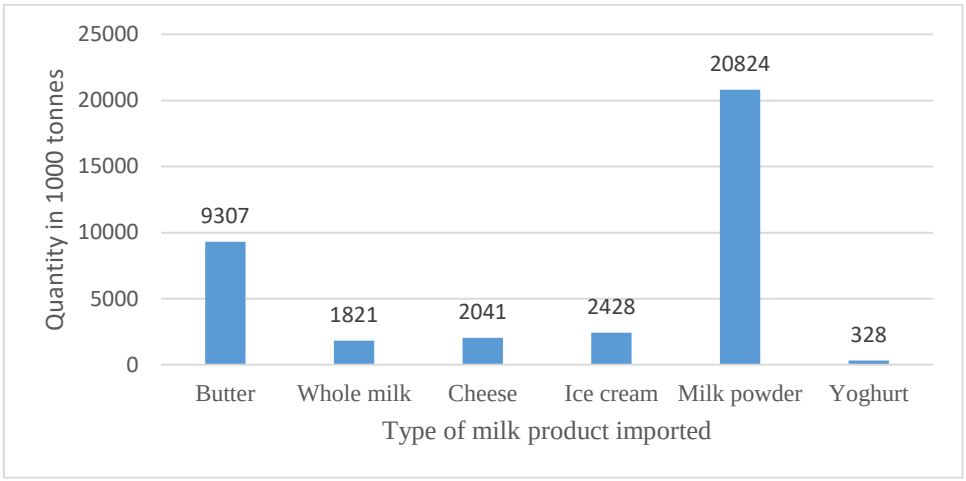


Figure 4.5 Total Milk and milk products import in Ethiopia 1993 through 2017
Source: Author's personal calculation from FAOSTAT, MoR and NBE data

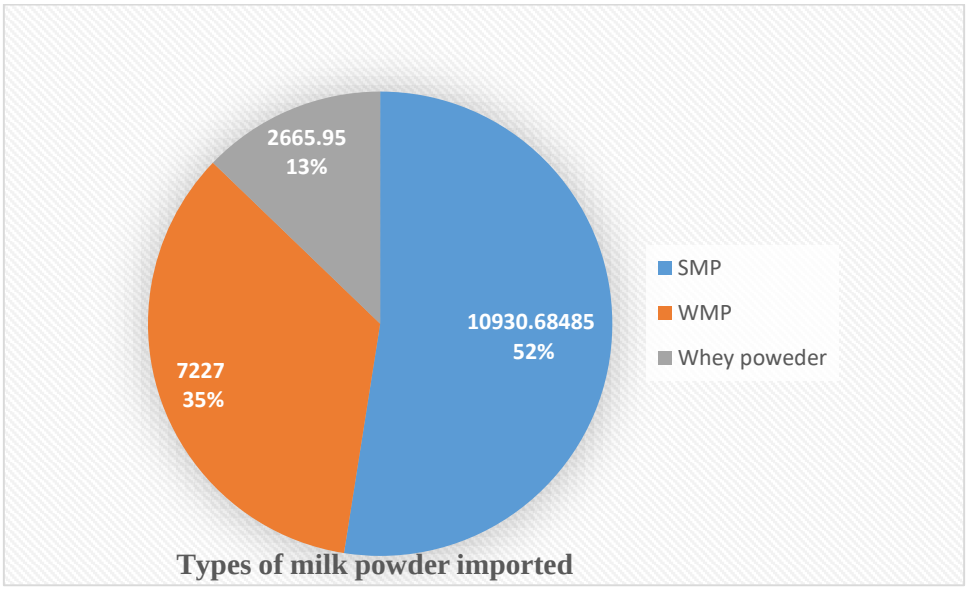


Figure 4.6 Share of the total milk powder imported in Ethiopia for the years 1993 - 2017
Sources: Author's calculation from FAOSTAT and MoR data

Whey powder import is a recent phenomenon (Figure 4.7) in Ethiopia, though we are not come across with relevant data as to why the case would be, it may be due to the current flourishing feed industries in the country. Whey produced in both the traditional and milk processing industries wasted uselessly and become the main source for pungent smell , environmental pollution, demanding frequent and high cost of effluent excavating from septic tanks though it can be used as feed for both human and animal; as a raw material for biogas production (personal communication). Whey based ingredients are protein sources for food industry (Guillaume, 2015).

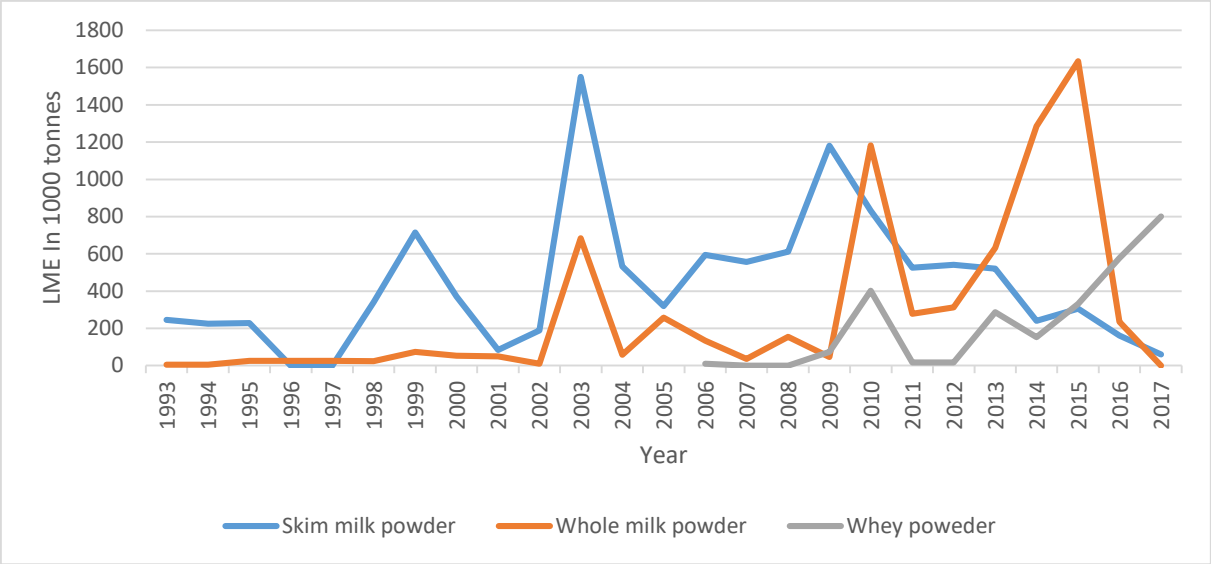
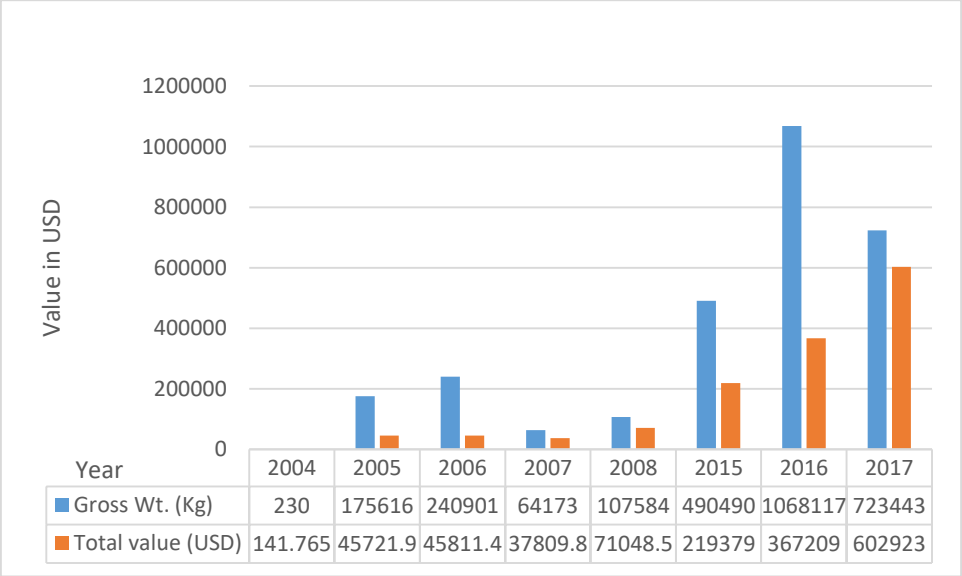


Figure 4.7 Types of milk powders import in Ethiopia
Source: Author's calculation based on FAOSTA and MoR data

Food manufacturing industries in Ethiopia have been importing milk and milk products as a raw material for their produce, however, since they are importing milk and milk products in bulk (Figure 4.8) without discriminating the type of milk products we are not able to infer an analysis.



Year	2004	2005	2006	2007	2008	2015	2016	2017
Gross Wt. (Kg)	230	175616	240901	64173	107584	490490	1068117	723443
Total value (USD)	141.765	45721.9	45811.4	37809.8	71048.5	219379	367209	602923

Figure 4.8 Imported milk and milk products (in bulk) by food manufacturing industries
Source: own calculation from MoR data

Since dairy policy is the core area for milk and milk products movements in and out of the country the researcher had keen interest to find out dairy policy in Ethiopia, however, there is no dairy policy in place in the country. Our finding is in agreement with ECDPM (2015) who

stated that Ethiopia has no specific dairy sector policy in effect and at present it is in the process of formulating a livestock master plan that shall convoy dairy related issues. In Ethiopia various initiatives have been made in the preparation of livestock development related policies. However, none of these were finalized for proper enactment by the government (Abebe *et al.,* 2016). Over the next five years the government is not only aiming at a decrease import of dairy products, but is also working on a dairy policy that will dream in dairy products export (Jelle *et al.*, 2015).

Commercial dairy imports dependency is proven through comparison with total milk consumption. Our findings illustrated (Figure 4.9) presence of higher milk and milk product import dependency between the years 1993 – 2000 and 2008 – 2011; highest import dependency from the year 2013 onwards, this would have negative impact on the economy in general and on local dairy producer farmers in particular. The present findings of milk and milk product dependency in Ethiopia is half way to the Sub-Saharan Africa which was reported by Paul (2015) as 90 percent. The Granger causality test in this research revealed that milk and milk products import negatively affected milk producer farmers though the magnitude is not known and beyond the scope of this research which needs further investigation. To reverse the negative impact of milk and milk products import on the local dairy producer farmers, due attention should be given by policy makers through import restriction and availing favorable ground to increase milk productivity locally.

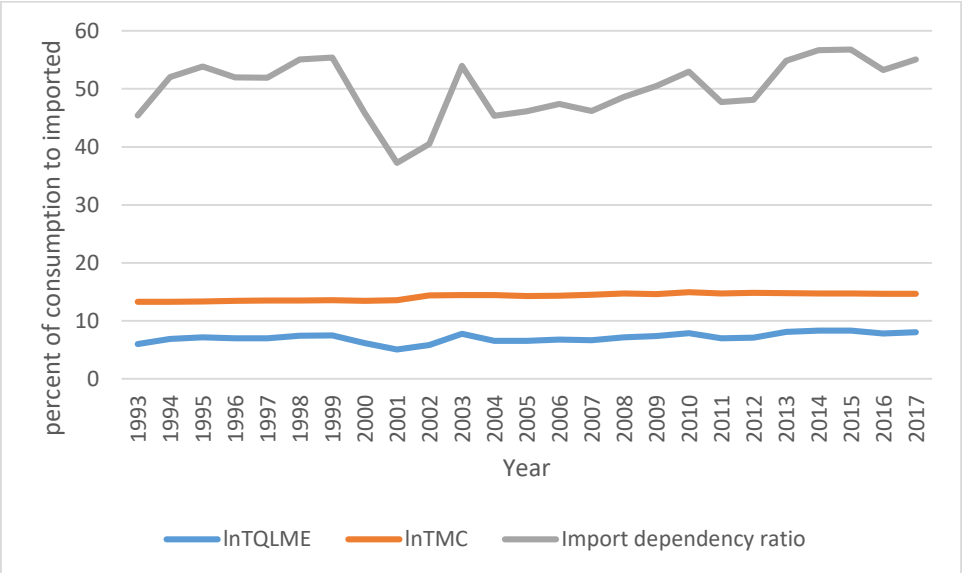


Figure 4.9 Percentage of milk and milk product consumption to imported dairy products
Legend: TQLME and TMC represented imported and consumed dairy products respectively
Source: Prepared by the author from FAOSTAT and MoR data

Similar to our findings Ruerd *et al* (2017) reported that Ethiopia become a net importer of milk products with an import bill rising from US$ 5.6 million in 2005 to US$ 7.6 million in 2014. Trade deficit is the result of an increase in import. Import tariff and quota have paramount importance in improving trade deficit. There are two schools of thought for import restrictions: 'trade optimists' advocate for free-trade policies, whereas 'Trade pessimists' are inward looking but favor import substitution and protection policies (Muhammad *et al.,* 2017).

4.2 Results of Econometric Analysis

4.2.1 Testing model performance

The data was checked for its homoscedasticity and found heteroskedastic. In order to estimate the reduced form equation of the model, Maitah and Smutkal (2012) made several trials by including and excluding different variables until reaching the most efficient estimates. To remove the heteroskedastic effect the data was computed by adding and dropping different variables. Variance Inflation Factor (VIF) was used at every steps of adding and dropping variables. The process of adding and dropping variables terminated once the VIF point attained to below 10 (Table 4.1). Finally Breusch-Pagan test was used to check the heteroscedasticity and the data found to be homoscedastic.

Table 4.1 Variance inflation factor test of the variables of the study

Variable	VIF	1/VIF
lnTQWMF	9.33	0.107177
lnPOP	6.70	0.149287
lnAPIM	3.10	0.322736
lnRGDPPC	1.06	0.942639
Mean VIF	5.05	

To check the presence of multicollinearity between the dependent and independent variables correlation was computed. The result indicated that no strong dependence (coefficient higher than 0.8) between the dependent and independent variables was established (Table 4.2).

Table 4.2 Correlation between the variables of the study

	lnTQLME	lnAPIM	lnPOP	lnTQWMF	lnRGDPPC
lnTQLME	1.0000				
lnAPIM	0.0894	1.0000			
lnPOP	0.5594	0.7360	1.0000		
lnTQWMF	0.4834	0.8190	0.9217	1.0000	
lnRGDPPC	-0.1262	-0.2373	-0.1894	-0.2126	1.0000

For ease of calculation and uniformity of measurements, all milk and milk products were converted in to Liquid Milk Equivalent (LME), conversion factor showed in the appendixes. The dependent variable, the quantity of milk and milk products imported (TQLME), regressed against the four independent variables. Average price of imported milk products (APIM), Human population (POP), locally produced fresh milk (TQWMF) and the per capita income (RGDPPC) were the four independent variables maintained after the adding and dropping processes performed to tackle the perfect collinearity problem encountered. The null hypothesis where $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ rejected at $P<0.01$, coefficients are non-zero, confirming goodness of the model.

4.2.2 Augmented Dickey Fuller (ADF)

In order to be able to estimate a model, first step to do is testing the stationarity of the data (Agus *et al.,* 2017). To tackle Autocorrelation problem ADF have developed Augmented Dickey Fuller test (equation 1, 2 and 3). Augmented Dickey Fuller (ADF) was employed for checking stationarity of the data using the three equation models of the ADF test – Equation model one (Intercept only), Equation model two (Trend and Intercept) and Equation three model (No trend and no intercept). In all the three equation models, the test statistics found to be less than the 5% critical values which implies that at level all comply the presence of unit root. To make variables stationary we should go for differencing. After first differencing the test statistics of two third of the equation models (equation model one and equation model three) found to be greater than the 5% critical value confirming the stationarity of the variables. Similar results were obtained using autocorrelation and partial autocorrelation test in that at level the presence of unit root confirmed and at first difference the variable attained its stationarity. Despite large space requirement, of the five variables only the dependent variable's autocorrelation (Table 4.3) and ADF test (Table 4.4) results displayed here. Since all variables were integrated of the same order i.e. I (1) the next step will be Johansen co-integration test. The order of integration is the number of unit roots contained in the series or the number

of differencing operations it employed to make a time series stationary (Weber *et al.*, 2012).

Table 4.3 Autocorrelation and partial autocorrelations test for the dependent variable

```
. corrgram lnTQLME
```

LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autocor]
1	0.5241	0.5610	7.7242	0.0054		
2	0.1535	-0.1961	8.4156	0.0149		
3	0.1544	0.3585	9.1467	0.0274		
4	0.2337	0.1788	10.902	0.0277		
5	0.1446	0.0592	11.608	0.0406		
6	0.0350	-0.0012	11.651	0.0702		
7	0.1114	0.2887	12.116	0.0968		
8	-0.0247	-0.2258	12.141	0.1450		
9	-0.1536	0.1220	13.135	0.1566		
10	-0.1512	0.1027	14.164	0.1656		

```
. corrgram d.lnTQLME
```

LAG	AC	PAC	Q	Prob>Q	[Autocorrelation]	[Partial Autocor]
1	-0.0408	-0.0414	.04518	0.8317		
2	-0.4858	-0.5034	6.7381	0.0344		
3	-0.1239	-0.2524	7.1946	0.0659		
4	0.2179	-0.1114	8.6765	0.0697		
5	0.1348	-0.0301	9.273	0.0987		
6	-0.2172	-0.2649	10.909	0.0912		
7	0.0675	0.1797	11.076	0.1353		
8	-0.0856	-0.1513	11.362	0.1820		
9	-0.0929	-0.1280	11.721	0.2295		
10	0.0699	-0.1250	11.938	0.2892		

Table 4.4 Augmented Dickey Fuller test of study variables

```
. dfuller lnTQLME, regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        24

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -2.524            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.1098

------------------------------------------------------------------------------
  D.lnTQLME |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
    lnTQLME |
        L1. |  -.4390147   .1739582    -2.52   0.019    -.799782   -.0782475
            |
      _cons |   3.193376   1.239025     2.58   0.017    .6237956    5.762956
------------------------------------------------------------------------------

. dfuller lnTQLME, trend regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        24

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)            -3.033            -4.380            -3.600           -3.240
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.1230

------------------------------------------------------------------------------
D.lnTQLME       |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
        lnTQLME |
            L1. |   -.60515   .1995096    -3.03   0.006    -1.020053   -.1902472
         _trend |   .0351948    .022602     1.56   0.134    -.0118087    .0821983
          _cons |   3.929553   1.290474     3.05   0.006     1.245864    6.613241
------------------------------------------------------------------------------

. dfuller lnTQLME, noconstant regress lags(0)

Dickey-Fuller test for unit root                   Number of obs   =        24

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)             0.309            -2.660            -1.950           -1.600
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  D.lnTQLME |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
    lnTQLME |
        L1. |   .0066072   .0213737     0.31   0.760    -.0376077    .0508221
------------------------------------------------------------------------------
```

Table 4.4 Augmented Dickey Fuller test of study variables……. *Continued*

Augmented Dickey-Fuller test for unit root Number of obs = 20

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.159	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0225

D2.lnTQLME	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnTQLME						
LD.	-2.250022	.7122161	-3.16	0.006	-3.768074	-.7319688
LD2.	1.003916	.5587505	1.80	0.093	-.1870322	2.194865
L2D2.	.4043381	.3922794	1.03	0.319	-.4317856	1.240462
L3D2.	.1114094	.2518375	0.44	0.665	-.4253695	.6481884
_cons	.1302415	.1708195	0.76	0.458	-.2338516	.4943346

. dfuller d.lnTQLME, trend regress lags(3)

Augmented Dickey-Fuller test for unit root Number of obs = 20

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.449	-4.380	-3.600	-3.240

MacKinnon approximate p-value for Z(t) = 0.0452

D2.lnTQLME	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
D.lnTQLME						
L1.	-2.561967	.7428956	-3.45	0.004	-4.15532	-.9686146
LD.	1.24167	.5809568	2.14	0.051	-.0043589	2.487698
L2D.	.5546783	.4036959	1.37	0.191	-.3111633	1.42052
L3D.	.1762983	.2527446	0.70	0.497	-.3657849	.7183814
_trend	.0369935	.0296876	1.25	0.233	-.0266801	.1006672
_cons	-.3482765	.4190584	-0.83	0.420	-1.247067	.5505144

. dfuller d.lnTQLME, noconstant regress lags(3)

Augmented Dickey-Fuller test for unit root Number of obs = 20

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.110	-2.660	-1.950	-1.600

D2.lnTQLME	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnTQLME						
LD.	-2.095576	.6738101	-3.11	0.007	-3.52399	-.6671625
LD2.	.8834709	.5288959	1.67	0.114	-.2377383	2.00468
L2D2.	.3230162	.3725294	0.87	0.399	-.4667108	1.112743
L3D2.	.0660902	.2414996	0.27	0.788	-.4458661	.5780465

4.2.3 Lag selection

The Time series for economic data is usually stochastic or has a trend that is not stationary, meaning the data has a root unit (Agus *et al.,* 2017). In estimating relationships between economic variables and using regression technique non-stationary variable causes several problems (Nader *et al.,* 2013). The number of lags to be included in the unit root test depends on the significant lag of the autocorrelation function and the partial autocorrelation function plots of the correlogram and partial correlogram. By rule of thumb, ACF computed up to a third to a quarter of the length of the time series (Emeka and Aham, 2016). The number of lags (orders) to be used in a VAR model can be determined based on Akaike Information Criterion (AIC), Hannan Quinn (HQ) or Schwarz Information Criterion (SC) (Agus *et al.,* 2017). Before conducting the co-integration test, the optimum lag length was selected based on the least values of LR, Akaike Information Criterion (AIC), Hernan- Quinn criterion (HQIC) and Schwartz criterion (SIC). Based on the assumption the lower the value the better the model will be, we select lag three since all lower values in each lag selection criteria were at lag three (Table 4.5). Therefore we will be using lag three in all system equations.

Table 4.5 Lag selection of study variables

Selection-order criteria
Sample: 1996 - 2017 Number of obs = 22

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-5.93919				1.9e-06	.994472	1.05289	1.24244
1	127.51	266.9	25	0.000	1.0e-10	-8.86453	-8.51405	-7.37675
2	170.848	86.676	25	0.000	3.0e-11	-10.5316	-9.88908	-7.80401
3	249.351	157.01*	25	0.000	1.0e-12*	-15.3956*	-14.4609*	-11.4281*

Endogenous: lnTQLME lnAPIM lnPOP lnTQWMF lnRGDPPC
Exogenous: _cons

4.2.4 Johansen Cointegration test

The term cointegration was coined by Granger as a formulation of the phenomenon that nonstationary processes can have linear combinations that are stationary (Søren, 2014). Johansen cointegration test was used to see the cointegrity among variables. Variables were differenced and at their first difference they attained stationarity which comply with Johansen test assumption in that variables are non-stationary at level but become stationary at their first difference, integrated of the same order. The value of trace statistics is lower than the critical value at maximum rank order of three which designated the number of cointegration models in the system, which is three. As second alternative we used the max statistics which give us the

same result as that of the trace statistics in that the value of max statistics have lower value than the critical point at the third maximum rank order. This test proved the stationarity and associations of variables (Table 4.6). This implies that the five variables, both the dependent and independent variables, have an association-ship, they are co-integrated and moving together. To proceed to the next step we do have two alternatives, using VAR when variables are not cointegrated or VECM when variables are co-integrated. In this case since variables are co-integrated, VECM model was selected to examine the presence of long-run and short-run causality among variables.

Table 4.6 Johansen Cointegration test for the study variables

Johansen tests for cointegration

Trend: constant — Number of obs = 22
Sample: 1996 - 2017 — Lags = 3

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	55	142.45722	.	213.7877	68.52
1	64	192.13635	0.98907	114.4294	47.21
2	71	226.65866	0.95665	45.3848	29.68
3	76	242.04925	0.75319	14.6036*	15.41
4	79	248.67622	0.45253	1.3497	3.76
5	80	249.35106	0.05950		

maximum rank	parms	LL	eigenvalue	max statistic	5% critical value
0	55	142.45722	.	99.3583	33.46
1	64	192.13635	0.98907	69.0446	27.07
2	71	226.65866	0.95665	30.7812	20.97
3	76	242.04925	0.75319	13.2539	14.07
4	79	248.67622	0.45253	1.3497	3.76
5	80	249.35106	0.05950		

4.2.5 Vector Error Correction Model (VECM)

When variables are cointegrated for long-run relationship with the same level of stationarity, VECM Granger causality is most suitable (Muhammad *et al.*, 2017). Since the variables are cointegrated VECM model was selected to examine the presence of short run (Table 4.7) and long-run causality among variables. The VECM model convert variables in to their first difference automatically. The VECM result showed that the error correction term, cointegration equation one (ce1 L1) coefficient, is negative and significant confirming long run causality running from the independent variables to the dependent variable (quantity of milk and milk

products imported) which indicate that the independent variables influence the dependent variable in the long run. The excerpt part of the VECM (Table 4.8) appeared here simply to show the robustness of the model while the full analysis showed in the appendixes.

The null hypothesis entails that there is no short run causality running from the independent variables to the dependent variable against the alternative hypothesis have short run causality coming from the independent variables to the dependent variable. The VECM showed that coefficients of the independent variables are all insignificant confirming absence of short run causality running from the independent variables to the dependent variable. This has to be checked. Since the result indicate the probability value of greater than 5 percent we cannot reject the null hypothesis, we accept the alternative hypothesis. There is no short run causality running from the independent variables to the dependent variable because all jointly are zero, meaning independent variables are not explaining the dependent variable in the short run.

Table 4.7 Short run causality test for study variables

```
( 1)  [D_lnTQLME]LD.lnAPIM = 0
( 2)  [D_lnTQLME]L2D.lnAPIM = 0
( 3)  [D_lnTQLME]LD.lnPOP = 0
( 4)  [D_lnTQLME]L2D.lnPOP = 0
( 5)  [D_lnTQLME]LD.lnTQWMF = 0
( 6)  [D_lnTQLME]L2D.lnTQWMF = 0
( 7)  [D_lnTQLME]LD.lnRGDPPC = 0
( 8)  [D_lnTQLME]L2D.lnRGDPPC = 0

          chi2(  8) =    5.02
        Prob > chi2 =    0.7558
```

Table 4.8 Vector Error Correction Model for study variables

```
. vec lnTQLME lnAPIM lnPOP lnTQWMF lnRGDPPC, trend(constant) rank(3) lags(3)

Vector error-correction model

Sample:  1996 - 2017                            Number of obs     =         22
                                                AIC               =  -15.09539
Log likelihood =  242.0492                      HQIC              =  -14.20751
Det(Sigma_ml)  =  1.91e-16                      SBIC              =  -11.32633

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_lnTQLME             14     .543221   0.8028   28.49567   0.0122
D_lnAPIM              14     .212152   0.7814   25.02593   0.0343
D_lnPOP               14      .00646   0.9793   330.7056   0.0000
D_lnTQWMF             14     .080337   0.9486    129.209   0.0000
D_lnRGDPPC            14     .181731   0.5009   7.024521   0.9338
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnTQLME						
_ce1						
L1.	-2.573922	.832775	-3.09	0.002	-4.206131	-.9417133
_ce2						
L1.	-2.562185	1.997983	-1.28	0.200	-6.47816	1.353791
_ce3						
L1.	9.116595	7.412525	1.23	0.219	-5.411687	23.64488
lnTQLME						
LD.	1.1491	.5757568	2.00	0.046	.0206375	2.277563
L2D.	.5433008	.4191708	1.30	0.195	-.2782588	1.36486
lnAPIM						
LD.	.7948492	1.370159	0.58	0.562	-1.890613	3.480311
L2D.	.4595236	.796072	0.58	0.564	-1.100749	2.019796
lnPOP						
LD.	-1327.498	1773.85	-0.75	0.454	-4804.179	2149.184
L2D.	992.2807	1404.804	0.71	0.480	-1761.085	3745.647
lnTQWMF						
LD.	-.524361	1.589048	-0.33	0.741	-3.638838	2.590116
L2D.	-1.089756	1.173549	-0.93	0.353	-3.389871	1.210358
lnRGDPPC						
LD.	-3.048684	3.600974	-0.85	0.397	-10.10646	4.009095
L2D.	-1.558225	2.689867	-0.58	0.562	-6.830268	3.713817
_cons	-.0946298	11.00913	-0.01	0.993	-21.67213	21.48287

Correlation coefficient measures the correlation between two variables. Correlation coefficient takes values between -1< r <1. Both the sign (positive 0< r <1 and negative -1< r < 0 correlations) and magnitude of correlation coefficient is important. Lagrange –multiplier test and Breuch-Godfrey LM tests were used to check the residual autocorrelation in the model (Table 4.9 and Table 4.10). Both tests result confirmed that there is no autocorrelation in the model which is desirable to accept the model.

Table 4.9 Langrage – Multiplier test for autocorrelation for study variables

lag	chi2	df	Prob > chi2
1	25.9035	25	0.41276
2	18.7800	25	0.80755

H0: no autocorrelation at lag order

Table 4.10 Breush-Godfrey LM test for autocorrelation for the study variables

lags(*p*)	F	df	Prob > F
1	1.156	(1, 19)	0.2957

H0: no serial correlation

4.2.6 Jarque-bera test

Jarque-bera test was employed to check normal distribution of disturbances. The result showed that majority of individual variables are insignificant that accept the null hypothesis which assured us the normal distribution of the residuals, however, the overall combinations of the variables found to be significant (P < 0.01) that rejects the null hypothesis which is not good (Table 4.11). When conflicting results have appeared this test give you a room to focus and decide based on the target variable. Our target variable is TQLME having a probability value of more than 5% which lead us to accept the null hypothesis confirming the residuals of this milk and milk products import model is normally distributed leading inevitably to accept the model.

Table 4.11 Jarque-bera test for normal distribution of restudies of the study variables

Equation	chi2	df	Prob > chi2
D_lnTQLME	1.083	2	0.58183
D_lnAPIM	0.752	2	0.68660
D_lnPOP	37.720	2	0.00000
D_lnTQWMF	1.049	2	0.59180
D_lnRGDPPC	1.372	2	0.50366
ALL	41.976	10	0.00001

The negative and significant coefficient (ce1 L1), majority of the variables (80%) in the VECM becoming significant, absence of serial correlation and the normal distribution of the residuals are the indications for the goodness of the model.

4.2.7 Granger causality test

After establishing the VAR model the Granger causality test was employed. Granger causality test was applied to determine the direction of dynamic relationships, the direction of association. The assumption in Granger causality test is variables are stationary, if not need it stationary before testing Granger causality test. The result indicated that, of the four independent variables two of them, APIM ($P< 0.01$) and POP ($P<0.05$), are influencing the dependent variable (TQLME) and the remaining two variables have no cause (Table 4.12), whereas the four independent variables have affecting the dependent variable jointly ($P<0.01$). The Granger causality test confirming unidirectional cause coming from the milk and milk product import to the local milk production ($P<0.05$) and jointly all variables also affect the local milk production ($P<0.01$). The Granger causality test concluded that the milk and milk products import highly affected milk producers though the magnitude is not known and beyond the scope of this research which needs further investigation. Dairy product consumers need comes from both the imported and locally produced milk and milk products. The granger causality test revealed that the market share of imported milk products are much higher than the locally produced ones and as a result local milk producer farmers lost the market for their produce which has negative impact on the income of the local milk producer farmers. The amount and value of dairy imports will continue to rise if improvements in domestic production and marketing of milk is not in place (Land O'Lakes, 2010).

Table 4.12 Granger causality Wald tests for study variables

Equation	Excluded	chi2	df	Prob > chi2
lnTQLME	lnAPIM	17.743	2	0.000
lnTQLME	lnPOP	8.4984	2	0.014
lnTQLME	lnTQWMF	5.6865	2	0.058
lnTQLME	lnRGDPPC	3.6152	2	0.164
lnTQLME	ALL	45.333	8	0.000
lnAPIM	lnTQLME	.52769	2	0.768
lnAPIM	lnPOP	33.407	2	0.000
lnAPIM	lnTQWMF	2.0604	2	0.357
lnAPIM	lnRGDPPC	6.489	2	0.039
lnAPIM	ALL	47.654	8	0.000
lnPOP	lnTQLME	1.5952	2	0.450
lnPOP	lnAPIM	3.0017	2	0.223
lnPOP	lnTQWMF	.06327	2	0.969
lnPOP	lnRGDPPC	.4981	2	0.780
lnPOP	ALL	9.2489	8	0.322
lnTQWMF	lnTQLME	10.95	2	0.004
lnTQWMF	lnAPIM	.71903	2	0.698
lnTQWMF	lnPOP	11.197	2	0.004
lnTQWMF	lnRGDPPC	.78209	2	0.676
lnTQWMF	ALL	45.859	8	0.000
lnRGDPPC	lnTQLME	.48228	2	0.786
lnRGDPPC	lnAPIM	.62617	2	0.731
lnRGDPPC	lnPOP	4.1379	2	0.126
lnRGDPPC	lnTQWMF	1.0128	2	0.603
lnRGDPPC	ALL	8.2984	8	0.405

CHAPTER FIVE
5 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Milk and milk product import increased 1993 through 1998 and after two years of decline it showed sharp increase at year 2000 and continue increasing after wards at the same time the value of milk and milk product import increased from its 6.3 million USD in 1993 to almost 8.7 million USD in 2003 and more than 9.5 million USD in 2015. The cumulative milk and milk products import data for the last 25 years showed that milk powder, butter and ice cream accounts 57, 25 and 7 percent share of the total milk and milk products import respectively. The import dependency of Ethiopia for milk and milk product found to be high which have a negative impact on the economy in general and on local dairy producer farmers in particular.

The Granger causality test concluded that the milk and milk products import negatively affected milk producer farmers though the magnitude is not known and beyond the scope of this research which needs further investigation. With a country having more than 80 percent smallholder farmers whose income comes from their livestock, milk and milk products import should not be a burden. The price elasticity of milk imports showed that for every percent increase in milk and milk products price, the quantity of milk and milk products imported decreased to 1.28 percent.

The significant effect of import price in reducing dairy products import coupled with the Granger causality test results obtained in this research where milk producer farmers are highly affected by milk and milk products import, policy makers should focus on import restrictions that discourages import but simultaneous solutions to improve milk productivity locally, otherwise the consequences will exacerbated the existing milk and milk products supply demand gap.

A number of publication relevant to dairy exports have been published and in the contrary dairy import was totally ignored. To formulate a strategy plan of a country especially Ethiopia, with huge number of livestock and untapped resources, knowing dairy imports have paramount importance in identifying dairy gaps that leads to device best solutions for the encountered problems.

5.2 Recommendations

Milk powder import accounted for 57 percent of the total milk and milk product import for the last 25 years (1993 – 2017) and focusing in reversing this issue would have great impact in preserving the prevailing hard currency problem in the country. Substituting imports via establishing adequate number of high processing capacity milk powder processing plants, since its amount outweighs the other milk products imported in Ethiopia, would be solution.

Dairy policy is the core area for milk and milk products movements in and out of the country. The researcher had keen interest to find out dairy policy in Ethiopia, however, there is no dairy policy in the country. Having paramount importance in devising dairy strategy of the country, dairy policy should be in place. Due attention should be given to highly mechanized dairy farms with emphasis on feed and genetic improvement considering the local production and consumption that can shoulder the ever rising human population growth.

Imported milk and milk products consumption conversion factor is not available in literatures so that this study obliged to consider 100% consumption even if some percent of the product can be wasted before reaching the consumer. The author recommend that investigating the imported milk and milk products consumption conversion factor should be one of future research area.

To use uniform measurement of milk and milk products with different forms (liquid and semisolid) liquid milk equivalent is the appropriate measurement. However, milk and milk products import data in the Ministry of Revenue archive registered indiscriminately which is not convenient for analysis. This unethical deed has to be corrected.

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7 LIST OF APPENDEXS

Appendix 1 Vector Error Correction Model analysis for study variables

```
. vec lnTQLME lnAPIM lnPOP lnTQWMF lnRGDPPC, trend(constant) rank(3) lags(3)

Vector error-correction model

Sample:  1996 - 2017                            Number of obs     =         22
                                                AIC               =  -15.09539
Log likelihood =  242.0492                      HQIC              =  -14.20751
Det(Sigma_ml)  =  1.91e-16                      SBIC              =  -11.32633

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
D_lnTQLME             14     .543221   0.8028   28.49567   0.0122
D_lnAPIM              14     .212152   0.7814   25.02593   0.0343
D_lnPOP               14      .00646   0.9793   330.7056   0.0000
D_lnTQWMF             14     .080337   0.9486    129.209   0.0000
D_lnRGDPPC            14     .181731   0.5009   7.024521   0.9338
------------------------------------------------------------------
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
D_lnTQLME						
_ce1						
L1.	-2.573922	.832775	-3.09	0.002	-4.206131	-.9417133
_ce2						
L1.	-2.562185	1.997983	-1.28	0.200	-6.47816	1.353791
_ce3						
L1.	9.116595	7.412525	1.23	0.219	-5.411687	23.64488
lnTQLME						
LD.	1.1491	.5757568	2.00	0.046	.0206375	2.277563
L2D.	.5433008	.4191708	1.30	0.195	-.2782588	1.36486
lnAPIM						
LD.	.7948492	1.370159	0.58	0.562	-1.890613	3.480311
L2D.	.4595236	.796072	0.58	0.564	-1.100749	2.019796
lnPOP						
LD.	-1327.498	1773.85	-0.75	0.454	-4804.179	2149.184
L2D.	992.2807	1404.804	0.71	0.480	-1761.085	3745.647
lnTQWMF						
LD.	-.524361	1.589048	-0.33	0.741	-3.638838	2.590116
L2D.	-1.089756	1.173549	-0.93	0.353	-3.389871	1.210358
lnRGDPPC						
LD.	-3.048684	3.600974	-0.85	0.397	-10.10646	4.009095
L2D.	-1.558225	2.689867	-0.58	0.562	-6.830268	3.713817
_cons	-.0946298	11.00913	-0.01	0.993	-21.67213	21.48287

Appendix 1 Vector Error Correction Model analysis for study variables …..*Continued*

D_lnAPIM						
_ce1						
L1.	.0115969	.3252359	0.04	0.972	-.6258538	.6490476
_ce2						
L1.	-1.100583	.780302	-1.41	0.158	-2.629947	.4287809
_ce3						
L1.	-3.222291	2.894923	-1.11	0.266	-8.896236	2.451654
lnTQLME						
LD.	.0299333	.2248588	0.13	0.894	-.4107819	.4706485
L2D.	.0106427	.163705	0.07	0.948	-.3102132	.3314985
lnAPIM						
LD.	.0885454	.5351085	0.17	0.869	-.960248	1.137339
L2D.	.0159313	.3109018	0.05	0.959	-.593425	.6252876
lnPOP						
LD.	960.0229	692.7678	1.39	0.166	-397.777	2317.823
L2D.	-958.4805	548.639	-1.75	0.081	-2033.793	116.8322
lnTQWMF						
LD.	-1.019854	.6205946	-1.64	0.100	-2.236197	.1964886
L2D.	-.4444047	.4583236	-0.97	0.332	-1.342702	.4538931
lnRGDPPC						
LD.	-.2817577	1.406342	-0.20	0.841	-3.038137	2.474621
L2D.	.5298533	1.050514	0.50	0.614	-1.529116	2.588822
_cons	.1223746	4.299558	0.03	0.977	-8.304604	8.549353
D_lnPOP						
_ce1						
L1.	.0050247	.0099027	0.51	0.612	-.0143842	.0244336
_ce2						
L1.	.0148135	.0237584	0.62	0.533	-.031752	.0613791
_ce3						
L1.	.0013171	.0881437	0.01	0.988	-.1714413	.1740755
lnTQLME						
LD.	.0008751	.0068464	0.13	0.898	-.0125436	.0142939
L2D.	.0013101	.0049844	0.26	0.793	-.0084592	.0110794
lnAPIM						
LD.	-.0083193	.0162928	-0.51	0.610	-.0402526	.023614
L2D.	-.0037147	.0094662	-0.39	0.695	-.0222682	.0148388
lnPOP						
LD.	11.08515	21.09316	0.53	0.599	-30.25669	52.427
L2D.	-5.631778	16.70478	-0.34	0.736	-38.37254	27.10899
lnTQWMF						
LD.	.0021969	.0188957	0.12	0.907	-.034838	.0392317
L2D.	-.0089515	.0139549	-0.64	0.521	-.0363026	.0183996
lnRGDPPC						
LD.	-.0211974	.0428198	-0.50	0.621	-.1051228	.0627279
L2D.	.0320052	.0319857	1.00	0.317	-.0306856	.094696
_cons	-.1256441	.1309115	-0.96	0.337	-.382226	.1309377

Appendix 1 Vector Error Correction Model analysis for study variables …..*Continued*

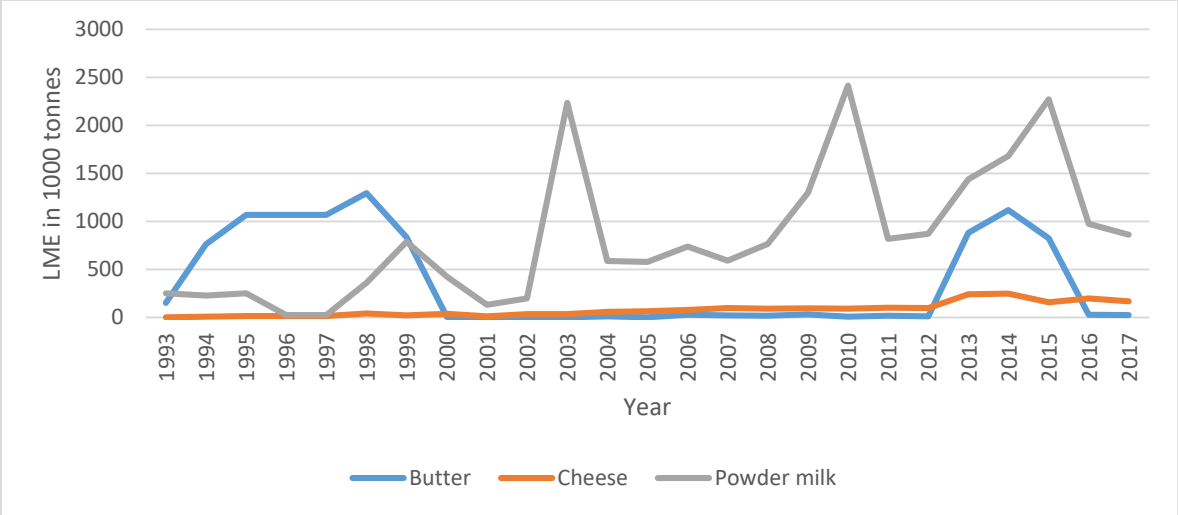
D_lnTQWMF						
_ce1						
L1.	-.55557	.1231589	-4.51	0.000	-.796957	-.314183
_ce2						
L1.	-.4041795	.2954813	-1.37	0.171	-.9833121	.1749532
_ce3						
L1.	7.87392	1.096237	7.18	0.000	5.725336	10.0225
lnTQLME						
LD.	.3525005	.0851485	4.14	0.000	.1856124	.5193885
L2D.	.2117289	.0619911	3.42	0.001	.0902287	.3332292
lnAPIM						
LD.	.3360295	.2026325	1.66	0.097	-.0611229	.7331819
L2D.	.4632187	.1177309	3.93	0.000	.2324704	.693967
lnPOP						
LD.	835.7321	262.3342	3.19	0.001	321.5665	1349.898
L2D.	-344.7524	207.7562	-1.66	0.097	-751.947	62.44222
lnTQWMF						
LD.	-.6497714	.235004	-2.76	0.006	-1.110371	-.1891721
L2D.	-.4140576	.1735559	-2.39	0.017	-.7542209	-.0738942
lnRGDPPC						
LD.	-2.190757	.5325471	-4.11	0.000	-3.23453	-1.146983
L2D.	1.454211	.3978038	3.66	0.000	.6745303	2.233893
_cons	.2972828	1.628137	0.18	0.855	-2.893808	3.488373
D_lnRGDPPC						
_ce1						
L1.	-.0796488	.2785998	-0.29	0.775	-.6256943	.4663967
_ce2						
L1.	.0143226	.6684131	0.02	0.983	-1.295743	1.324388
_ce3						
L1.	-1.089781	2.479815	-0.44	0.660	-5.950129	3.770567
lnTQLME						
LD.	-.032757	.1926159	-0.17	0.865	-.4102772	.3447633
L2D.	-.036211	.140231	-0.26	0.796	-.3110587	.2386368
lnAPIM						
LD.	.0343792	.4583783	0.08	0.940	-.8640258	.9327842
L2D.	.0381239	.266321	0.14	0.886	-.4838557	.5601035
lnPOP						
LD.	-647.7883	593.4306	-1.09	0.275	-1810.891	515.3142
L2D.	428.1221	469.9687	0.91	0.362	-492.9996	1349.244
lnTQWMF						
LD.	.1121057	.5316064	0.21	0.833	-.9298237	1.154035
L2D.	.4111398	.3926038	1.05	0.295	-.3583494	1.180629
lnRGDPPC						
LD.	1.33074	1.204684	1.10	0.269	-1.030397	3.691877
L2D.	-1.010545	.8998786	-1.12	0.261	-2.774275	.7531847
_cons	.994317	3.683037	0.27	0.787	-6.224302	8.212936

Appendix 2. Milk and milk products conversion factors into LME (Whole Milk Equivalent)

Commodity	**Commodity code**	**Conversion factor**
Fresh milk	FRM	1.0
Dry Milk (Skim or whole)	DRM (DSM or DWM)	7.6
Milk, Condensed and evaporated	MCE	2.0
Cheese and curd	CHC	4.4
Butter	BUT	6.6
Butter oil	BUO	8.0
Other (as part of food aid)	ODP	2.0

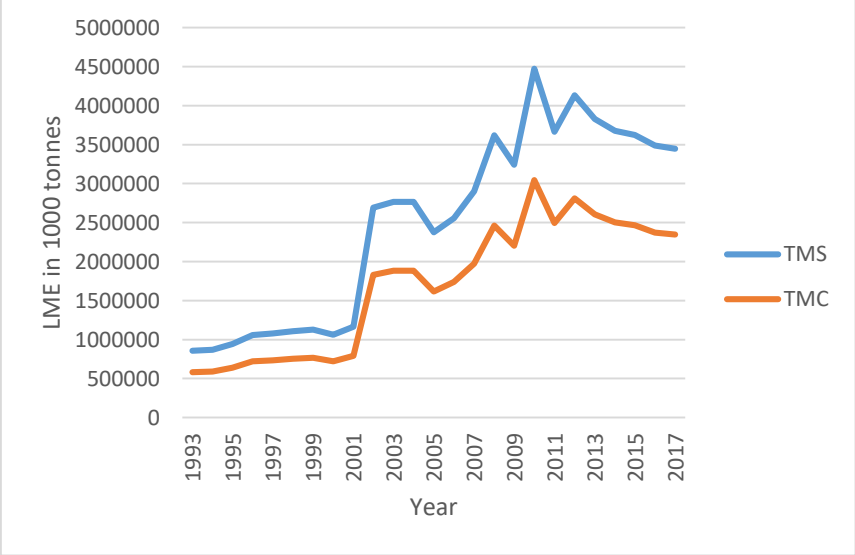
Source: FAO.1978. Milk and milk products: Supply, demand and trade projections 1985. ESC:PROJ/78/3. Rome as cited in ILCA (1984)

Appendix 3 Semi-solid milk and milk product import in Ethiopia



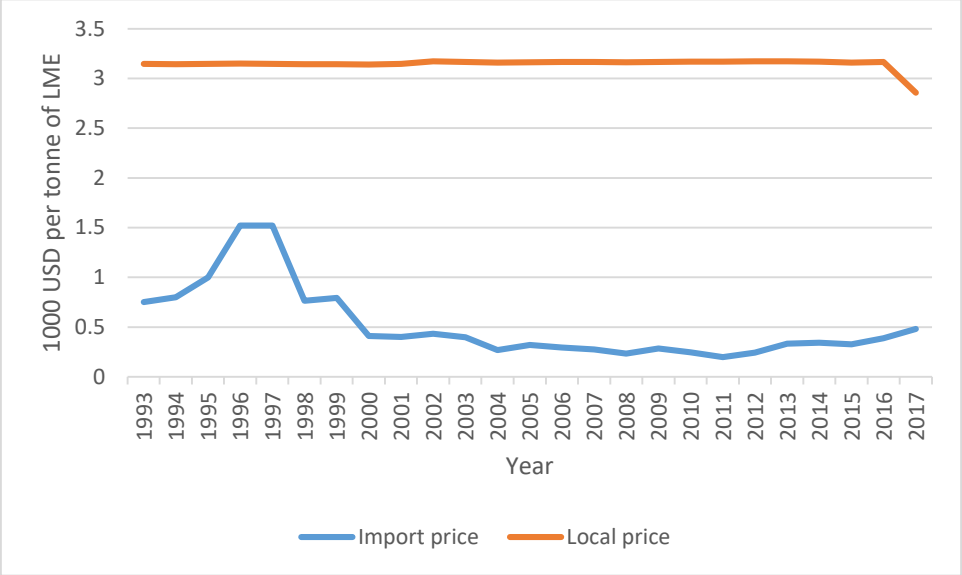
Sources: Author's Own calculation

Appendix 4 Milk Supply (TMS) and consumption (TMC) in Ethiopia



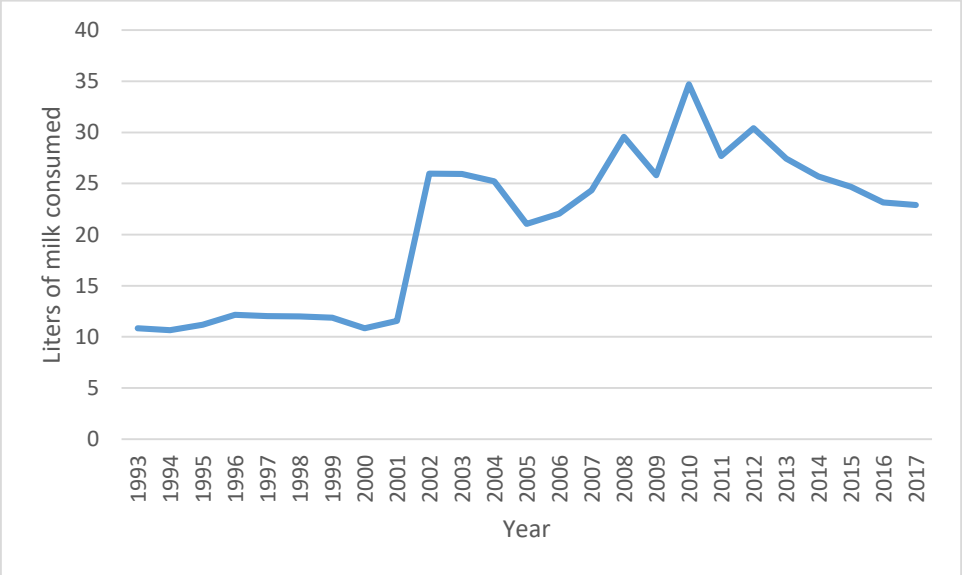
Sources: Author's Own calculation

Appendix 5 Milk prices of imported and locally produced milk in Ethiopia



Sources: Author's Own calculation

Appendix 6 Per Capita milk consumption per annum in Ethiopia



Sources: Author's Own calculation