INCOME AND PRICE EFFECT ON BILATERAL TRADE AND CONSUMPTION THROUGH EXPENDITURE CHANNEL: A CASE OF CHICKPEA

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ABSTRACT

Income and price affect chickpea trade expenditure and consumption expenditure share respectively. An empirical model was estimated to examine the trade effect through the expenditure channel using Almost Ideal Demand System and thus considering non-homotheticity in preferences. The results of the analysis indicated that global chickpea trade has increased from 100000 metric tons in 1988 to about 2.5 million metric tons in 2015. Between the same period consumption and production of chickpea had an increasing trend. USA and Canada had become part of the top 10 chickpea producers by 2015 signifying the increasing demand of chickpea in western countries. Factors that affected relative chickpea trade to importers income were relative market size of the exporter, bilateral distance and contiguous borders. Also, a percentage increase in the adjusted mean income of chickpea consuming country will lead to 94% decrease in the consumption of chickpea when country pair effects are considered.

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CHAPTER 1. INTRODUCTION

Background of the Study

Chickpea (*Cicer arietinum* L.), commonly known as garbanzo beans is an important nutritional grain legume. It is part of the diet of many people in the developing countries serving as the source of protein for many homes in such countries. A cup (0.00024 metric tons) of chickpea is known to provide approximately ten grams of protein. It is also a rich source of calcium, iron, phosphorus, and other minerals which form a significant part in the diet of vegetarians. (Latham, 1997; Yamani and Mehyar, 2011; Wallace *et al.*, 2016). It is also a good source of carbohydrates among other pulses. The consumption of chickpeas is increasing remarkably worldwide in recent years. In the last decade, it has gained popularity significantly in western countries due to its nutritional content with a versatile sensory application in food. Their rich, creamy and nutty flavor also has given them added advantage in the western world. Chickpeas has somewhat meaty texture and that's makes it a viable substitute for meat in many dishes.

Chickpea is mostly consumed as hummus in the US and other western countries. Hummus is a popular traditional food originating from the Middle East region made from cooked mashed chickpea mixed with oils and spices (Yamani and Mehyar, 2011). According to Wallace *et al.* (2016), the market of hummus since 2010 has increased by over 25% and over the past decade chickpea sales alone has increased from 2010 by about $530M as at 2013 in the U.S. This has been in part attributed to increased consumer recognition of pulses and their derived products or, in scientific terms, their high nutritional quality.

Globally, chickpea is the third most important pulse crop in production, next to dry beans and field peas. Legumes have multipurpose use and can be consumed either directly as food or in various processed forms. (Kumara Charyulu and Deb, 2014; Merga and Haji, 2019). Chickpea is thought to have originated from Levant and ancient Egypt, which is logical since the plant grows well in temperate and semi-arid regions (Davidson, 1999). In recent decades, the cultivation of the crop has shifted more to tropical areas where it is grown under cool temperatures in order to achieve the maximum yield. Among the leguminous crops cultivated in cool temperate zones, chickpea is believed to be the most drought resistant. It is able to produce reasonable yields under low input and marginal environmental conditions. Chickpea is grown in over two hundred countries across all the seven continents in the world. The share of chickpea in pulse production was about 17 percent and also occupies about 17 percent of the total area under pulse cultivation worldwide (FAOSTAT 2019). The global chickpea mean production area was about 12 million ha, with a production of 11 million metric tons and an average yield of 915 kg/ha in 2015.

The total chickpea production area is in developing countries and constitute about 95% of total world production area (Kumhar *et al.*, 2013). The South and West Asia regions account for about 90% of the total world chickpea production harvested. India is the largest and the world's leading producer of chickpea with an average production of over 9 million metric tons of chickpeas harvested in 2014, accounting for 67% of global chickpea production. The other major chickpea-producing countries include Pakistan, Turkey, Australia, Myanmar, Ethiopia, Iran, Mexico, Canada and the USA. According to FAOSTAT (2018), the producer price of chickpea has rose from 343$/ton in 2003 to 477$/ton in 2006 due to the demand.

Problem Statement

In developed countries where people have higher income, the demand for top quality products is high. That is, high-quality goods are associated with higher income elasticities (Brooks, 2006; Verhoogen, 2008; Fajgelbaumy, *et al.,* 2011). The literature on consumer expenditure has focused mainly on some combination of increased quality of the product, convenience, and variety of foods (Frazão *et al.*, 2008). For example, over the last two decades, consumption patterns in transition countries such as China, South Korea, India, and Thailand have been converging to the consumption level in countries with higher income levels. Growth in income is considered a primary force behind converging global consumption patterns (Meade and Rosen, 1997; Frazão *et al.*, 2008). There is also a well-developed theoretical and empirical trade literature showing globalization as contributing factors to this global converging pattern in consumption (Meade and Rosen, 1997; Frazão *et al.*, 2008; Ozturk and Cavusgil, 2019). Melitz (2003) provides first theoretical evidences that globalization leads to aggregate industry productivity growth. Melitz and Ottaviano (2008), Aghion *et al.*, (2009) and Chen *et al.* (2009), Trefler and Zhu (2010) find large scale empirical evidences verifying the theoretical findings in Meltiz (2003). The distributional impact of welfare from international trade because of the associated changes in production and relative price is uneven across countries.

International trade affects both producers and consumers, which is easy to understand. However, the empirical and theoretical trade studies have not focus on analyzing the consumption effect, in that, these studies assume representative consumer and homothetic preferences on the demand side. The canonical theoretical trade model based on firm-level heterogeneity proposed by Melitz (2003) is not an exception to this. A few notable exceptions include theoretical contribution by Matsuyama (2019) and an empirical study by Fajgelbaum and Khandelwal (2016), both of which explore non-homothetic preferences for demand led gains from open trade. Using non-homothetic preferences, Fajgelbaum and Khandelwal (2016), find large differences in how trade affects individual non-representative consumers along their income distribution. Their findings are based on the theoretical underpinnings that consumers with heterogeneous income and tastes purchase different quantities of a homogeneous good. Plus, that the poorer countries' expenditure is concentrated in tradable products and sectors with low price elasticity. However, given their data aggregation level whereby 5000 different HS-6 products are aggregated into 23 tradable and one non-tradable (service) sectors, their results can only be valid for a highly aggregated sector relative to other 22 aggregated sectors and one non-tradeable industry at best. At the worst, their results may hold relative to the only non-tradeable, service sector for lack of variability in the data. Additionally, the time variation in aggregated expenditure patterns might be more muted or aggravated depending upon the country's size and consumer preferences. For example, larger[1] countries may have higher consumption demand, import demand, and even exports.

In this respect, this thesis examines how individual non-representative consumer’s income affects national trade expenditure on a highly disaggregated product using Hs-6 digit data. In doing so, we consider the cross-country differences in income distribution and, in some specifications, estimate importer specific income elasticities. Non-homotheticity in modeling is introduced by using an almost ideal demand system (AIDS) rather than traditionally overused constant elasticity of substitution preferences in international trade literature.

On the production side, Sharma (2020) shows that producers adjust their quantity and price decision, and more importantly, their production technology based on consumers' revealed preferences conditional on income. Hallack (2010) finds that the quality of goods that countries produce and consume varies systematically with their income levels. Consistent with the study above, Hallak and Schott (2011) show that when a country exports variety of a given quality to two different markets of similar size, it exports a higher volume to the country whose income ranking is identical to its own. Bils and Klenow (2001) find that, quality demanded is strongly

[1] Larger countries here are understood as countries with a larger population or GDP.

correlated with household income. As described in Brooks (2006) and Verhoogen (2008), the positive association between the demand for quality and household income may suggest a positive relationship between per capita income and quality of consumption at the country level.

Therefore, in this research, we map bilateral trade data to production data and retrieve consumption data. This consumption data is then used to evaluate the relationship between price, income, and consumption expenditure while considering differences in income distribution across countries. With all these in mind, the research questions set to answer in this thesis are:

1. How does aggregate income affect product level share in trade expenditure?
2. How does price affect product level share in consumption?

This thesis research answers the above research questions using the case of bilateral chickpea trade and country-level consumption. The choice of the product is mainly driven by three factors:

1. Product that potentially shows country-time variation in production, consumption, and bilateral trade so there is sufficient variation in price and income share to explain variation in expenditure shares.
2. Availability of data.
3. Global popularity especially since the third wave of globalization so that trade and production data could be mapped to retrieve consumption data.

Global and particularly US consumption pattern has been changing rapidly for crops such as quinoa, teff, coconut, chickpea (USDA, 2013; Bond, 2017). Major databases such as Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), Eora global supply chain database of a multi-region input-output table (MRIO), International Monetary Fund (IMF) database, World bank data, United Nation Database, Organization for Economic Co-operation and

Development (OECD) database and United Nation commodity trade database (Comtrade) were explored. Data were fairly good for Chickpea, but not complete for these other crops.

Objective of the Study

The specific objectives of this research are:

1. To analyze the effect of income on trade expenditure share in Chickpea.
2. To examine the price effect on consumption expenditure share in Chickpea.

Significance of the Study

The study intends to ascertain the Income and price effect on chickpea trade and consumption respectively through the expenditure pattern. Analyzing the effect of income on trade expenditure share will help know how chickpea trade is affected by income of countries. Due to the diverse roles and benefits derived from chickpea this research will help understand significantly how the level of income of consumers' impacts on chickpea trade and eventually on nutritional security as the demand of chickpea has surge in recent years in western countries.

Estimating the extent and direction of the chickpea price effect on consumption expenditure share will help determine as to whether chickpea price is complementing or hindering the consumption of chickpea. Since chickpea consumption is related to healthy consumption, this study will provide substantial information on expected consumption pattern which will guide health authorities and decision makers on their decision making. Again, this study will help increase the awareness of chickpea trade, consumption and underscore the benefit it brings to consumers. The study will also give a sense of direction for other researchers who want to conduct further research on chickpea by adding to existing literature.

Again, this study will help increase the awareness of chickpea trade, consumption, prices and underscore the relationship between them. The study will also give a sense of direction for other researchers who want to conduct further research on chickpea by adding to existing literature.

Organization of the Study

This research is organized into five chapters. Chapter one provides background information on the study. Chapter Two reviews the relevant literature on history, importance, and global Chickpea production and trade. Chapter three discusses the theoretical model pertinent to the research question and empirical estimation technique employed for data analysis. This chapter also includes a description of the data and data sources. The results and discussions of the thesis research are presented in Chapter Four. Chapter five presents the summary and conclusions derived from the study.

CHAPTER 2. LITERATURE REVIEW

This chapter provides the overview of global chickpea production and trade. It also presents both the Empirical literature on the link between trade and consumption.

Overview of Chickpea Production and Trade

Chickpea is an edible dry seeds pulses plant belonging to the Leguminosae family. There are two main varieties of chickpeas: Kabuli and Desi type. The desi chickpea is dark seeded chickpea mostly smaller, reddish brown-colored with a thick seed coat while the kabusi is a larger cream-colored seed with a thin seed coat (Agbola *et al.* 2002). According to Knights *et al.*, 2007; Reddy *et al.*, 2007), the world production of chickpea is dominated by the desi variety consisting of about 75% and 25% of the kabuli types. The desi chickpea type can withstand cooler temperatures and matures quicker than kabuli chickpea.

Chickpea production is a less laborious work and demands low external inputs compared to cereals in their production process. Many researchers have attributed the recent attention on chickpea to many factors. This includes chickpea genetic diversity, the agronomic practices, chemical and nutritional composition and industrial processing, including the influence of cooking methods on the nutritional quality and development of attractive, convenient ready-to-eat food formulations (Vaz Patto *et al.*, 2015; Dida Bulbula and Urga, 2018; Summo *et al.*, 2019). Canada and Turkey produce about 50% of kabuli type of chickpea and majority of the produce is exported.

Chickpea is grown in all the seven continents of the world with over 59 countries producing it on the large scale under varied environmental and climatic conditions. About 95% of the total chickpea area is in developing countries. The Indian subcontinent is the leading chickpea producer in the world with the South and South East Asia dominating in chickpea production with about 80% of regional contribution. But the performance of the sub-continent in terms of productivity is found to be very poor with an average yield below 1 metric ton per ha. Yield level has increased from 717 kg/ha in 1994-96 in South and South East Asia to 811 kg/ha in 2008-10 which is a 13% increment, growing at an annual rate of 0.85% (http://www.cgiar.org/). Although chickpea production in developed countries do not contribute much towards total world output, yield is particularly high some Eastern European countries.

India is the major producer as well as consumer of pulses in the world and by far the largest chickpea growing country in the world in terms of area and quantity. India and Pakistan together contribute over 75% of total world chickpea area under production. Other major producing countries of chickpeas includes Australia, Myanmar, Ethiopia, Turkey, Pakistan, Russia, Iran, Mexico, USA, and Canada. The South East Asia regions have seen a substantial increase in area harvested under chickpea in the last 14 years by about 67% with developed countries increasing by 48% for the same period. Over the same period the Sub Saharan Africa also increased area harvested under chickpea by 18% and marginally less than 1% in South Asia. The Caribbean, Middle-East and North Africa regions experienced a declining area and production of chickpea for the same 14 years period. According to Merga and Haji (2019) world chickpea yields have increased by 10% from 1994-96 to 2006-08 crop seasons. But the yields in South Asia, the lead producing region of chickpea increased by 5% in the same period. In Middle-East and North Africa, the next important chickpea producing region, yields declined by 2%. The North American Countries such Mexico, USA, and Canada have attained better productivity ranging 1.5 -1.7 ton per ha as compared to other major chickpea producer countries in the world. India produces 9.075 million tons chickpea representing 65% of total chickpea production in the world as at 2017. Australia follows as the second leading country with about 14% share over the world.

Consumption of chickpea is expected to grow most rapidly in Asia and Africa which produce about 78% of world chickpea production. Chickpea is ranked third among the pulse crops consumed and accounts for about 11.7 million tons annually. Production and consumption of chickpea is very high in South and South East Asia with highly fluctuating per capita availability which has slightly fallen over the years. This is because of high growth in population of India where the production is not able to meet the demand for chickpea although production has increased by about 1.3% per annum between 1980 and 2010. From 1980 and 2009, demand for chickpea fluctuated with an average increase of about 0.91% per annum in the Middle East and North Africa. The average Middle East and North Africa consumption of chickpea is around 2.3 kg/person/year between 1980 and 2009 which is the second highest after South and South East Asia. Consumption levels are low in the developed countries, Latin America and sub-Saharan Africa with average consumption ranging between 0.21 kg/person/year to 0.33 kg/person/year although total production and consumption has increase over time. However, both Latin American and developed regions show high variability in consumption of over 50% between 1980 and 2009. In general, the overall positive growth rates for the developing world and chickpea explains some of the challenges faced at the country level in chickpea production. In some major chickpea producing and consuming countries, the production growth rate is not at the same pace with the growth in demand for chickpea and this is mostly as a result of the population growth. This has led to increasing imports of chickpea crops by some of the large pulse consuming countries such as India, Brazil and Turkey.

When domestic production of chickpea in a country is not able to meet the demand for consumption for specific types of pulses, countries have to often look for surplus production elsewhere, which may be limited for a preferred type of chickpea. This leads to instability in the domestic markets and affects the domestic prices. The challenges faced by many countries to increase chickpea production are inter-linked with the trends and patterns in price, trade and consumption of chickpea domestically and around the world.

Trade in chickpea globally has continuously and constantly climbed up since 1980s mostly among the developed countries. Until the early 1980s, chickpea exports were controlled by a few developing countries. Countries such as Turkey, Syria and Mexico together accounted for 95% of the global exports of chickpea. Gradually, countries such as Australia and Canada began to produce chickpea primarily for exports to the Indian subcontinent where consumption is high. The share of developing countries in global chickpea exports declined from 99% in the early years of the 1980s.

Chickpea exports by the developed countries has increased by about 173% from 182,000 tons in 1994-96 to nearly 0.5 million tons in 2007-09 (FAOSTAT, 2010) and over 60% of the chickpea produced in these countries are traded. In contrast, South and South East Asia also had increased chickpea export by several folds from just 3500 tons to about 200 thousand tons between period of 1994-96 and 2007-09 but the percentage traded as against production is just 2.5% between 2008 and 2010 (Wallace *et al.*, 2016; Merga and Haji, 2019). Between 1994 and 2009, Middle East and North Africa has also witnessed a drop-in production, rise in import of chickpea and fall in export. In Latin America and Caribbean, between the same period exports increased by 28with over 80% of its production been exported. Although chickpea trade internationally is negligible compared to other agricultural commodities, the volume of trade has increased considerably over the period.

According to Kassie *et al.* (2009), though, there is positive export and import growth rate of about 9.4% and 15.4% respectively from 1994 to 2005, the marketed volume share is only about

9% of the total average production. Again, within the chickpea producing countries, over 92% of the chickpeas are consumed domestically. The study also found out that the international trade variability of chickpea is high compared to production variability. The coefficient of variation of export and import was 28% and 35%, respectively during 1994 and 2006. Turkey, Australia, Mexico, Iran and Canada were the major within the period. Australia, Turkey and Mexico were the top three exporting countries and accounted for 53% of all exports between 1994 and 2006. India, Pakistan, Spain, Bangladesh, Algeria, United Arab Emirates, and Italy remains the major chickpea importing countries respectively. Distinct from exports, imports are not focused on a few countries but rather distributed widely, with the top seven importing countries accounting for 64.3% of total world imports. India, Pakistan and Bangladesh are the major importing countries of the desi type chickpea, whereas the kabuli type are mainly imported by the Middle East, Northern Africa and developed countries (Agricultural and Agri-food Canada, 2004).

Empirical Studies of Consumption and Trade

Growth in trade as a result of globalization has led to many researches to analyze factors that contribute to the surge in international trade and its effects on consumers in those countries. Empirical evidence on trade liberalization’s effects on an industry’s productivity and resource reallocation can be found in aggregate as well as in firm-level studies. In 1961, Linder proposed hypothesis that was concerned with two central problems of trade theory which are the theory of the gains from trade, and the theory of trade structure. The hypothesis was that countries with similar per capita income have similar demand structures for a particular good. Thus, these countries will consume similar quality products as a result of similar income level and that, this should lead to them trading with each other. The hypothesis further suggested that countries will specialize in the production of certain high-quality goods and will trade these goods with countries that demand these goods.

The Linder hypothesis has attracted substantial empirical research and reviews over the years. However, Hallak (2010) reviewed the product-quality view of the Linder hypothesis and concluded that the evidence has failed to provide consistent support for the hypothesis. The study explained the failure by building a theoretical framework to ascertain the applicability of the hypothesis. The study argued that, in Linder's theory the fundamental role played by product quality is significant such that the hypothesis is formally derived but only applicable when formulated as a sector-level prediction. The study tested the hypothesis using a sample of 64 countries in 1995 and it was realized that the estimate supported the sectoral Linder hypothesis. Thus, when the effect of intersectoral determinants of trade is controlled, countries of similar per capita income intensely trade more with each other. But empirical results from the study did not support the Linder hypothesis as a prediction for aggregate trade level.

Melitz (2003) developed a dynamic model to analyze how international trade affects the intra-industry firm's productivity. The impact of trade and trade liberalization was therefore analyzed using the equilibrium model developed. The model explains why growth opportunities of some firms are improved due to trade but simultaneously trimming the opportunities of other firms in the same industry. Thus, the model is able to show how the introduction to trade induces the more productive firms to go in to the export market and will at the same time force the least productive firms to exit the industry. Additionally, the industry's exposure to trade lead to inter-firm reallocation towards firms that are more productive. Furthermore, firms with high productivity took advantage of the liberalization to export more. The paper also showed how the aggregate industry productivity growth generated by the reallocations due to trade contributes to a welfare gain pointing to benefits from trade that had not been observed through the earlier trade theories. Another observation was that, among firms in an industry, export cost had a significant effect on the firms differently. This leads to different levels of the gains from trade among the firms in the industry but the aggregate effect of trade on the industry leads to increase in productivity gains in the industry. The study concluded that, since countries have different levels of efficiency, firms that are more efficient gain from trade as a result of increased share and profit in the industry while less efficient firms lose and exit the market eventually. These firms are coexisting in an industry with different productivity levels because they face different initial uncertainties concerning their productivities before making an irreversible investment to enter the industry. Also, each firm's decision to export occurs after it gains knowledge of its productivity and how profitable it is to enter into trade.

According to a study by Dingel (2017) on the determinants of quality specialization, it stated 2 hypotheses based on literature that suggests that high-income countries export high-quality goods. This has some consistency with Linder hypothesis. These two hypotheses could explain such specialization by the high-income countries, and the different implications of the specialization on welfare, inequality and trade policy of the countries. Firstly, The Linder hypothesis was formalized by Fajgelbaum *et al.,* (2011) and it states that home domestic demand determines the pattern of specialization and therefore predicted that high-income locations export high quality products. Again, the factor proportions model (The Heckscher-Ohlin) also predicts high income locations export skill intensive, skill abundant and high-quality products. These hypothesis and empirical evidence could not separate these explanations as different hypothesis. This study using data from United States manufacturing plants' shipments and factor inputs micro data developed a model that built both hypotheses. It was found out that home market demand explains as much of the relationship between income and quality as differences in factor usage.

Aguiar and Bils (2015) study attempted to find out the extent to which the increase in income inequality since 1980 was emulated by consumption inequality. The sturdy constructed an alternative measure of consumption expenditure by employing the demand system. The aim of the demand system is to correct for systematic measurement error in the Consumer Expenditure Survey and achieved by summing household expenditures. The study based this measure of consumption inequality on how richer versus poorer households allocate spending across luxury and necessities over time. Using the Engel curve approach the systematic measurement error was corrected and that allowed for the detailed expenditure reports on different classes of goods. The required assumptions for the model employed is that the demand system should correctly be specified and the expenditure elasticities to be stable across period. This allowed biases to differ across good and income class over the years, as well as allowing for classical mis-measurement at the level of good, household and year interactions. This multi differencing approach corrects for measurement error that can vary over time by both good and income. It was found that, consumption inequality unlike estimated direct responses on expenditures, trailed income inequality much more closely.

Hallak and Schott (2011) estimated cross-country differences in product quality. The study developed a method where observed export prices of countries' are decomposed into quality against quality-adjusted components. This allows increases in all consumers' valuation using any tangible or intangible attribute of a good. The method was intended for obtaining such estimates that incorporates information about world demand for countries. Countries with trade surpluses are expected to produce goods of higher quality than countries running trade deficits when export prices are held constant. The study counted for variation in trade balances induced by horizontal and vertical differentiation, and the evolution of manufacturing quality for top exporters between 1989 and 2003. It was concluded that the observed unit value ratios can be a poor approximation for relative quality differences. Also, it was observed that countries' quality is converging more rapidly than their income level and countries appear to vary in terms of displaying high-quality versus low-price growth strategies.

Caron *et al.* (2014) investigated the empirical relationship between certain characteristics of goods in production with other characteristics of preferences and demand. The study hypothesized an empirical relationship between factor intensities of goods in production and their corresponding income elasticities of demand. The benchmark model was used to set up a model for trade in equilibrium; the demand, production and endowment. In addition, the model was used to test for positive correlation between income elasticity and factor intensity. Secondary data from GTAP 7 version containing consistent and reconciled production, consumption, endowment, trade data, and input-output tables for 57 sectors of the economy, 5 production factors, and 94 countries in 2004 were used for the empirical analysis. The study estimated the importance of per capita income in determining demand patterns. The results of the study showed that the income elasticity of demand varies considerably across goods from different industries and moreover significantly related both in economic and statistical terms to the skill intensity of a sector This correlation between skill intensity and income elasticity implied the factor content of consumption varies systematically with income and since rich countries are relatively skilled-labor abundant, they are relatively specialized in consuming the same goods and services that they are specialized in producing, and so trade more with one another than with poor countries. The consumption patterns are determined partly by the goods that the country have comparative advantage. Again, when the implications of this correlation for empirical trade puzzles were explored, the study found that it can reduce Heckscher-Ohlin-Vanek models overprediction of the variance of the net factor content of trade relative to that in the data by about 60%. There was also a positive sector-level correlation between income elasticity and a sector's tradability, which helps explain the higher trade-to-gross domestic product (GDP ratios in high-income relative to low-income countries. The study concluded that high-income countries had comparative advantage since they have abundance of skilled workers who end up consuming the goods and services produced in the country. This leads to increase in consumption, which consequently stimulates TFP growth. In addition, this further explained the hypothesis why the trade between high-income countries are relatively higher that low-income countries and also why technological changes in these countries are influenced by non-homothetic preferences.

Ying *et al.* (2014) examined how economic growth of the Association of Southeast Asian Nations (ASEAN) was affected by short-run and long run equilibrium relationships of globalization between 1970 and 2008. The study focused on the effects of economic, social and political globalization on the economic growth of these member states. Konjunktur-forschungsstelle (KOF) index of globalization was developed using Panel data from the ASEAN countries. Elasticities of growth resulting with respect to economic, political and social globalization were determined using panel fully-modified Ordinary Least Square (FMOLS). The elasticities of growth with respect to economic and social globalization were found to be 1.48 and -0.874 respectively. This indicated that economic globalization leads to an increase in economic growth whiles social globalization negatively influenced economic growth in the period. The study concluded that economic globalization is more effective and therefore governments should put more effort to promote international trade and foreign direct investment.

Fajgelbaumy *et al.* (2011) developed a framework for studying income distribution, product quality, and international trade among countries. The proposed framework was aimed at studying differentiated products which are traded horizontally and vertically. This was done using non-homothetic preferences over goods of different quality using the observed consumption patterns which ensures trade patterns depends on the distribution of income among trading partners. They found out that consumers will purchase and consume a homogeneous good and make a discrete choice of quality and variety of a differentiated product if they have heterogeneous incomes and tastes for the goods. As the preferences and taste among consumers are distributed, it generates a nested-logit demand structure that ensures that as income increases the fraction of consumers who buy a higher-quality product also increases. The model features a domestic-market effect that helps to explain why richer countries export higher-quality goods. Thus, when a country exports variety of a given quality to two different markets of similar size, it exports more to the country whose income status is more similar to its own. The model offers a yielding tool that allows one to study of trade policy for different income groups and welfare consequences of trade in an economy.

Ruann and Gopinath (2008) investigated the effects of trade liberalization on the global productivity distribution in processed food industries. The resulting intra-industry reallocation of market shares and resources across countries were examined. The study tested the hypothesis that an industry's average productivity of processed food industries increases with liberalized trade. The study applied firm-heterogeneity model of Melitz (2003) and Helpman *et al.* (2004) to investigate the mean shifts in the global productivity distribution and the intra-industry consequences of trade reform using processed food industries. The study tested for the effect of liberalized trade on shifts in alternative percentiles/quantiles of the global productivity distribution.

This allowed the study to explore reallocation of resources among countries with varying levels and growth rates of productivity in a given industry. Data was assembled from five processed food industries in 34 developed and developing nations for the estimate, through a value-added equation, cross-country and cross-industry productivity levels. The estimates derived from the data indicated significant cross-country variation in productivity levels, with the US as the productivity leader in each of the five food industries used for the estimation. For each industry, a non-parametric kernel density estimator was used to estimate the approximate global productivity distribution in each year. The effects of trade liberalization on alternative quantiles of the global productivity distribution were then quantified. More specifically, the mean and percentile values were used to represent the shifts of the global productivity distribution. Using alternative econometric specifications, it was found that the estimates of trade-liberalization effects on such measures of global productivity distribution was robust. The results suggested that trade liberalization significantly boosts an industry's average productivity and again shifts to the right of the percentile values of the global productivity distribution. Thus, countries with faster productivity growth than the global average benefit from trade liberalization by acquiring a larger share of global markets and resources. While countries with slower productivity growth, irrespective of their comparative advantage would have to make significant adjustments to employment and income due to trade liberalization. This indicated increased shares of global value-added, output, and labor, implying total factor productivity growth relative to the global average was a key determinant of intra-industry reallocation of market shares and resources of the industry players. From the results obtained in the study, it was suggested that a liberalized trade can improve industry average productivity thereby improving the welfare and income of an economy. The intra-industry reallocation of market shares and resources is dependent on country productivity growth.

Fieler (2011) analyzed the relationship between non-homotheticity and bilateral trade using empirical evidence from a quantitative data. The argument from the study was that gravity models predict that trade flows increase with total income of importer and exporter. But what it does not recognize is how income is divided into income per capita and population among the importing and exporting country. However, Bilateral trade data analyzed for the study showed that income per capita is strongly correlated with trade and grows as income per capita increases. The study also found that trade largely was unresponsive to population. Developing a Ricardian trade model of trade, the model developed allowed divergence population to diverge and the elasticity of trade with respect to income per capita. In the study, goods were subdivided into types, which differ in the income elasticity of demand and the extent of heterogeneity in production technologies. The restricted model's predictions regarding variations in trade due to size and income is improved as a result. The study concluded that trade among rich countries occurs primarily in highly differentiated goods, while trade of rich with poor countries occurs across sectors experiment with counterfactuals. Middle-income countries becomes worse off but poor and rich countries become better off when there is a positive technology shock in China.

Fajgelbaum and Khandelwal (2016) developed a trade model in measuring the unequal gains from trade. It is well known that individual consumers are affected differentially by relative price changes as a result of trade when these consumers consume different baskets of goods. Thus, consumers at different income levels within an economy dedicate different shares of their expenditure on goods that are imported. The distributional implications of trade were therefore analyzed by incorporating a non-homothetic demand structure with good-specific Engel curves.

This allowed variations in the elasticity of the expenditure share with respect to individuals' total expenditures across goods. This was able to allow Fajgelbaum and Khandelwal (2016) to measure the unequal gains from trade across consumers within countries. Thus, it ensured a considerable variation in the gains from trade of poor relative to rich consumers depending on each country's degree of specialization in high income-elastic goods. Data on aggregate expenditures and parameters estimated from the non-homothetic gravity equation was required for the analysis. It was found that the poor consumers relative to rich consumers gained from trade, since the poor concentrate their spending in more traded sectors. This also depended on each country's degree of specialization in high income elastic goods. The study concluded that trade typically favor the poor when sectoral heterogeneity is introduced in trade model.

CHAPTER 3. METHODOLOGY

This section describes the theoretical framework, data collection approach, method of analysis adopted in addressing the study objectives.

Theoretical Framework

This study employs the Almost-Ideal Demand System (AIDS) results imbedded in the gravity trade model as used by Fajgelbaum and Khandelwal (2016). Fajgelbaum and Khandelwal (2016) and Deaton and Muellbauer (1980) both explained the importance of using the AIDS. AIDS is used since it allows changes in welfare through the expenditure channel experienced by consumers at each expenditure level as a result of changes in prices and can be recovered from demand parameters and aggregate statistics. The AIDS model gives an arbitrary first-order approximation to any demand system and has many desirable qualities. Its first-order approximation qualities to any demand system is important for the purpose of this study. It is flexible enough to satisfy the key requirement of good-specific income elasticities and has convenient aggregation properties that allow to accommodate within country inequality. According to Fajgelbaum and Khandelwal (2016), this model allows the endowment of the single factor of production to vary across consumers, generating within-country inequality. Secondly, consumer preferences are given by the AIDS and allows goods from each sector and country of origin to enter the model with different income elasticity into the demand of individual consumers. Aggregate trade patterns as a result are driven therefore both by standard Ricardian forces since there is differences in productivities and trade costs across countries and sectors. Also, by demand forces where there are cross-country differences in income distribution and differences in the income elasticity of exports by sector and country.

Allowing for differences in income elasticities across goods in an international trade framework isn't new but few studies has analyzed the effect of trade on inequalities through the expenditure channel. This framework also allows the quantification and measure of welfare changes from trade using aggregate statistics instead of distributional changes. The approach is based on aggregate statistics and model parameters that can be estimated from readily available bilateral chickpea trade, chickpea production and consumption data which can therefore be implemented across many countries and over time. Using the properties of demand from the standard demand theory, the distribution of welfare changes in response to price changes across consumers that vary in their total expenditures is established.

Studying an economy of J goods for final consumption with price vector $\mathrm{p} = \{p_j\}_{j=1}^{J}$ given by $h = 1, \dots, H$ consumers or index household. Consumer h has indirect utility v_h and total expenditures x_h. The indirect utility function is denoted by $v(x_h, \mathrm{p})$. We let $s_{j,h} \equiv s_j(x_h, \mathrm{p})$ be the share of good j in the total expenditures of individual h, and S_j be the share of good j in aggregate expenditures. The change in log to the infinity of the indirect utility of consumer h to the log of prices and expenditure level is given by:

$$\hat{v}_h = \sum_{j=1}^{J} \frac{\partial \mathrm{In} v(x_h, \mathrm{p})}{\partial \mathrm{In} p_j} \hat{p}_j + \frac{\partial \mathrm{In} v(x_h, \mathrm{p})}{\partial \mathrm{In} x_h} \hat{x}_h \qquad (1)$$

The equivalent variation of consumer h associated with the price and expenditure changes $\left\{\{p_j\}_{j=1}^{J}, \hat{x}_h\right\}$ is defined as the change in individual log expenditure, $\widehat{w}_h$, which at a constant price leads to the indirect utility change $\hat{v}_h$ given as

$$\hat{v}_h = \sum_{j=1}^{J} \frac{\partial \text{In} v(x_h, \text{p})}{\partial \text{In} x_h} \hat{w}_h \tag{2}$$

when Roy's identity applied after adding equations (1) and (2) leads to formula for the equivalent variation:

$$\hat{w}_h = \sum_{j=1}^{I} \left(-\hat{p}_j\right) s_{j,h} + \hat{x}_h \tag{3}$$

The expenditure-share weighted average of price changes is captured on the first term on the right-hand side of equation (3) and this referred to as the expenditure effect. This represents the increase in the cost of living as a result of a change in prices applied to the pre-shock expenditure basket. $\hat{w}_h$, is therefore referred to as the welfare change of individual h, acknowledging that by this it means the equivalent variation, expressed as share of the initial level of expenditures, associated with a change in prices. When equation (3) is organized, it becomes suitable when rewritten as follows:

$$\hat{w}_h = \hat{W} + \hat{\psi}_h + \hat{x}_h, \tag{4}$$

Where

$$\hat{W} \equiv \sum_{j=1}^{J} \left(-\hat{p}_j\right) S_{j,} \tag{5}$$

becomes the aggregate expenditure effect, and

$$\hat{\psi}_h \equiv \sum_{j=1}^{I} \left(-\hat{p}_j\right) (s_{j,h} - S_j) \tag{6}$$

becomes the individual expenditure effect of consumer h

The term $\hat{W}$ is therefore the welfare change through the expenditure channel in the absence of within country inequality that corresponds to all consumers featuring the same distribution of expenditures. It also corresponds to the welfare change through the cost of expenditures for a hypothetical representative consumer. The individual welfare changes, $\hat{\psi}_h$ in turn captures that consumers may be affected differentially by the same price changes due to differences in the composition of their expenditure basket. It will not be zero for some consumers if only there is variation across consumers in how they allocate expenditure shares across the goods. This study therefore focuses on how international trade impacts the welfare distribution $\{\hat{\psi}_h\}_{h=1}^{H}$ in equation (6).

Almost-Ideal Demand System

The Almost-Ideal Demand System (AIDS) is a demand system introduced by Deaton and Muellbauer (1980) and it's an extension of model proposed by Working (1943) and Leser (1963). It has been widely used due to its ability to unify almost all theoretically and empirically desirable properties as well as possessing functional forms that is consistent with household and trade data. The most desirable properties of the AIDS are its arbitrary first order approximation, satisfying the axiom of choice, it aggregates exactly over consumers while still allowing non-linear Engel curves, the homogeneity and symmetry property can be tested and imposed by simple parameter restrictions and the demand equations become linear if the translog price index is approximated (Muellbauer, 1975). According to Deaton and Muellbauer (1980), it is defined by the indirect utility function

$$v(x_h;\ \mathrm{p}) = F\left[\left(\frac{x_h}{a(\mathrm{p})}\right)^{1/b(\mathrm{p})}\right], \qquad (7)$$

where $a(\mathrm{p})$ and $b(\mathrm{p})$ are price aggregators and $F[\cdot]$ is a well-behaved increasing function. The first price aggregator, $a(\mathrm{p})$, is independent from non-homotheticities and interpreted as the cost of a subsistence basket of goods. It also has the form of a homothetic translog price index. The second price aggregator, $b(\mathrm{p})$, captures the relative price of high-income elastic goods. Again the larger the consumer's expenditure level x_h relative to the first price aggregator $a(\mathrm{p})$, the larger is the welfare gain from a reduction in the cost of high-income elastic goods, as captured by a reduction in $b(\mathrm{p})$. a and b are referred to as the homothetic and non-homothetic components of preferences respectively.

The AIDS is the special case that satisfies

$$a(\mathrm{p}) = \exp\left(\underline{\alpha} + \sum_{j=1}^{J} \alpha_j \ln p_j + \frac{1}{2} \sum_{j=1}^{J} \sum_{k=1}^{J} \gamma_{jk} \ln p_j \ln p_k \right), \tag{8}$$

$$b(\mathrm{p}) = \exp\left(\sum_{j=1}^{J} \beta_j \ln p_j \right), \tag{9}$$

where the parameters satisfy the restrictions $\sum_{j=1}^{J} \alpha_j = 1$, $\sum_{j=1}^{J} \beta_j = \sum_{j=1}^{J} \gamma_{jk} = 0$, and $\gamma_{jk} = \gamma_{kj}$ for all j, k.

When the Shephard's lemma approach to the indirect utility function defined by equations (7) to (9) generates an expenditure share in good j for individual h equal to:

$$s_j(\mathrm{p}, x_h) = \alpha_j + \sum_{k=1}^{J} \gamma_{jk} \ln p_k + \beta_j \ln\left(\frac{x_h}{a(\mathrm{p})} \right) \tag{10}$$

For $j = 1, \ldots, J$. Expenditure shares are restricted to be non-negative for all goods. Equation 10 is assumed to predict nonnegative expenditure shares for all goods and consumers, so that the non-negativity restriction is not binding. Since expenditure shares add up to one, this guarantees that expenditure shares are also smaller than 1. These expenditure shares have two features that suit this purpose. First, the elasticity with respect to the expenditure level is allowed to be good-specific. Goods for which $\beta_j > 0$ have positive income elasticity, while goods for which $\beta_j < 0$ have negative income elasticity. Again, the expenditure shares are able to admit aggregation, in the sense that market level behavior is represented by the behavior of a single consumer. The aggregate market share of good j is

$$S_j = s_j(\mathrm{p}, \tilde{x}), \tag{11}$$

where $\tilde{x}$ is an inequality-adjusted mean of the distribution of expenditures across consumers expressed as;

$$\tilde{x} = \overline{x}e^{\Sigma},$$

where $\overline{x} \equiv \mathrm{E}\left[x_h\right]$ is the mean and $\Sigma \equiv \mathrm{E}\left[\frac{xh}{\overline{x}} ln\left(\frac{xh}{\overline{x}}\right)\right]$ is the Theil index of the expenditure distribution, $\tilde{x}$ is identified as the expenditure level of the representative consumer and this makes the distribution of budget shares for the aggregate economy the same as the distribution of budget shares for an individual with expenditure level $\tilde{x}$. The aggregate expenditure shares in equation 11 is expressed as

$$S_j = \alpha_j + \sum_{k=1}^{J} \gamma_{jk} \ln p_k + \beta_j y, \tag{12}$$

The term $y = \ln\left(\frac{x_h}{a(\mathrm{p})}\right)$ and denotes the ratio between the adjusted mean of the expenditure distribution and the homothetic price index. y is referred to as adjusted “real" income as proposed by Deaton and Muellbauer (1980a).

The Individual Expenditure Effect with Almost-Ideal Demand

From equation 10 and 12, the difference in the budget shares of good j between a consumer with expenditure level x_h and the representative consumer is given by

$$s_{j,h} - S_j = \beta_j \ln\left(\frac{x_h}{\tilde{x}}\right) \tag{13}$$

Consumers with income Higher than the representative consumer have larger expenditure shares than the representative consumer in positive β_j goods and lower shares in negative β_j goods. When we combine equation 13 with equation 6 which defines the individual expenditure effect we obtain.

$$\hat{\psi} h = -\underbrace{\left(\sum_{j=1}^{J} \beta_j \hat{p}_j \right)}_{=\hat{b}} \times \ln\left(\tfrac{x_h}{\bar{x}}\right), \tag{14}$$

where $\hat{b}$ is the proportional change in the log of the non-homothetic component $b(\mathrm{p})$. Note that $\beta_j \hat{p}_j$ equals the covariance between the good's specific income elasticities and the price changes. A positive or negative value of $\hat{b}$ reflects an increase in the relative prices of high- (low-) income elastic goods, leading to a relative welfare loss for rich or poor consumers respectively. Collecting terms, the welfare change of consumer h is

$$\hat{\omega}_h = \hat{W} - \hat{b} \times \ln\left(\tfrac{\hat{x}_h}{\bar{x}}\right) + \hat{x}_h, \tag{15}$$

Given a distribution of expenditure levels x_h across consumers, this expression generates the distribution of welfare changes in the economy through the expenditure channel. A useful property of this structure is that, the coefficients $\left[\hat{W}, \hat{b}\right]$ can be expressed as function of demand parameters and aggregate statistics. From equation 5 and equation 15, $\hat{W}$ and $\hat{b}$ are basically the weighted averages of price changes, $\hat{W} = S' \hat{p}$ and $\hat{b} = \beta' \hat{p}$. Which can be expressed as a function of changes in aggregate expenditure shares and in the change in adjusted mean income y after inverting the aggregate demand system in equation 10.

Combining with the definition of the aggregate and the individual expenditure effects $\left[\hat{W}, \hat{b}\right]$ from equations (5) and (6), corresponding to arbitrary infinitesimal price changes yields

$$\hat{W} = S'\Gamma^{-1}\left(dS - \beta dy\right), \tag{16}$$

$$b = \beta'\Gamma^{-1}\left(dS - \beta dy\right), \tag{17}$$

A direct corollary is that computing $\hat{W}$ and $\hat{b}$ only demands knowledge of the parameters $\{\Gamma, \beta\}$, the levels and changes in aggregate expenditure shares $\{S, dS\}$, and the change in adjusted real income, dy. Therefore, as long as the substitution and income-elasticity parameters $\{\Gamma, \beta\}$, are known, a researcher armed with a sequence of the aggregate statistics $\{S_j\}_{j=1}^{J}$ and y over time can account not only for the aggregate expenditure effect, $\hat{W}$, but also for the deviation from that aggregate effect corresponding to consumers at each level of expenditures, ψ_h.

International Trade Framework with the Demand Structure

Assuming a world economy consisting of N countries, each of them specialized in the production of a different good. Each country specializes in the production of a different variety within each sector $s = 1, \ldots, S$, so that there are $J = N \times S$ varieties, each defined by a sector and origin. From the perspective of an individual consumer, these goods can be demanded with different income elasticities. Let p_{ni}^{s} be the price of goods in importing country n from exporting country i of goods in sector s and p_i be the price vector in country i. For perfect competitive market $p_{ni}^{s} = \tau_{ni}^{s} p_{ii}^{s}$, where τ_{ni}^{s} is the bilateral iceberg trade costs of exporting from i to n. p_{ii} denotes the local price of domestically produced goods in country i and equivalent to p_i.

Using labor as the only factor of production, let z_h be the effective units of labor of individual h and Z_n be the productivity of each unit of labor in country n. Therefore, in every sector the wage rate per unit of labor in country n is $w_n = p_{nn}^{s} Z_n^{s}$, and individual h in country n

receives income of $x_h = z_h \times w_n$. Each country is characterized by a mean $\overline{z}_n$ and a Theil index Σ_i of its distribution of effective units of labor across the workforce. Individual income equals expenditure and at aggregate level due to balance trade.

The demand side is given by the almost-ideal demand and reformulate the aggregate expenditure share of equation 10. Let X_{ni}^s be the value of exports from exporter i to importer n in sector s and let Y_n be the total income of importer n. The aggregate expenditure shares in country n for goods originated in country i in sector s is

$$S_{ni}^s = \frac{X_{ni}^s}{Y_n} = \alpha_{ni}^s + \sum_{s'=1}^{S}\sum_{i'=1}^{N}\gamma_{ii'}^{ss'} \ln p_{ni}^{s'} + \beta_i^s y_{n}, \tag{18}$$

where, $a_n = a(\mathrm{p}_n)$ is the homothetic price index in country n, and $y_n = \ln\left(\frac{\overline{x}_n}{a_n}\right) + \Sigma_n$ denotes adjusted mean income of the economy. The income elasticity β_i^s is allowed to vary across both sectors and exporters. The richer the importing country (higher $\overline{x}_n$) or the more unequal it is (higher Σ_n), the larger is its expenditure share from countries that produce goods with positive income elasticity, $\beta_i^s > 0$. The parameter α_{ni}^s may vary across exporters, sectors, and importers, and it captures the overall taste in country n for the goods exported by country i in sector s independently from prices or income of the importer.

The coefficient $\gamma_{ii'}^{ss'}$ is the semi-elasticity of the expenditure share in good (i, s) with respect to the price of good (i', s') when we assume no cross-substitution between goods in different sectors. Also, within each sector s, it's assumed the same elasticity between goods from different sources is represented as

$$\gamma_{ii'}^{ss'} = \begin{cases} -\left(1-\frac{1}{N}\right)\gamma^{s} & \text{if } s = s' \text{ and } i = i' \\ \dfrac{\gamma^{s}}{N} & \text{if } s = s' \text{ and } i \neq i' \\ 0 & \text{if } s \neq s' \end{cases} \tag{19}$$

Using equation 19, the expenditure share in goods from the country of origin i in sector s can be simplified to equation 20. The corresponding expenditure share for consumer h in goods from country n in sector s is also shown in equation 21

$$S_{ni}^{s} = \alpha_{ni}^{s} - \gamma^{s}\left[\ln\left(p_{ni}^{s}\right) - \tfrac{1}{N}\sum_{i'}^{N}\ln p_{ni'}^{s}\right] + \beta_{i}^{s} y_{n}. \tag{20}$$

$$s_{ni,h}^{s} = \alpha_{ni}^{s} - \gamma^{s}\left[\ln\left(p_{ni}^{s}\right) - \tfrac{1}{N}\sum_{i'}^{N}\ln p_{ni'}^{s}\right] + \beta_{i}^{s}\left(\ln\left(\frac{x_{h}}{\tilde{x}_{n}}\right) + y_{n}\right). \tag{21}$$

Adding up equation (20) across exporters, the share of sector s in the total expenditures of country n is:

$$S_{n}^{s} = \sum_{i=1}^{N} S_{ni}^{s} = \bar{\alpha}_{n}^{s} + \bar{\beta}^{s} y_{n}, \tag{22}$$

where

$$\bar{\alpha}_{n}^{s} = \sum_{i=1}^{N} \alpha_{ni}^{s},$$
$$\bar{\beta}^{s} = \sum_{i=1}^{N} \beta_{i}^{s}.$$

In turn, the share of sector s in total expenditures of consumer h is

$$s_{n,h}^{s} = \sum_{i=1}^{N} s_{ni,h}^{s} = \bar{\alpha}_{n}^{s} + \beta_{i}^{s}\left(y_{n} + \ln\left(\frac{x_{h}}{\tilde{x}_{n}}\right)\right). \tag{23}$$

From equations (22) and (23) the expenditure shares across sectors portrays an ‘‘extended Cobb-Douglas’’ form, which allows for non-homotheticities across sectors through $\bar{\beta}^s$ on top of the fixed expenditure share $\bar{\alpha}_n^s$. In equation 22 $\bar{\beta}^s$ are referred to as sectoral betas

Non-Homothetic Gravity Equation

The model results in a non-homothetic gravity equation which was used to analyze the data to estimate the key parameters such as the elasticity of substitution across exporters and the income elasticity of the goods supplied by each exporter $\{\beta_i^s\}$. Combining equation 20 and the description of y_n gives

$$\frac{X_{ni}^s}{Y_n} = \alpha_{ni}^s + \gamma^s \ln\left(\frac{\tau_{ni}^s p_{ii}^s}{\bar{\tau}_n^s \bar{p}^s}\right) + \beta_i^s \left[\ln\left(\frac{\bar{x}_i}{a(\mathrm{p}_i)}\right) + \Sigma_n\right], \tag{24}$$

Where

$$\bar{\tau}_n^s = \exp\left(\frac{1}{N}\sum_{i=1}^{N} \ln\left(\tau_{ni}^s\right)\right)$$
$$\bar{p}^s = \exp\left(\frac{1}{N}\sum_{i=1}^{N} \ln\left(p_{ii}^s\right)\right)$$

Total income of each exporter i equals the sum of sales to every country. This is used to simplify the terms in square brackets of equation 24. The gravity equation is expressed as

$$\frac{X_{ni}^s}{Y_n} = A_{ni}^s + \frac{Y_i^s}{Y_w} + \gamma^s T_{ni}^s + \beta_i^s \Omega_n, \tag{25}$$

where

$Y_w = \sum_{i=1}^{I} Y_i$ stands for world income, and where

$$A_{ni}^{s} = \alpha_{ni}^{s} - \sum_{n'=1}^{N} \left(\frac{Y_{n'}}{Y_w} \right) \alpha_{ni}^{s} \tag{26}$$

$$T_{ni}^{s} = \ln\left(\frac{\tau_{ni}^{s}}{\overline{\tau}_{n}^{s}} \right) - \sum_{n'=1}^{N} \left(\frac{Y_{n'}}{Y_w} \right) \ln\left(\frac{\tau_{n'i}^{s}}{\overline{\tau}_{n'}^{s}} \right), \tag{27}$$

$$\Omega_n = \left[\ln\left(\frac{\overline{x}_n}{a_n} \right) + \Sigma_n \right] - \sum_{n'=1}^{N} \left(\frac{Y_{n'}}{Y_w} \right) \left[\ln\left(\frac{\overline{x}_{n'}}{a_{n'}} \right) + \Sigma_n \right]. \tag{28}$$

The first term in equation 25, A_{ni}^{s}, captures cross-country differences in tastes across sectors or exporters but becomes zero if α_{ni}^{s} is constant across importers n. The next two terms after A_{ni}^{s} on the right-hand side are standard gravity equation terms. They capture relative market size of the exporter, $\frac{Y_i^s}{Y_w}$, bilateral trade costs and multilateral resistance, T_{ni}^{s} through trade costs relative to the world. The last term, Ω_n is the non-homothetic component of the gravity equation, which includes the good-specific Engel curves that are needed to measure unequal gains from trade across consumers. This term captures resistance to trade through mismatch between the income elasticity of the exporter and the income distribution of the importer. The larger Ω_n, either because average income or inequality in the importing country n is high relative to the rest of the world, the higher is the share of expenditures devoted to goods from country i when i is specialized in high income elastic goods. The gravity equation in (25) becomes the translog gravity equation when the non-homothetic term, Ω_n disappears.

Estimation of the Empirical Framework for Gravity Equation

The study employed the international trade model as described previously by Fajgelbaum and Khandelwal (2016). It was employed across countries and chickpea sector based on differentiation by origin with regards to chickpea trade. This involved the estimation of a non-homothetic gravity equation using the properties of demand to express the distribution of welfare changes across consumers as a function of aggregate expenditure shares and demand parameters. When this demand function is embedded in a standard gravity model of trade, it becomes a natural empirical framework of canonical Armington model in which products are differentiated by country of origin. The model is then use as a framework to measure the importance of trade as a driver of inequality through the expenditure channel.

The left-hand side of equation 25, $\frac{X_{ni}^{s}}{Y_n}$, can be directly measured using the data from the sector and exporters share in importer's expenditures. Similarly, we use exporter's sales in sector s to construct $\frac{Y_i^s}{Y_w}$. The term T_{ni}^{s} in equation 25, captures bilateral trade costs between exporter i and importer n in sector s relative to the world. There's no direct data of bilateral trade costs across countries, so proxies are used as bilateral observables between the countries. For this study, we assume $\tau_{ni}^{s} = d_{ni}^{\rho^s} \prod_j g_{j,ni}^{-\delta_j^s} \tilde{\varepsilon}_{ni}^{s}$, where d_{ni} stands for distance, ρ^s reflects the elasticity between distance and trade costs in sector s, the g's are other gravity variables including common border and common language, and $\tilde{\varepsilon}_{ni}^{s}$ is an unobserved component of the trade cost between i and n in sector s. This allows the gravity equation 25 to be rewritten as

$$\frac{X_{ni}^{s}}{Y_n} = A_{ni}^{s} + \frac{Y_i^s}{Y_w} + \left(\gamma^s \rho^s\right) D_{ni} + \sum_j \left(\gamma^s \delta_j^s\right) G_{j,ni} + \beta_i^s \Omega_n + \varepsilon_{ni}^{s}, \tag{29}$$

Where

$$\bar{d}_n = \tfrac{1}{N} \sum_{i=1}^{N} \ln\left(d_{ni}\right),$$
$$D_{ni} = \ln\left(\tfrac{d_{ni}}{\bar{d}_n}\right) - \sum_{n'=1}^{N} \left(\tfrac{Y_{n'}}{Y_w}\right) \ln\left(\tfrac{d_{n'i}}{\bar{d}_{n'}}\right)$$
□

and where $G_{j,ni}$ is defined in the same way as equation D_{ni} but with $g_{j,ni}$ instead of d_{ni}. □

A_{ni}^{s} is measured by decomposing α_{ni}^{s} into an exporter effect α_{i}, a sector-specific effect α^{s}, and an importer-specific taste for each sector ε_{n}^{s}

$$\alpha_{ni}^{s} = \alpha_{i}\left(\alpha^{s} + \varepsilon_{n}^{s}\right) \tag{30}$$

Imposing the restriction $\sum_{i=1}^{N} \alpha = 1$, under the assumption of equation 30, the sectoral expenditure shares from the upper-tier equation 22 becomes

$$S_{n}^{s} = \alpha^{s} + \bar{\beta}^{s} y_{n} + \varepsilon_{n}^{s} \tag{31}$$

Equation 31 is an Engel curve that projects expenditure shares on the adjusted real income. thus, regressing sector expenditure shares on sector dummies and the importer's adjusted mean income interacted with sector dummies. The interaction coefficients will have the structural interpretation as the sectoral betas $\bar{\beta}^{s}$. From equations 26, 30, and 31, $A_{ni}^{s} = \alpha_{i}\left(S_{n}^{s} - S_{W}^{s} - \bar{\beta}^{s}\Omega_{n}\right)$ where S_{W}^{s} is the share of sector s in world expenditures. Combining this with the gravity equation 29, the following equation is arrived:

$$\frac{X_{ni}^{s}}{Y_{n}} = \frac{Y_{i}^{s}}{Y_{w}} + \alpha_{i}\left(S_{n}^{s} - S_{W}^{s}\right) - \left(\gamma^{s}\rho^{s}\right)D_{ni} + \sum_{j}\left(\gamma^{s}\delta_{j}^{s}\right)G_{j,ni} + \left(\beta_{i}^{s} - \alpha_{i}\bar{\beta}^{s}\right)\Omega_{n} + \varepsilon_{ni}^{s}, \tag{32}$$

The gravity equation 32 identifies $\left(\beta_{i}^{s} - \alpha_{i}\bar{\beta}^{s}\right)$ using the variation in Ω_{n} across importers for each exporter. The sectoral gravity equation aggregates to the gravity equation of a single-sector model. Summing equation 32 across sectors s gives the total expenditure share dedicated to goods from i in the importing country n,

$$\frac{X_{ni}^{s}}{Y_{n}} = \frac{Y_{i}^{s}}{Y_{w}} - \left(\gamma^{s}\rho^{s}\right)D_{ni} + \sum_{j}\left(\gamma\delta_{j}\right)G_{j,ni} + \beta_{i}\Omega_{n} + \varepsilon_{ni}, \tag{33}$$

Equation 33 can be identified as the gravity equation that would arise in a single-sector model. This model was adopted to estimate the effect of income and chickpea price on chickpea trade expenditure share and chickpea consumption expenditure share respectively.

The Effect of Income on Trade Expenditure Share in Chickpea

To analyze the effect of income on chickpea trade expenditure share, Ordinary Least Square (OLS) regression model of single-sector gravity model as described in equation 33 was used. The chickpea trade expenditure share estimated was used as the dependent variable, while income and gravity variables were used as the independent variables. The gravity equation used in the analysis is specified as:

$$\frac{X_{ni}^{c}}{Y_n} = \beta_0 + \beta_1 \frac{Y_i}{Y_w} - \beta_2 Indist + \beta_3 contig + \beta_4 Ingini\_index \quad (34)$$

The description of these variables is presented in table 1

Table 1. Variables Used to Estimate Effect of Income on Trade Expenditure Share in Chickpea

Dependent Variable	Explanations	Units
X_{ni}^{c}	Aggregate trade without chickpea, intra chickpea trade, intra trade and Chickpea Export.	USD
Y_n	GDP of chickpea importing countries	USD
Independent variable		
Y_i	GDP of exporting country	USD
Y_w	Total world GDP	USD
Indist	log of bilateral distance	
contig	1=contiguity, 0=otherwise	
Ingini_index	Log of Gini coefficient of importing country	

The Price Effect on Consumption Expenditure Share in Chickpea

To analyze the effect of price on chickpea consumption expenditure share, OLS regression model as described in equation 12 was used. The chickpea consumption expenditure share estimated served as the dependent variable with price and adjusted mean income used as the independent variables. The equation is specified as:

$$InCons = \alpha_0 + \alpha_1 Iny_n - \alpha_2 In\,\text{Pr}\,ice + \alpha_3 RTA + \alpha_4 Inpop\_o \tag{35}$$

The description of these variables is presented in table 2.

Table 2. Variables used to Estimate Price Effect on Consumption Expenditure Share of Chickpea

Dependent Variable	Explanations
InCons	Log of Chickpea Consumption
Independent variable	
Iny_n	Log of mean adjusted income
InPrice	Log of chickpea Price
RTA	1=regional trade agreement (RTA), 0=otherwise
Inpop_o	Population

Data

Secondary data from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) and the United Nation Commodity Trade Statistics Database (Comtrade) were the main data source for the research. Relevant data were taken from these sources for the purpose of estimating data on chickpea relative trade, chickpea consumption and all relevant data. The FAOSTAT database was used for chickpea production data. Chickpea production data is in value terms in current United State Dollars (USD). The bilateral trade data generated for the final regression model included re-import and re-export data from the Comtrade database. For the aggregate trade data, the Application Programming Interface (API) bulk data from Comtrade was used to estimate the aggregate chickpea data and spans from 1988 to 2018. The aggregated data used for the final analysis therefore falls between 1988 and 2015 with about 70000 bilateral data involving 179 countries. GDP, population and Gini coefficient of the countries were obtained from the world bank database while bilateral distance, common language, regional trade agreement and border information were sourced from the Centre d'Études Prospectives et d'Informations Internationales (CEPII) Gravity equation database (Mayer and Zignago, 2011; Head and Mayer, 2014; Melitz and Toubal, 2014). Chickpea demand was used as a proxy for chickpea consumption which was derived from the production, export and import. This approach used since the data of chickpea consumption was not available. Chickpea consumption demand was estimated as Production added to import less export. The mean adjusted income was generated as GDP multiplied by the Gini coefficient of countries.

CHAPTER 4. RESULTS AND DISCUSSION

This chapter presents and discusses the results of the study. The chapter begins with the summary statistics of chickpea production and trade in the world. Single-sector gravity equation estimates of chickpea trade to show effect of price on chickpea expenditure share follows and effect of income on chickpea consumption.

Global Chickpea Production and Trade

The characteristics of global chickpea production between 1988 and 2015 are presented in figure 1 and table A 1 in the appendix. The majority of the world production comes from the Asian continent with Europe producing the least chickpea within the period. Since most of the European countries are developed, this result confirms Kumhar *et al.*, (2013) conclusion that majority of chickpea production is from the developing countries. Figure 1 shows the trend of production of chickpea. The figure shows an increase in production by all continents from 1988 to 2015. Table A1 in the gives the actual production values by the continents and the world. World output increased from 5.8 million metric tons to 11 million metric tons in 2015.

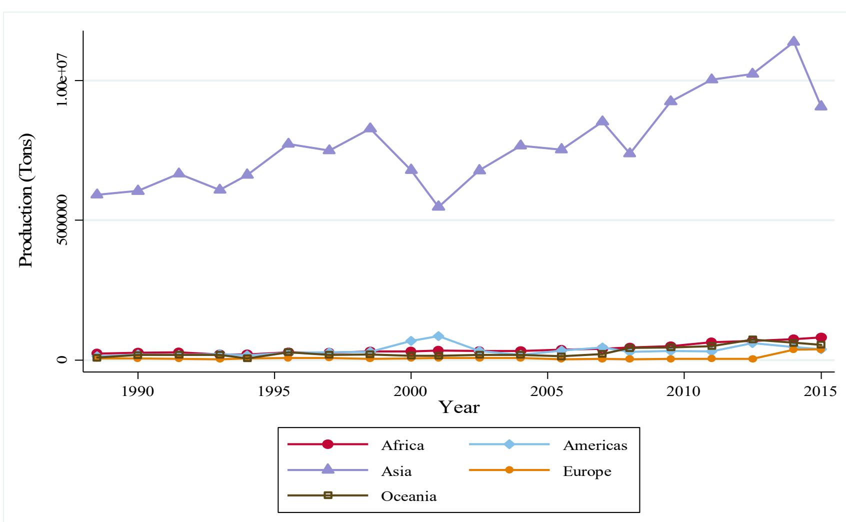

Figure 1. Global Chickpea Production Trend from 1988 to 2015

India is by far the highest producer of chickpea globally within the period of 1988 and 2015 as shown in table 3. Turkey is the second highest producer which occurred within the same period with a total of 17345313Mt. Countries such as Pakistan, Australia, Myanmar, Iran, Ethiopia, Mexico, Canada and Syria respectively follow as the top chickpea producing countries from 1988 to 2015. Table 3 provide the sum of chickpea output from 1988 to 2015. Table A2 focuses on the trends in chickpea production observed in the top 10 chickpea growing countries in the world for 1988, 2002 and2015. Overall, the trend in production quantity in these top 10 countries seem to have doubled, except in Pakistan where the increase is marginal compared to the other 9 in 2015. Morocco and Bangladesh had left the top 10 producers by 2015. From table A1, it can be seen that develop countries producing chickpea had increase over the period. Countries such as Canada, USA and Australia have become part of the major 10 chickpea producers by 2015. This is consistent with the increase in demand of more healthy protein by developed countries.

Table 3. Top 10 Chickpea Producing Countries from 1988 to 2015

Country	Production (Mt)
India	165442500
Turkey	17345313
Pakistan	15370749
Australia	8233325
Myanmar	6994061
Iran	6623978
Ethiopia	5394085
Mexico	4820839
Canada	2760601
Syrian Arab Republic	1422832

Global Chickpea Trade

Globally, the chickpea quantities traded has increased considerably since the 1980s. Table A5 and figure 2 show the trend in the increrase in global export from 1988 to 2015. The total traded chickpea was around 100000 metric tons in 1988 and rises to about 2.5 million metric tons in 2015.

When countries are ranked and compare according to the volume of chickpea traded as in table A3 and table A4, India showed an increase in import by about 3 folds from 1988 to 2015 with the value increasing about 600% within the same period. Though India has been the leading world producer and importer of chicpea, its export of chickpea is low. This is attributed to the high consumption of chickpea by India and as such most of its production is domestically consumed. From figure 3 and table A5, it is noticed that, although the chickpea trade has increased over the period between 1988 to 2015, the global production has increased more in relative terms than the increased in trade.

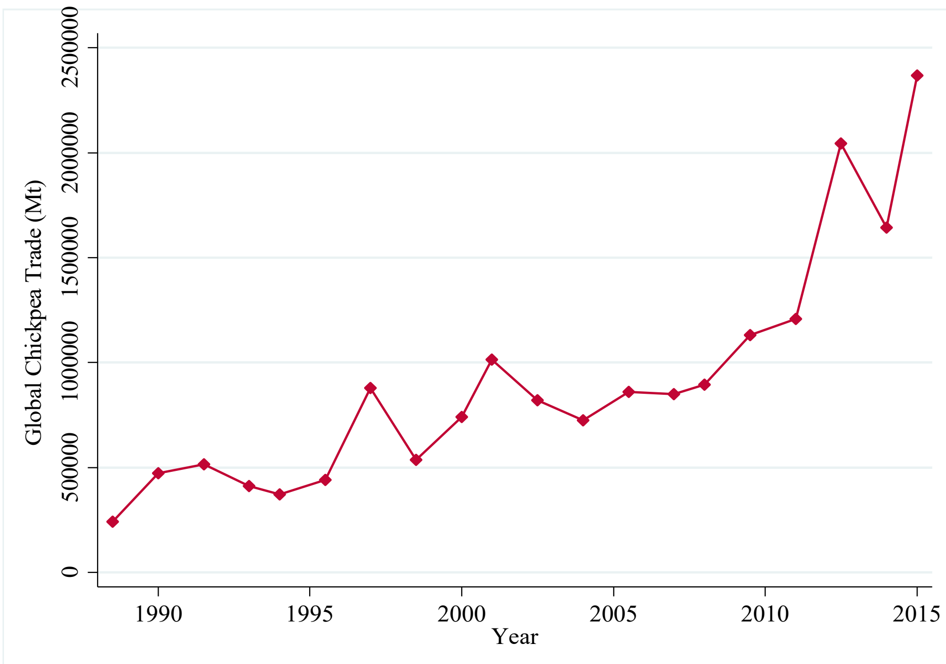

Figure 2. Global Chickpea Trade from 1988 to 2015

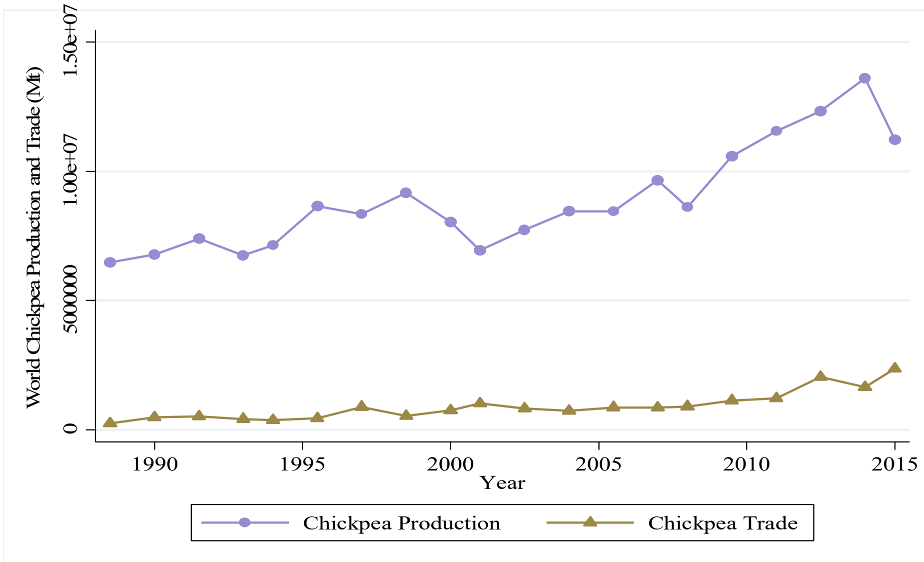

Figure 3. Global Chickpea Production and Trade from 1988 to 2015

Chickpea Consumption and Production Trend

Table A6 provides the top 10 chickpea consuming countires from 1988 to 2915. India has been the highest consumer between the period. Figure 4 shows the trend in production and consumption of chickpea for India. India's consumption and production have all been increasing since the 1988.

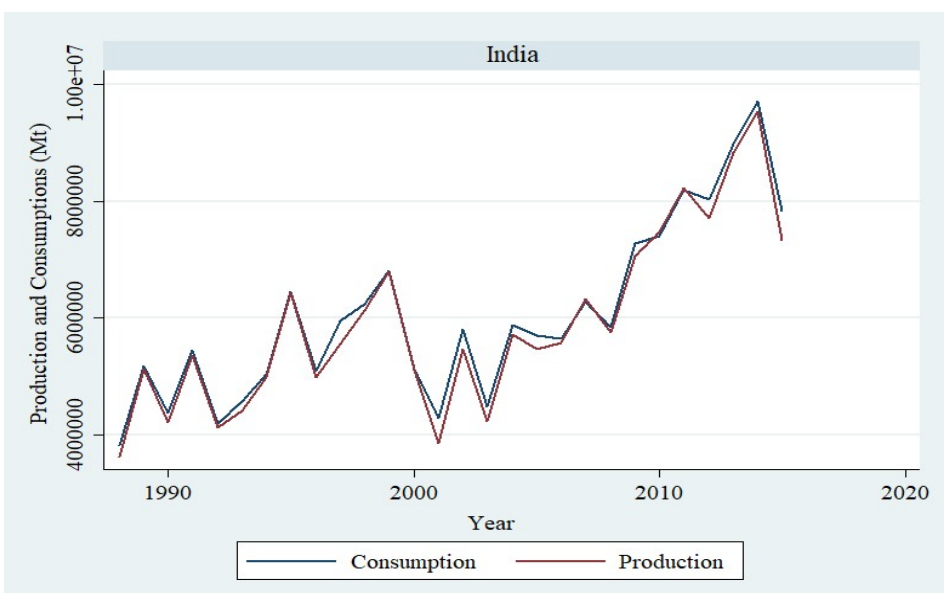

Figure 4. Chickpea Production and Consumption for India

Figure 5 indicates the trend for production and consumption for Australia and the USA. For Australia, the increase in chickpea production is higher than its consumption.

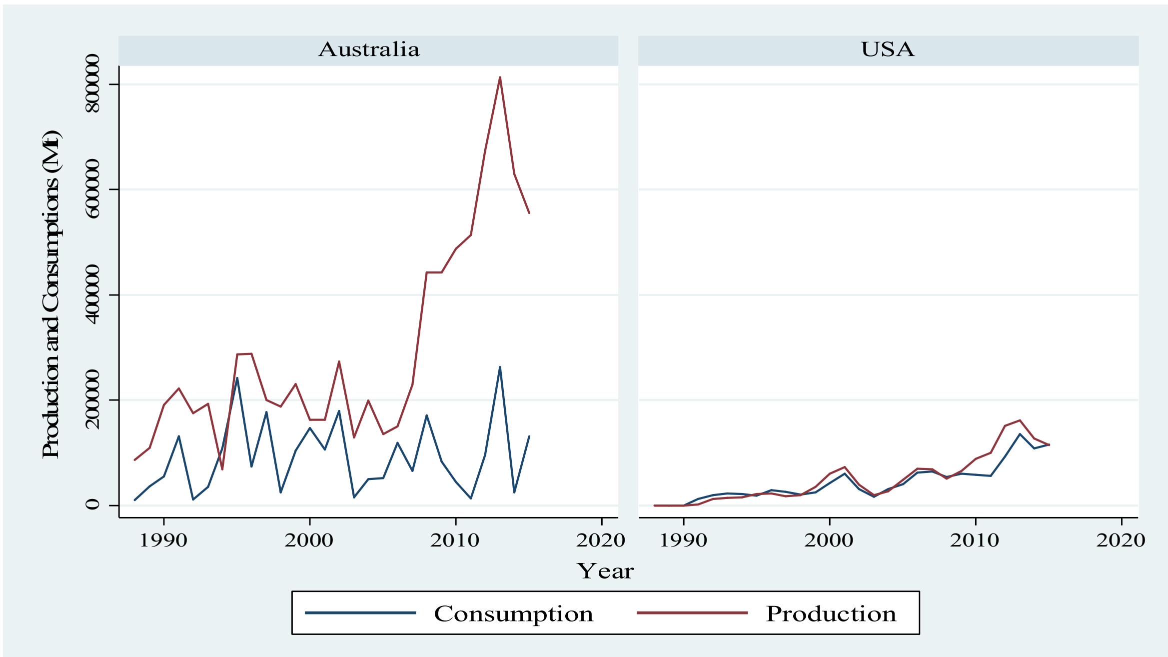

Figure 5. Chickpea Production and Consumption for Australia and USA

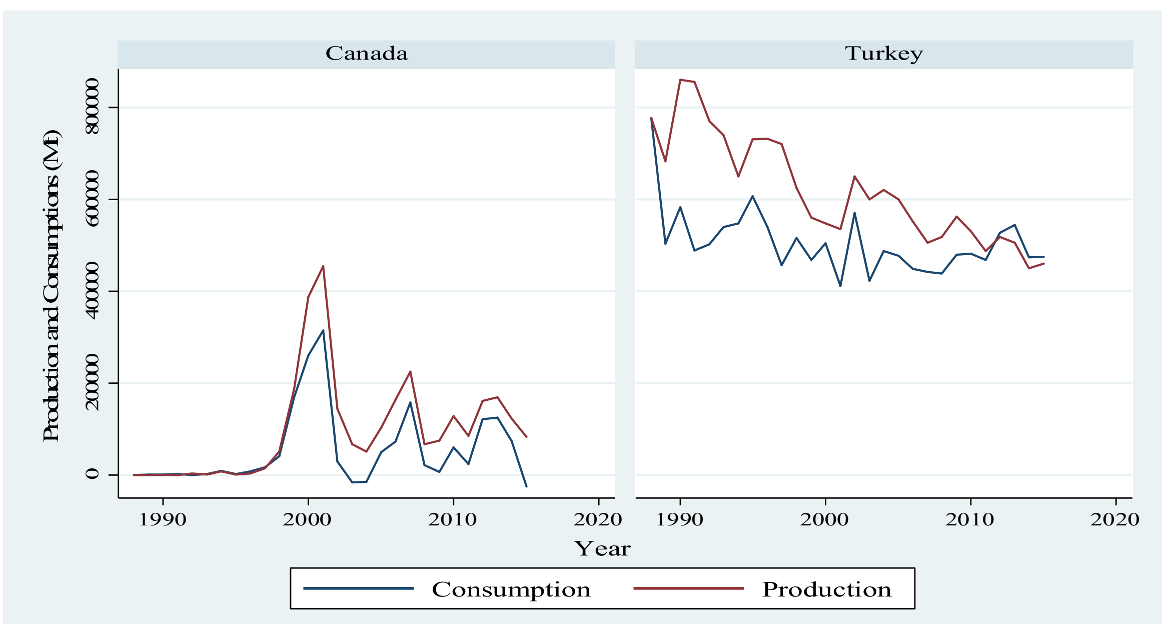

Figure 6. Chickpea Production and Consumption for Canada and Turkey

Figure 6 shows the relationship between production and consumption in Canada and Turkey between 1988 and 2015. The trend of Canada is not consistent compared to Turkey which shows a downward trend for production and consumption of chickpea for the period. By 2015 the consumption of chickpea was higher than production making Turkey a net importer of chickpea.

Econometric Results and Discussion

The econometric results are organized into two sections. First, the effect of income on chickpea trade expenditure share is examined. Second, we estimate a model that includes income (lny_n) and price (lnPrice) variables to discuss how they affect chickpea consumption expenditure share.

Examining the Effect of Income on Trade Expenditure Share of Chickpea

Table 4 shows the OLS regression to examine the income effect of chickpea trade through the expenditure channel. All the columns in table 4 use full sample for the analysis. The initial estimated models include standard gravity variables including the logarithm of bilateral distance (lndist), and the indicator variables for contiguous borders (Cont). The specification in columns 1 and 2 exploits variation in gravity variables while column 3 exploits country-time variation in income share. Income share is importer's share of GDP in world GDP.

The findings show the estimates of the effects of the standard gravity variables are in accordance with our expectations and consistent with the empirical trade literature. The coefficient on Yi_Yw is significant at 1% significance level for all the models. Recall that Yi_Yw measures country's income share in the world income. This sign is positive indicating that as the country's relative income increases, its bilateral chickpea imports in value terms increases ceteris paribus. The value for Yi_Yw is about 3, which indicates that as the country's income share relative to other countries increases by a unit its chickpea expenditure relative to its total income increases by 3 units. That means, when a country's national income increases by $100 dollars keeping the world income constant, its relative expenditure on chickpea trade increases by $300.

Table 4. Effect of Income Share on Chickpea Trade Expenditure Share

	1	2	3	4	5
Yi_Yw	3.0304*** (0.1947)	3.0240*** (0.1935)	3.0256*** (0.1936)	3.1004*** (0.1821)	3.1004*** (0.1821)
lndist	-0.0072*** (0.0005)	-0.0055*** (0.0005)	-0.0056*** (0.0005)	-0.0051*** (0.0006)	-0.0051*** (0.0006)
contig		0.0139*** (0.0028)	0.0135*** (0.0028)	0.0163*** (0.0027)	0.0163*** (0.0027)
lngini_index			0.0042* (0.0023)		0.0123*** (0.0024)
_cons	0.0624*** (0.0044)	0.0472*** (0.0045)	0.0334*** (0.0079)	0.0172 (0.0140)	0.0082 (0.0113)
Observations	15,695	15,695	15,695	15,695	15,695
R-Square	0.1876	0.1915	0.1917	0.3338	0.3338
Root mean square	0.0546	0.0544	0.0544	0.0509	0.0509
Exporter-time Fixed Effect	no	no	no	yes	yes
Importer Fixed Effect	no	no	no	yes	yes

Robust standard errors in parentheses. Notes: ***, **, * denote significance at 1%, 5% and 10% level, respectively.

The gravity variables bilateral distance and contiguity were significant at 1% level of significance for column 1, 2, 3, 4 and 5. The negative sign of the bilateral distance is consistent with gravity trade model. As bilateral distance is represented in the logarithmic form, lndist (log of bilateral distance), a unit increase in the bilateral distance reduces trade flows relative to total income between countries by less than 1% for all the models. The standard explanation for why distance matters for trade is that, transport costs are increasing in distance. Again, for agricultural products transport, distance is a major factor due to its perishability. The negative coefficient explains this effect of the geographical distances and reflects trade barriers that are proportional to geographic distances, which can result from both transport costs and informational unfamiliarity.

The variable contiguous border is statistically significant and has the intuitive signs in all the columns. In columns 2, 3, 4 and 5, where this variable is included, bilateral chickpea import is positively related to chickpea bilateral import demand (Xni) relative to importers income (Yn). One potential explanation for this result is that it is less costly to move chickpea from a country that shares contiguous borders relative to countries that do not share border and therefore reduces the transportation cost.

Unlike in columns 1 and 2 of table 4, column 3 includes the Gini coefficient (lngini_index), which captures the non-homothetic component in the AIDS model. More precisely, it describes the relative difference in mean income across countries. In column 3, where the exporter-time and importer fixed effect are not included, the coefficient is statistically significant at 10% level of significance. In column 5, where a similar model is estimated with exporter-time and importer effects, the coefficient of the Ingini_index is positive (0.0123). This indicates that as the average income or inequality in the importing country increases by a unit relative to the rest of the world, the share of expenditures devoted to chickpea from the country increases by about 1.2%.

The coefficient estimates (Beta's) were similar in most models above. However, models that control for exporter-time and importer changing variables performed better in terms of diagnostic tests. For example, the R-square values were generally higher (33.4%) in columns 4 and 5. Similarly, the root mean squared error were also lower (0.0509) in the columns 4 and 5. The R-square value indicates that about 33% of the variations in the chickpea bilateral import demand (Xni) relative to importers income (Yn) is explained by country's relative income share, bilateral distance, contiguity, and Gini coefficient. Likewise, the root mean squared error explains how the magnitude of the distribution and therefore the lower the root mean squares the better.

Examining the Income Effects on Chickpea Consumption Patterns

Table 5 shows the effect of income on chickpea consumption. The income is adjusted for income distribution within the country. This adjusted mean income is an estimate as it is a scalar multiplication of GDP of the consuming country and its Gini coefficient, a country-specific estimate of income inequality. Therefore, this constructed variable measures the welfare experienced by consumers at the mean of income distribution within the country. It proxies the non-homothetic unadjusted income component in the original aggregate share equation consistent with AIDS, and is not adjusted for the cost of living.

Table 5. Income Effects on Chickpea Consumption Patterns

	1	2	3
Iny_ii	0.6243*** (0.0897)	-0.9382*** (0.1345)	-0.9406*** (0.1426)
InPrice	-0.7774*** (0.1746)	-0.7444*** (0.1758)	-0.8088*** (0.1789)
RTA		-0.0129 (0.246)	-0.0741 (0.2524)
Inpop_o		0.4449*** (0.1369)	0.4843*** (0.144)
_cons	32.6759*** (2.6865)	40.9250*** (3.7367)	37.3694*** (4.6282)
Observations	1,285	1,285	1,285
R-Square	0.05	0.0564	0.0952
Root mean square	4.366	4.3546	4.3606
Country- effect	no	no	yes

Robust standard errors in parentheses. Notes: ***, **, * denote significance at 1%, 5% and 10% level, respectively.

The columns 1 and 2 of table 5 do not control for quality and taste parameters. In column 3, the country fixed effect is used to soak in country-specific time-invariant taste and quality parameters. When the model is augmented to control for country fixed effects, population, and reciprocal trade agreements-regional free trade agreements in column 3, like in other two columns, the coefficient on our primary variable of interest, lny_n remained negative. Further, the coefficient of lnprice is estimated more precisely (with lower standard error).

The negative sign of the adjusted mean income in column 3 indicates that the richer the chickpea importing country, the lower is its chickpea consumption. The value of Iny_n indicates that a percentage increase in the adjusted mean income of the importer will lead to a 94% increase in the consumption of chickpea. Chickpea is assumed to be a pro poor protein source and as such increase in adjusted mean income of consumers will lead to consuming different source of protein therefore reducing the consumption of chickpea.

This estimate is inconsistent with Hallack (2010), Bils and Klenow (2001). As the income effect is statistically significant and negative even when controlling for price and quality effect, it suggests that chickpea is an inferior good. The price coefficient has a negative sign in all three columns in table 5. This implies as prices increase, consumption decreases. For example, a 1% increase in chickpea price leads to about 81% increase in consumption in our most preferred specification in column 3. This will positively impact countries like Australia, Canada, and the USA, which are significant chickpea exporters compared to India, Bangladesh, and the United Arab Emirates, who are the major importers of chickpea. It also indicates that chickpea is not an inferior good, and as such, an increase in its price still leads to increased demand.

Sensitivity Analysis

In this section, we explore the income and price effect on consumption expenditure by countries. Estimations are shown for major exporters and producers of chickpea. Table 6 summarizes the price effect on chickpea consumption for the USA, China, India, Turkey, Canada, Australia, and Europe. The first column reproduces the full sample analysis for comparison. The time-invariant chickpea quality factor is controlled for using the country fixed effect.

In most cases, the coefficient on the price variable took a negative sign. That is, as the price increased, the chickpea consumption in these countries decreased. The coefficient on the price variable was positive only in the case of China, turkey and Australia. The coefficient was not statistically significant for these countries and Canada although Canada had a negative sign. India is among the top producers of chickpea but it's also the top consumer of chickpea. Therefore, changes in prices would cause a significant shift in the consumption pattern.

Similarly, the coefficient on adjusted mean income carries a positive sign in the USA and Canada. These were contrary to the overall analysis though were not significant. That is, as the mean adjusted income increased, chickpea consumption increased for these countries. In exception, the price impacted chickpea consumption negatively in the case of USA, Canada and India. Given that the Income effect is negative for Europe and India though insignificant, but the price effect is statistically significant, we can conclude chickpea is inferior good in India and Europe.

Table 6. Sensitivity Analysis for Selected Countries on their Chickpea Price Effects on Chickpea Consumption Patterns

	ALL	Europe	USA	China	India	Turkey	Canada	Australia
Iny_n	-0.9406*** (0.1426)	-0.4545 (0.7544)	0.9932 (1.1205)	-1.2164* (0.6967)	-1.2492 (0.8496)	-0.4125 (0.6372)	0.3161 (1.5354)	-0.5599 (1.3950)
InPrice	-0.8088*** (0.1789)	-1.1156*** (0.2744)	-0.5925 (1.0357)	0.5096 (0.5937)	-2.8005*** (0.7556)	0.6242 (0.9800)	-2.4029 (2.0410)	4.1194 (3.0081)
fta_wto	-0.0741 (0.2524)	0.1676 (0.4433)	-1.1589 (2.1188)	1.0596 (1.2950)	0.9997 (1.7615)	-0.5644 (1.1033)	-3.2564 (2.2096)	-2.9937 (3.4145)
Inpop_o	0.4843*** (0.1440)	-0.2796 (0.7706)	-1.7159 (1.3685)	0.9601 (0.7060)	0.1467 (0.4903)	0.7271 (0.7083)	0.215 (1.3640)	-1.4659 (1.7622)
_cons	37.3694*** (4.6282)	18.898 (21.2743)	-10.4932 (31.2361)	48.0104** (19.7460)	51.2888** (23.5445)	26.7845 (17.8363)	7.0235 (41.9377)	38.6323 (36.7362)
Observations	1,285	540	25	24	27	25	18	8
R-Square	0.0952	0.2001	0.1037	0.171	0.3656	0.0815	0.351	0.5365
Root mean square	4.3606	4.1538	5.2446	3.16	3.4185	2.6326	3.9485	3.0677
Country effect	yes	yes	yes	yes	yes	yes	yes	yes

Notes: ***, **, * denote 1%, 5% and 10% significance level, respectively.
Robust standard errors are reported in parenthesis

CHAPTER 5. SUMMARY AND CONCLUSIONS

This chapter presents the summary, major findings and conclusions of the study. It also provides policy recommendations based on the findings of the study.

Summary and Conclusions

The study examined the trade effect through the expenditure channel using AIDS and thus considering non-homotheticity in preferences. Therefore, it was possible to obtain the key parameters to identify the income and price effect on chickpea trade and chickpea consumption.

The bilateral trade and production data were combined to derive the results. Chickpea production data was from the Food and Agriculture Organizations' Statistical Database (FAOSTAT), and the Chickpea trade data was taken from the United Nations Commodity Trade Statistics Database (Comtrade). The production data were mapped with trade data to retrieve the consumption database. The sample period was 1988 to 2015, and included 69000 observations.

Ordinary Least Square regression and fixed effect OLS techniques were applied in analyzing the data to examine the income and price effect of chickpea consumption and bilateral trade through the expenditure channel.

- The majority of the world chickpea production comes from the Asian continent representing about 87% of the total output within the period under study. Europe produced the least chickpea with only 1% of the global production.
- Total world chickpea output increased from 5 million metric tons in 1988 to 10 million metric tons in 2015.
- India has been the highest producer, importer and consumer of chickpea consistently from 1988 to 2015, with a total production of 165442500 metric tons. Turkey is the second-highest producer with 17345313 tons. Countries such as Pakistan, Australia,

Myanmar, Iran, Ethiopia, Mexico, Canada, and Syria follow the top chickpea producing countries.

- Australia has been the highest exporter of chickpea between 1988 and 2015. Developed countries such as the USA and Canada had become significant producers and exporters of chickpea in the last decade.
- The relative size of the exporter to other countries, Yi_Yw, was positive and statistically significant at a 1% level for our most preferred specification. That is higher the country's income higher is its expenditure on bilateral import and consumption share.
- The coefficient of the Gini index was positive and statistically significant at a 1% level in our most preferred specification. As the mean adjusted income in the importing country increases by a unit relative to the rest of the world, the share of expenditure devoted to chickpea trade from the country increases by about 1.2%.
- Sub-sample analysis for country-specific estimates generally produced coefficients with the same sign as the full sample analysis. Notable include India and Europe, where the price effect on consumption was statistically significant, and the income effect on chickpea consumption was negative but not statistically significant.

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APPENDIX

Table A1. Distribution of Chickpea Production by Continents from 1988-2015 in Metric Tons

Year	Africa	Americas	Asia	Europe	Oceania	World
1988	255970	120946	5.20E+06	74797	85964	5.80E+06
1989	235123	176477	6.60E+06	63543	109362	7.20E+06
1990	275645	205410	6.00E+06	67683	190268	6.80E+06
1991	341180	217723	7.30E+06	59647	221859	8.10E+06
1992	219825	160849	6.00E+06	45131	175338	6.60E+06
1993	208296	222938	6.10E+06	42439	193108	6.80E+06
1994	206812	182211	6.60E+06	68632	68893	7.10E+06
1995	238024	205936	8.40E+06	46504	286909	9.20E+06
1996	337458	320448	7.10E+06	106709	287721	8.10E+06
1997	274423	286986	7.50E+06	90660	199840	8.30E+06
1998	326665	175963	8.10E+06	72839	187600	8.90E+06
1999	317512	426647	8.40E+06	45586	229900	9.50E+06
2000	321612	690761	6.80E+06	69020	162000	8.00E+06
2001	345592	865907	5.50E+06	77751	162492	6.90E+06
2002	373653	426529	7.30E+06	91294	273439	8.40E+06
2003	302942	236991	6.30E+06	71083	128738	7.00E+06
2004	329262	189924	7.70E+06	81187	198854	8.50E+06
2005	371713	292688	7.60E+06	36947	135215	8.50E+06
2006	395218	410185	7.40E+06	40226	149682	8.40E+06
2007	411143	452733	8.50E+06	47764	229202	9.70E+06
2008	453418	298796	7.40E+06	40050	442543	8.60E+06
2009	463746	297519	9.10E+06	42413	442543	1.00E+07
2010	540416	373811	9.40E+06	51655	487046	1.10E+07
2011	653111	316792	1.00E+07	54081	513338	1.20E+07
2012	691845	641020	9.40E+06	45481	673371	1.10E+07
2013	678739	600338	1.10E+07	55927	813300	1.30E+07
2014	755758	477801	1.10E+07	387028	629400	1.40E+07
2015	822827	391571	9.10E+06	390014	555400	1.10E+07

Table A2. Top 10 Producers of Chickpea from 1988 to 2015

1988		2002		2015	
Country	Production (Mt)	Country	Production (Mt)	Country	Production (Mt)
India	3625500	India	5473000	India	7332000
Turkey	777500	Turkey	650000	Myanmar	571500
Pakistan	371500	Pakistan	362100	Australia	555400
Myanmar	164100	Iran	301876	Ethiopia	520965
Ethiopia PDR	105603	Australia	273439	Turkey	460000
Iran	101339	Mexico	235053	Pakistan	379192
Mexico	88400	Myanmar	208500	Russian	319969
Australia	85964	Ethiopia	186801	Iran	193105
Bangladesh	74568	Canada	144500	Mexico	137809
Morocco	55600	Iraq	96776	USA	114440

Table A3. Exporting Countries from 1988 to 2015

1988			2002			2015		
Country	Export Value (USD)	Export Quantity (Mt)	Country	Export Value (USD)	Export Quantity (Mt)	Country	Export Value (USD)	Export Quantity (Mt)
Australia	29887804	96862	Mexico	82264543	142700	Australia	7.63E+08	1287000
India	2019914	2925	Iran	70208346	139700	Russian Federation	1.54E+08	326100
Greece	122051	220	Canada	43299477	125300	India	1.73E+08	187700
Portugal	120056	182	Turkey	49468538	108100	Ethiopia	23241903	114440
Fmr Fed. Rep. of Germany	106000	131	Australia	32474870	94867	Canada	75449362	113700
Switzerland	650	0.5	Germany	17529000	93981	Mexico	1.04E+08	94437
			Ethiopia	14693042	48630	Argentina	38073218	64448
			USA	10922303	21793	United Rep. of Tanzania	29661405	51865
			United Rep. of Tanzania	6032899	21082	USA	38204062	46491
			Russian Federation	2369755	9936	United Arab Emirates	28247343	39985

Table A4. Importing Countries from 1988 to 2015

1988			2002			2015		
Country	Import value (USD)	Import Quantity (Mt)	Country	Import value (USD)	Import Quantity (Mt)	Country	Import value (USD)	Import Quantity (Mt)
India	70464104	207000	India	105600000	332500	India	430100000	688100
Greece	2508564	5907	Spain	41813630	60137	Bangladesh	154600000	294200
Portugal	1862496	5532	Bangladesh	20354265	59305	United Arab Emirates	72241648	112000
Fmr Fed. Rep. of Germany	789000	1505	Algeria	22161157	34396	Algeria	62195746	58666
Japan	210123	354	Italy	12927633	22331	Saudi Arabia	40714434	55097
Australia	197894	440	Saudi Arabia	6207208	21483	Pakistan	34609057	54242
Switzerland	190969	298	Jordan	9585930	21113	USA	34025292	46941
Finland	17114	12	Tunisia	3525474	18711	United Kingdom	34319304	42510
Iceland	1323	1	Sri Lanka	6524546	17355	Turkey	45409641	37306
			USA	7115720	13471	Jordan	24365185	33258

Table A5. World Chickpea Production and Trade

Year	World Production (Mt)	Export quantity (Mt)	Export value (USD)	Import quantity (Mt)	Import value (USD)
1988	5.80E+06	100321	3.20E+07	221064	7.60E+07
1989	7.20E+06	260722	1.20E+08	136385	7.40E+07
1990	6.80E+06	471670	2.20E+08	230222	1.00E+08
1991	8.10E+06	512849	2.10E+08	249538	1.20E+08
1992	6.60E+06	516048	2.00E+08	335216	1.60E+08
1993	6.80E+06	410715	1.60E+08	403152	1.70E+08
1994	7.10E+06	370491	1.70E+08	280072	1.60E+08
1995	9.20E+06	297235	2.40E+08	230166	2.10E+08
1996	8.10E+06	584951	3.10E+08	431459	2.80E+08
1997	8.30E+06	878355	3.20E+08	670920	2.90E+08
1998	8.90E+06	575771	2.50E+08	407344	2.20E+08
1999	9.50E+06	494164	2.30E+08	303777	1.80E+08
2000	8.00E+06	741313	3.30E+08	365693	2.30E+08
2001	6.90E+06	1.00E+06	4.50E+08	883122	4.10E+08
2002	8.40E+06	848047	3.50E+08	729849	3.10E+08
2003	7.00E+06	790179	3.60E+08	754776	3.30E+08
2004	8.50E+06	723400	3.80E+08	693263	3.60E+08
2005	8.50E+06	854878	4.40E+08	818900	4.60E+08
2006	8.40E+06	865996	5.40E+08	718420	4.80E+08
2007	9.70E+06	719380	5.20E+08	849733	6.40E+08
2008	8.60E+06	796729	6.00E+08	895619	6.80E+08
2009	1.00E+07	1.10E+06	6.80E+08	1.00E+06	6.70E+08
2010	1.10E+07	1.20E+06	8.00E+08	1.10E+06	7.60E+08
2011	1.20E+07	1.20E+06	1.00E+09	1.10E+06	9.20E+08
2012	1.10E+07	1.90E+06	1.50E+09	1.50E+06	1.30E+09
2013	1.30E+07	1.60E+06	1.10E+09	2.20E+06	1.30E+09
2014	1.40E+07	1.60E+06	9.80E+08	1.20E+06	8.50E+08
2015	1.10E+07	2.40E+06	1.50E+09	1.70E+06	1.20E+09

Table A6. Top 10 Chickpea Consuming Countries from 1988 to 2015

1988		2002		2015	
Country	Consumption (USD)	Country	Consumption (USD)	Country	Consumption (USD)
India	4.50E+09	India	1.98E+09	India	5.33E+09
Turkey	2.78E+08	Turkey	3.31E+08	Myanmar	5.34E+08
Pakistan	1.17E+08	Iraq	1.18E+08	Turkey	4.66E+08
Myanmar	9.75E+07	Spain	8.58E+07	Ethiopia	1.89E+08
Iran	8.00E+07	Pakistan	6.59E+07	Iran	1.67E+08
Spain	5.73E+07	Australia	3.84E+07	Bangladesh	1.59E+08
Ethiopia	4.44E+07	Syria	3.59E+07	Tanzania	1.39E+08
Mexico	3.92E+07	Algeria	3.06E+07	Pakistan	1.13E+08
Bangladesh	2.47E+07	Iran	2.54E+07	Algeria	7.91E+07
Morocco	2.43E+07	Myanmar	2.32E+07	Malawi	7.36E+07