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# Effects of Trade Liberalization on the Agricultural Sector

Salome Boyd

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Written under supervision of Dr. Hendrik Vrijburg

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# Foreword

This thesis was conducted for completion of the MSc Public Administration program at Leiden University. I would like to thank my supervisor, Professor Hendrik Vrijburg, and Professor Joop de Kort for their time and valuable guidance. I would also like to thank my family and friends for their support during my time at Leiden University.

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## 1. Introduction

Many African nations liberalized trade in the 1980s and 1990s, transitioning from import-substituting economies, where governments implemented trade restrictions to protect domestic industries from foreign competition, to economies where market intervention was significantly reduced. Liberalized trade meant a reduction in import controls, as well as tariff and non-tariff barriers. This transformation was instigated by the World Bank, International Monetary Fund (IMF) and the United States Agency for International Development's (USAID) structural adjustment programs (SAPs). SAPs refer to a variety of efforts aimed to restructure the economies of developing countries (Perkins et al. 2013). SAPs often conditioned loans to developing countries on their commitment to macroeconomic policy changes meant to facilitate more open and free-markets (Potter et al., 2008; UNCTAD, 2008). The World Bank did this in the form of Structural Adjustment Loans (SALs). The proposed changes, referred to as structural adjustment, were argued to increase market efficiency and, thereby, strengthen economic performance in developing countries (Perkins et al. 2013). These institutions also argued that the proposed changes would make international trade fairer, allowing all market participants to trade on a level playing field and give consumers the freedom to choose which goods they consume. Subject to these conditions, already highly indebted[1], less developed states were finally being held accountable for their use of international funds (Robertson 2006). In need of the financial assistance, many states were compelled to conform (Perkins et al. 2013).

Efforts to increase trade liberalization of African countries still persist today, be it multi- and bilateral aid agencies conditioning debt relief on the transformation of

[1] After a rise in oil prices in 1973 and 1979 led to low interest rates, many developing countries took out large loans to stimulate development. However, when the United States (US) Federal Reserve responded to inflation by decreasing the supply of US dollars, leading to appreciation of the dollar relative to other currencies and fiercely rising interest rates. These developing countries, which had taken large loans in US dollars with variable interest rates, were no longer able to service their debts (Perkins et al. 2013).

macroeconomic policy, or in the form of (inter-)regional or global trade agreements (Perkins et al. 2013). While trade liberalizing conditions are justified by the World Bank, IMF and economists as facilitating development in underdeveloped countries, their rationale and imposition has been criticized by others, who suggest that by limiting a state's ability to protect its own economy, SAPs harm developing countries (UNCTAD, 2008; Handa and King, 1997; Berry, 1996). In light of development goals set by the United Nations to address food security, it is important to understand how trade liberalization may contribute positively or negatively to food security (United Nations General Assembly, 2015).

The impact on the agricultural sector is particularly interesting to analyze, not only because African countries typically have a comparative advantage in agricultural production and rely heavily on the agricultural sector for livelihoods and national growth, but also because it contributes to a country's ability to be food self-reliant, which has implications for food security (Perkins et al. 2013). This is a particularly relevant discussion for African countries, for which the share of expenditures on food is typically greater than in more developed countries[2]. It is common for expenditure on food in poor households to be 50 to 70 percent of their total income (*ibid.*). Developing countries are, furthermore, typically net importers of food. This makes developing countries and their consumers particularly sensitive to a rise or decline in food prices (Perkins et al. 2013; Koning and Pinstrup-Andersen 2007). Sensitivity to shocks in food price and supply is important to both consumers and producers, due to the unstable nature of the agricultural sector and the price inelasticity of demand. What happens in the agricultural sector, therefore, has a more direct and greater impact on food security (Fabiosa 2008). Hence, more empirical research on the effects of trade liberalization on the agricultural sector is needed.

[2] This is explained by Engel's Law, which suggests that even if an increase in income is accompanied by an increase in total expenditure on food, the percentage of income spent on food will decline. That is because income is expected to increase at a higher rate than demand for food (Perkins et al. 2013).

Furthermore, with African countries typically having a comparative advantage in agricultural production, the agricultural sector has great potential for exports and stimulating economic growth in African countries (Koning and Pinstrup-Andersen 2007). Due to intersectoral linkages, growth in the agricultural sector is expected to trickle down into other sectors of the economy, stimulating overall development of a country. In fact, agriculture is estimated to be three times as influential as nonagricultural activities in combatting poverty (Perkins et al. 2013). Historically, agriculture plays a crucial role in early economic development, being a primary contributor towards GDP and employment. In 2008, agriculture was the largest sector in many low-income countries, making up for 25 percent of their GDP (*ibid.*). As countries become increasingly efficient in agricultural production, they tend to shift resources (i.e. labor or capital) from agriculture towards industry and services, allowing further growth (*ibid.*). This is exemplified in southern Asia, where agriculture's contribution to GDP went from approximately 41 percent in the 1960s to 22 percent in the 1990s (*ibid.*).

This paper, therefore, presents empirical evidence measuring the effect of trade liberalization on the agricultural sector, indicated by developments in the trade balance, output, employment, total agricultural revenue and efficiency of production. In doing so, economic arguments for free trade are discussed, as well as critiqued on the effectiveness of trade liberalization and minimization of state intervention in stimulating development (Potter et al., 2008, p.93; Handa and King, 1997; Berry, 1996). The effect of trade liberalization on the agricultural sector and its implications for food security are also discussed. In conducting the analyses, standard panel regressions are used, measuring the effect of trade liberalization across countries and across time. The panel data used comes from the World Bank's public database.

After discussing various theories on trade, agricultural liberalization and food security in Chapter 2, the research methodology will be presented in Chapter 3. After introducing the

data, empirical research will be conducted and the results presented and analyzed in Chapter 4. Finally, implications of the results for food security will be discussed in Chapter 5.

## 2. Theory

### *Free Trade and Comparative Advantage*

Efforts to liberalize trade are supported by ideas on free-market capitalism, which stress that by opening markets to free trade and competition, and allowing market forces to govern without state intervention, known as a laissez-faire economy, economies will become increasingly efficient and thrive (Dunkley 2004). Free trade implies that goods and services can flow freely from one country to another without facing policy barriers or regulations, such as tariffs, quotas, import licenses or bans, subsidies and restrictions on foreign activity, intended to assist or protect local producers from competition or boost exports (*ibid.*). Economists, however, argue that these inhibit a level playing field and allow goods to be sold at inflated or artificially low prices. They also argue that such barriers result in inefficiency, as producers have little incentive to lower costs and increase productivity, preventing increased consumption and greater revenues (*ibid.*). This is founded on the idea that competition stimulates an efficient reallocation of resources, such as labor or capital, from less-efficient to more productive and profitable activities, leading to economic prosperity and growth at a national and global level and, ultimately, human progress (Dunkley 2004; Moon, 2000; Perloff 2007).

Ideas on efficient production and allocation of resources in an international trade system are further explained by the theory of comparative advantage, also known as Ricardo's Theory (named after David Ricardo). According to this theory, a country has comparative advantage for a particular good if the opportunity cost to produce that good is lower than the opportunity cost for other countries to produce the same good. The opportunity cost is often determined by the technology available to them and its productivity (Robertson 2006; Perloff 2007). Although

other countries may have an absolute advantage over this certain good, meaning that they can produce the good at a lower cost than other countries, it may still be profitable for them to import the good, because the opportunity cost to produce the good is greater. By importing the good, they can focus and invest resources on production of other, more profitable goods (Perloff 2007; Salvatore 2010; Robertson 2006). If each country is to produce the goods for which they have a comparative advantage, all countries would be able to consume more of each product than if each were to produce for themselves (Moon 2000; Potter et al. 2008; Perloff 2007). That is why the 'gains from trade' doctrine states that free international trade allows countries to consume more and increase revenues (Robertson 2006). In an international trading system, international prices provide a signal and incentive for market actors to conform to comparative advantage (*ibid.*).

Ricardo's Theory on comparative advantage was developed further by Eli Heckscher and Bertil Ohlin in the Heckscher-Ohlin model. According to the Heckscher-Ohlin model, comparative advantage is not determined by the technology available to each country, but rather by each country's factor endowments (Salvatore 2010; FAO 2003; Robertson 2006; Perloff 2007). According to Heckscher and Ohlin, countries can determine in which sector their production is most efficient based on how plentiful they are in land, labor and physical or human capital, although this may also be influenced by climate or their wealth in natural resources (Krugman and Wells 2015; Rodet 2017; Dunkley 2004). Countries with a relative endowment of land and labor will most likely have a comparative advantage in agricultural production, as is the case in many African countries (McCulloch, Winters and Cirera 2001).

By following the theory of comparative advantage, resources within a country will automatically shift from inefficient sectors to more efficient ones. By doing so, employment, for example, is released and made available for more productive and profitable activities (Moon 2000; Potter et al. 2008). Economists, thus, argue that all countries would benefit from the

gains of trade in such an international free-trade system, by making the most efficient use of their resources and ensuring that there are more goods available for consumption (Robertson 2006).

### *Protectionism and Import-Substitution Industrialization*

Despite this, states often place protectionist measures, such as quotas and tariffs, to limit imports, or subsidies, to increase production and stimulate export. These protectionist measures stem from mercantilism, which prevailed from the 16th to 18th century, when Western European governments restricted imports, particularly of agricultural goods, and stimulated exports in order to facilitate industrial growth and the growth of their national economy (Moon 2000). By restricting imports, states allowed domestic firms to capture a greater share of the domestic market, giving more certainty to local producers. As one of the goals under mercantilism was to be autonomous and food self-sufficient[3], the agricultural producers particularly benefited from this system. Not only were they assured sales to individuals, but also to the industrial sector, such as food processors, who could not rely on cheap imported inputs. This was also the timeframe in which the Agricultural Revolution took place and producers significantly increased productivity. Not only did this strengthen and assure revenue and employment in the agricultural sector, but it also stimulated industrial growth (*ibid.*).

In the past century, newly independent and developing countries have attempted to model this system through import-substitution industrialization (ISI). Through ISI, countries would impose import barriers, such as tariffs, licenses or quotas, to shield domestic firms within a certain sector from foreign competition (Perkins et al. 2013; Robertson 2006; Moon 2000). This was done with the purpose of replacing imported goods with domestically produced goods, so that local firms would be guaranteed sales and an opportunity to increase their

[3] Food self-sufficiency refers to the "production of food in quantities consumed domestically" (World Health Organization and Food and Agricultural Organization 2003, chp.3), ruling out any form of dependence on imported food.

capacity (Perkins et al. 2013; Moon 2000). The aim was for local producers to increase productivity, such that their exports could compete on the global market. By encouraging exports, countries could increase their consumer base and their GDP. They could also improve their trade balance, such that the value of exports increases relative to imports, stimulating economic growth. It is generally speaking better to avoid an excess of imports over exports, or a trade deficit, because when a country consumes imports from other countries, they forego profits and employment that could have been theirs, stimulating growth of foreign economies rather than their own (Moon 2000). Furthermore, the value of exports determines a country's ability to finance imports. Some argue that trade deficits are risky for net-importing countries, because they may at some point have difficulty financing the imports they depend on (World Health Organization and Food and Agricultural Organization 2003). Other economists, however, would argue that this is a mercantilist approach and that, in practice, a trade deficit is not problematic. According to Perkins et al. (2013), there are three alternatives to financing a deficit. Namely, borrowing from foreign governments and banks or international institutions; attracting investments; or cutting back on their stock of foreign reserves.

Many developing countries pursued ISI in response to reduced international trade and collapsing commodity prices in the 1930s, which resulted in increased import restrictions in developed countries (Robertson 2006). Developed countries were also becoming increasingly productive, technologically advanced, able to resemble tropical growing environments and develop artificial substitutes for certain commodities. Developing countries, which were particularly dependent on primary commodities for export, began doubting arguments on the gains of trade and the future of primary commodity exports. Instead, they turned to ISI, believing industrialization was the road to development (*ibid.*). The idea was to shift production from primary commodities, where productivity was low, prices fluctuated and opportunities for export were decreasing, to manufactured goods (Perkins et al. 2013). However, because

manufacturing in developing countries was underdeveloped relative to those in developed countries, promoters of ISI believed it was necessary for governments to protect against importation of certain goods, in order to allow local producers to increase productivity and develop to a globally competitive level (*ibid.*). Import restrictions raised the prices of imports, reduced the overall quantity of imports and allowed domestic producers to charge higher prices for their manufactured goods. This was necessary to compensate for higher production costs (*ibid.*). However, when governments discovered that domestic demand for manufactured goods was too low, due either to low population size or low per capita income, and would not result in efficient production, they increased exports by demanding preferential access to markets in Organization for Economic Co-operation and Development (OECD) countries (Robertson 2006; Perkins et al. 2013). Thus, some countries became more export oriented, which economists argue was an opportunity for producers to be exposed to competition and new technology, encouraging them to increase productivity (Perkins et al. 2013).

While a few countries were successful in using the ISI strategies, these were primarily larger economies whose success began when they opened their borders for trade (Perkins et al. 2013; Robertson 2006). On the contrary, most cases of ISI were not successful, which is evident from the considerable number of infant industries in developing countries, in Africa and elsewhere, that never managed to compete at a global level (*ibid.*). Economists argue that this is, in fact, because they protected their industry from competition or protected them for too long, limiting their access to new ideas and technology, as well as their incentive to innovate and increase efficiency. Furthermore, by limiting exports and thereby their consumer base, firms were not able to take advantage of economies of scale (*ibid.*). In the meantime, local consumers bore the costs through higher prices, producers maintained high production costs and limited profits, and governments accumulated huge debts (Perkins et al. 2013).

Most economists have reservations against the ISI strategy to development, except for with infant industries. In the case of infant industries, economists can overlook the inefficiencies of ISI under certain conditions. First and foremost, protecting infant industries should be a temporary measure. Thus, tariffs should decline overtime, as productivity increases and costs decrease, until the infant industry is able to compete at the global level without any protection (*ibid.*). Economists argue that tariffs should only be used if the expected benefits to society are greater than the costs of protection, i.e. the infant industry would need to be healthy enough to survive on the global market and capable of reaching this level (*ibid.*).

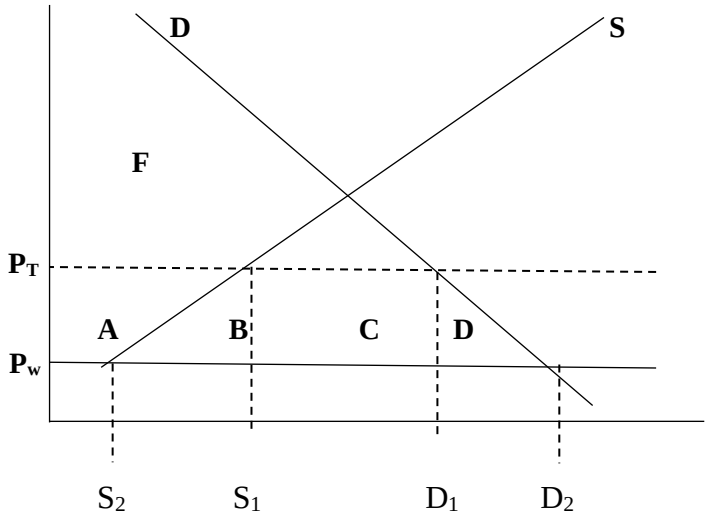


**Figure 1** – When states set tariffs, they effectively increase the price of a good from Pw to $P_T$. By doing so, they raise the producer surplus by Area A. Area F represents the consumer surplus, or resources that they would have been willing to pay, but could save or spend elsewhere. Tariffs also allow production to continue inefficiently, rather than letting resources be used more efficiently elsewhere. Area B therefore represents the inefficient use of resources that could have been used more efficiently elsewhere. Area D represents the consumption inefficiency, because the consumption decreases with a higher price. Together Areas A and D form the deadweight loss. Area C represents the government revenue from the tariff.

Nonetheless, economists hold many reservations against the ISI strategy, which can be illustrated using supply and demand curves, as presented in Figure 1. When governments place tariffs, the price of a good increases from $P_W$, world price, to $P_T$, price in a protected economy. Imports are reduced from $D_2 – S_2$ to $D_1 – S_1$. This means that producers who are not cost-

effective enough to sell their good at $P_w$ are now able to sell their goods locally at a higher price. However, by setting a tariff, resources continue to be used inefficiently, rather than being freed for more efficient economic activities, as theories on comparative advantage suggest would happen in a free market. This is demonstrated by the producer surplus (Area A) and production inefficiency (Area B) in Figure 1. Furthermore, because consumers are forced to pay a higher price, some decide to forego purchasing, resulting in a consumer loss (Area D). Ultimately, total welfare loss to consumers, is equal to Area A + B + C+ D, because it represents what they would have saved or spent on other goods, if they had been able to buy the good at the world price (Perkins et al. 2013; Robertson 2006).

Thus, economists argue that by forcing consumers to pay higher prices, ISI transfers resources from consumers to inefficient import-competing producers (Robertson 2006). While one of the aims of ISI is to give infant industries the chance to increase productivity, economists argue that by protecting these industries from competition, they are in fact allowing producers to continue being inefficient. Without competition, they have little incentive to increase efficiency. Thus, there is a loss of utility to consumers and a loss of potential profits to producers (Perkins et al. 2013).

Though the mercantile system in Western Europe and ISI strategies in developed countries have passed, certain elements continue to be used today. For example, import restrictions frequently take the form of tariffs, but also non-tariff barriers, such as quotas, licensing, product safety standards, regulations on hygiene, labor or local content, and occasionally, prohibition. While some of the non-tariff barriers may serve various purposes, or be more discreet forms of protectionism, they nonetheless serve to protect domestic employment and company profits, provide government revenue, and influence the balance of trade (Moon 2000; Robertson 2006).

Alternatively, subsidies are used to boost certain industries, stimulate an increase in production and export excess produce. Just as tariffs do, subsidies also distort world prices and trade. Subsidies stimulate overproduction and export of goods that in reality firms do not have a cost advantage in. Excess goods are dumped on the global market for artificially low prices. As subsidized producers sell for below the cost-price value and increase their share within foreign markets, even producers in countries with comparative advantage have difficulty competing (UNDP 2003; McCulloch, Winters and Cirera 2001).

While economists prefer a free market, with no state intervention, some have shown preference for subsidies over tariffs, because the deadweight loss incurred is lower. This is illustrated by Area B in Figure 2, which represents resources that could have been used more efficiently elsewhere. Contrary to using tariffs, subsidies create no loss of consumer welfare. This is because subsidies shift the supply curve to the right, without changing the price, so consumers pay the same price. Unlike tariffs, where consumers pay the costs, subsidies are funded by the government. Because funds come from taxpayer money, the total cost of the subsidy (Area A + B) is less visible to society (Perkins et al. 2013).

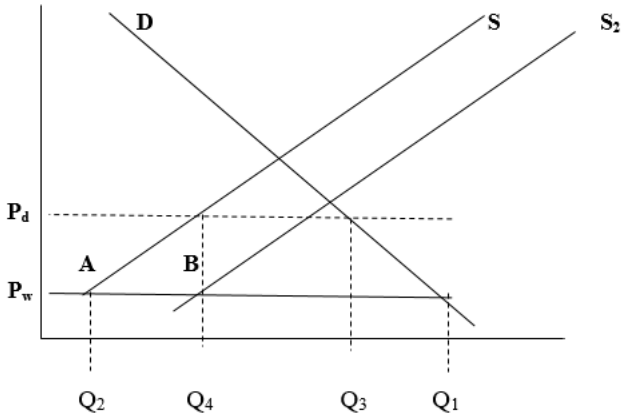


**Figure 2** – When states subsidize production, production costs are lowered for producers. The supply curve shifts to the right and production shifts from $Q_2$ to $Q_4$. However, consumers still purchase $Q_1$ at $P_w$, because the price remains that same. Therefore, subsidies do not result in any consumer loss. Area A represents the producer surplus. Area B represents the deadweight loss, or the inefficient use of resources that could have been used more efficiently elsewhere. Together, area A and B represent the cost of the subsidy, which the government pays for with taxes. Therefore, the burden is shared by society as a whole, not just amongst consumers.

### *Contemporary International Trade*

However, because of the trade-off between the efficiency and increased consumption that comes with a free market, and the social justice and self-sufficiency that comes with protectionist measures, no state has fully accepted either. All continue to practice a mix of liberal and protectionist measures (Moon 2000). Developing countries typically rely on tariffs, while developed countries, with more capital and established institutions, also make use of various more discreet, non-tariff barriers to trade, such as subsidies, and health and safety standards (Moon 2000; Tutwiler and Straub 2007).

Because states will always seek trade policies in their best interest, the World Trade Organization (WTO), previously the General Agreement on Tariffs and Trade (GATT), continues to push for international free trade agreements that will increase efficiency of the global market. Liberalizing agricultural trade has proven to be particularly difficult. Realizing that agricultural liberalization would require a trade-off with other values (i.e. self-sufficiency) and could have distributional consequences[4] for their own citizens (i.e. lower producer prices and profits, threatened employment), most countries only sought free trade agreements with reduced tariffs on their main export crops (Moon 2000).

With agricultural policies costing consumers an estimated 200-300 billion USD per year in the form of subsidies and inflated market prices, the WTO finally succeeded in 1995 to close loopholes that had long distorted markets, by requiring all non-tariff barriers, including quotas and subsidies, to be replaced by tariffs by 2001 in developed countries and 2005 in

[4] The distributional consequences of trade refer to the fact that protectionist measures intended to support some producers or industries may in fact harm others. For example, by restricting imports of a certain good in order to protect domestic producers of that good, an industry that once relied on cheap imports of the same good may incur higher costs due to the protectionist measures. Other instances may lead to unemployment (Robertson 2006). Advocates for protectionist policies argue that government intervention in trade is necessary for stability, social justice and specific distributional outcomes. Others point out that protectionist measures are futile unless governments sufficiently invest in infrastructure, research, technology, institutions and facilitate input and output markets (Koning and Pinstrup-Anderson 2007). This also includes making credit or capital accessible for producers to make necessary investments (Koning and Pinstrup-Andersen 2007). Others argue that protectionist measures are not even necessary, because if governments invest in the above and provide alternative means of employment, the distributional consequences can be minimized.

developing countries. This transformation increased the measurability and comparability of protectionist measures across countries. Furthermore, states were to reduce tariffs by 25 percent and 10 percent, in developed and developing countries, respectively (*ibid.*).

The implementation and success of agricultural liberalization in developed countries, such as the U.S. or members of the EU, have been criticized for continuing to influence agricultural production indirectly by providing subsidies in other, more discreet forms, such as subsidies on land or export credits (Robertson 2006; Dawkins 1999). In fact, it is primarily the OECD members that determine global markets, due to their extensive agricultural systems built upon technological advancement and high capital investments (Tokarick 2003; Robertson 2006). Despite developing countries, including those in Africa, having an abundance of land and cheap labor and, thus, comparative advantage in agricultural production, imports from OECD countries continue to be threatening (McCulloch, Winters and Cirera 2001; Robertson 2006).

In addition to heavily subsidizing agriculture, the EU has been criticized for its degree of protectiveness over the agricultural sector. This is evident from the Lomé Convention, for example, which was a nonreciprocal trade agreement between the EU and African, Caribbean and Pacific (ACP) countries. Four different agreements, each a part of the Lomé Convention, were signed between 1975 and 2000, which gave former colonies of EU member states duty-free access to the EU market. However, many agricultural products were excluded from these agreements. Some, such as bananas and rice, could be imported at a low- or zero-tariff, but only up to a certain amount (Blandford 2007). Despite new trade agreements, such as the Cotonou Agreement, the Economic Partnership Agreements (EPA) and the Everything But Arms (EBA) agreement, which have increased liberalization, the EU continues to be criticized for disrupting agricultural markets.

### *Food Security and the Agricultural Sector*

As recognized by the Food and Agriculture Organization of the United Nations (2003), trade and competition directly affect agricultural production, prices, employment and revenue, which in turn affects food security. Food security is a multi-faceted term, which has been defined in numerous ways (FAO 2016; FAO 2003). While some study food security as the availability of food, others study consumption and nutrition. Likewise, some study food security at a national level, while others study it at regional or household level. Though there have been countless more micro-level definitions, taking into consideration distribution, consumption and subsistence farming, due to lack of available data, this paper will primarily consider national food security based on food production and general developments in the agricultural sector.

In addition to being a source of income and employment, the state of the agricultural sector affects the availability and price of food, and ultimately determines food security in African countries (Ali and Taukder 2010). When food prices increased in 2008, food imports increased by approximately 75 percent in developing countries and an additional 40 million people went hungry (Perkins et al. 2013). That is because poor households, including agricultural producers, are typically net consumers of food. This crisis demonstrates just how vulnerable people in developing countries are to rising food prices and the consequences it has for their food security. Only producers who can sell plenteous amounts can benefit from rising food prices (Perkins et al. 2013). Furthermore, destabilization from food price shocks are felt economy-wide. That is because with a lower purchasing power, a significant portion of total expenditures spent on food and a price inelastic demand for food, consumers will demand fewer non-agricultural goods and services as food prices increase. Furthermore, investors who rely on price signals to make investment choices, both in the agricultural sector and other sectors

of the economy, may avert investments or make less sound choices due to confusing price signals (*ibid.*).

A well-established agricultural sector is crucial for food security in developing countries, particularly in the early stages of development, since it serves as a source of affordable food, ensures employment, generates income and stimulates development in other sectors of the economy through intersectoral linkages (Johnston 1970; Rozelle and Swinnen 2004; Ali and Talukder 2010; FAO 2016). The intersectoral linkages can be found in several ways. For instance, when the agricultural sector increases productivity, it reduces prices and frees up labor and capital for other economic activities. Those whose increased productivity compensates for lower prices see a rise in income and are able to spend more on non-agricultural goods. Consumers, whose food costs are reduced, are also able to increase nutritional diversity and spend more on non-agricultural goods. Furthermore, by providing sufficient and affordable food for consumers, the agricultural sector assures a healthy labor force (Perkins et al. 2013). The capacity of an agricultural sector to stimulate growth in non-farming sectors is also known as agriculture-demand-led-industrialization (*ibid.*). Since excess production of food and non-food agricultural goods can be used as inputs in local industries or can be exported, earning foreign currency, excess production is beneficial for individual producers and the national economy.

Economists have attempted to quantify the direct and indirect effects of agricultural growth on national economic growth using 'growth multipliers,' or the effect of a $1 increase in agricultural value on the aggregate GDP. The impact is greater when benefits are widely spread amongst producers and when agricultural employment holds a greater share of total employment (*ibid.*).

Because of its links to other sectors of the economy and its multiplying effect, the agricultural sector has been referred to as an "engine of growth" for developing countries (Ali

and Taukder 2010). Unfortunately, despite their comparative advantage in agricultural production, establishment of the agricultural sector in many African countries is limited. Not only is productivity lower than in more developed countries, but there is often also less diversity in exports. This is because these countries were historically subsistence producers and did not have the infrastructure, capital, technology or institutions to develop themselves as other countries did to compete on the global market.

For African countries to fully reap the benefits of this sector, it is essential that they increase their capacity and productivity of the agricultural sector (measured in terms of land, labor or capital inputs) to maximize profitability. Doing so is necessary to sustain agricultural development in the long run, since when costs are reduced, producer incomes rise (Perkins et al. 2013). Increasing competitiveness would lower production costs, making food more affordable and farming more profitable. Even producers who are net-consumers can benefit from a decrease in prices, assuming that the gains in reduced spending are greater than their loss of income (*ibid.*). Of course, the livelihoods of producers who are net-sellers rather than net-consumers are particularly at risk. Producers whose productivity increases at a faster rate than prices are better able to cope, however, which once again highlights the importance of productivity growth (*ibid.*).

Developing countries, however, are often not in a position to benefit from free trade, be it in the agricultural sector and other sectors alike, which is why local farmers are often threatened by the steady supply of cheap imported food (FAO 2003; FAO 2016). Because prices are determined by the global supply, local prices no longer reflect local production, which threatens local producers' livelihood and their ability to purchase food (Ali and Talukdar 2010; McCulloch, Winters and Cirera 2001).

While access to cheaper inputs (i.e. new seed varieties, pesticides or fertilizers) may reduce production costs and increase productivity for some, not all producers have access or

capital to take advantage of these cheap inputs (FAO 2003; Perkins et al. 2013). This is because limited market access, weak institutions and restricted capacity in the agricultural sector do not allow producers to respond to market opportunities. This is where governments can play an essential role in stimulating growth and ensuring equal distribution of the benefits between rural and urban producers. They can do this by investing in sufficient infrastructure and research, and facilitating input and output markets (Perkins et al. 2013). Undergoing technical change is also crucial to raising productivity. However, due to diversity and the need for context-specific production methods, governments face many challenges in disseminating technology and ideas to highly dispersed producers. Unless they are adopted *en masse*, the impact and growth of the sector will be limited (*ibid.*).

Instead, governments in developing countries have primarily relied on tariffs to protect local producers from competition and give them the opportunity to increase their capacity and fully exploit the potential of their agricultural sector (Tutwiler and Straub 2007). However, just as producers are not able to benefit from free trade, producers' ability to increase their capacity in a protected market is still limited due to insufficient technology, institutions and market access (Perkins et al. 2013).

Economists also argue that tariffs do more harm than good in developing countries for a variety of reasons. As previously mentioned, tariffs increase food prices for consumers and take away the incentive for producers to increase competitiveness. Higher prices under a tariff are also expected to harm producers, as most subsistence farmers consume more than they produce (Tutwiler and Straub 2007). Furthermore, when consumers are dependent on local production, which fluctuates with irregular weather, consumption is also subject to variation. In a free market, however, food imports can stabilize the supply of food across countries, as supply and prices will be less volatile to shock. That is due to an increase in the number of suppliers, but also because supply and prices no longer depend on local conditions, such as

climate and economic or political stability. Because domestic shortfalls are cushioned by global production, consumption and food security are stabilized (*ibid.*). Therefore, tariffs not only take away the incentive to be efficient, but by increasing food prices and limiting availability of food in times of crisis, they threaten food security (*ibid.*).

Despite this, tariffs were also placed with the idea of pursuing self-sufficiency and allowing money to circulate domestically, spill over into other sectors and boost national growth, rather than exiting the local economy and stimulating growth of foreign economies (Byerlee, Echeverria and Gillespie 2005). However, as Moon (2000) explains in his book *Dilemmas of International Trade*, relying on exports of primary products is not promising for the long-term development of a country, due to low and sometimes declining prices, slow increases in demand, and volatility in output and export earnings due to fluctuations in harvest. That is also why diversification and expanding production to include cash crops with a higher price, such as cocoa, is advised by development economists. This increases stability of the sector and poor farmers' ability to escape poverty and increase food security (Perkins et al. 2013; Tutwiler and Straub 2007). However, for this to be successful, expanding the consumer base to include foreign markets is important (Tutwiler and Straub 2007). Moon (2000) also argues that export of primary products, rather than domestically processed products, severely limits agriculture-demand-led-industrialization, because exporters forego the opportunity to support the local manufacturing and services sector, which is essential in overcoming a dependency on the agricultural sector (Ali and Talukder 2010). The growth multiplier would, thus, be greater if raw goods were to be processed domestically, as this would boost local economic growth in the long-run.

In any case, the FAO (2003) recognizes that while trade liberalization can benefit a nation in terms of food security, this is not guaranteed. This is because whether agricultural openness and lower prices is good for the national economy depends on whether a country is a

net consumer or net producer. Net-importing countries benefit from lower prices, because as the value of imports decreases relative to exports, they experience a healthier trade balance (FAO 2000). A rise in food prices, however, would be particularly harmful to net-importing countries, because food is a necessity and higher prices on food imports would increase total expenditures and worsen the trade balance (*ibid.*).

Additionally, whether lower food prices increase or decrease food security also depends on the situation of those who are food insecure and where they find employment. As explained by the FAO (2003), many of the world's poorest families depend on agricultural production as a source of income. Thus, if lower prices lead to lower revenues and increased unemployment, food security could worsen in these countries. That is because even if food becomes more affordable through cheap imports, households may lose the income needed to pay for food.

Nevertheless, even if trade liberalization results in higher food security for a nation as a whole, not all groups of society will benefit from trade liberalization, as they may differ between and within groups of consumers and groups of producers, in terms of their access to markets and capital (*ibid.*). Once again, that is where governments play an essential role in stimulating agricultural growth and limiting distributional consequences, thereby guaranteeing that all producers have access to international markets and the means to make investments, while ensuring that those who are not able to compete, can find employment elsewhere.

### *Anticipated Impact of Trade Liberalization on the Agricultural Sector*

This research tests several hypotheses. How each of these are related to each other is presented in Figure 3.

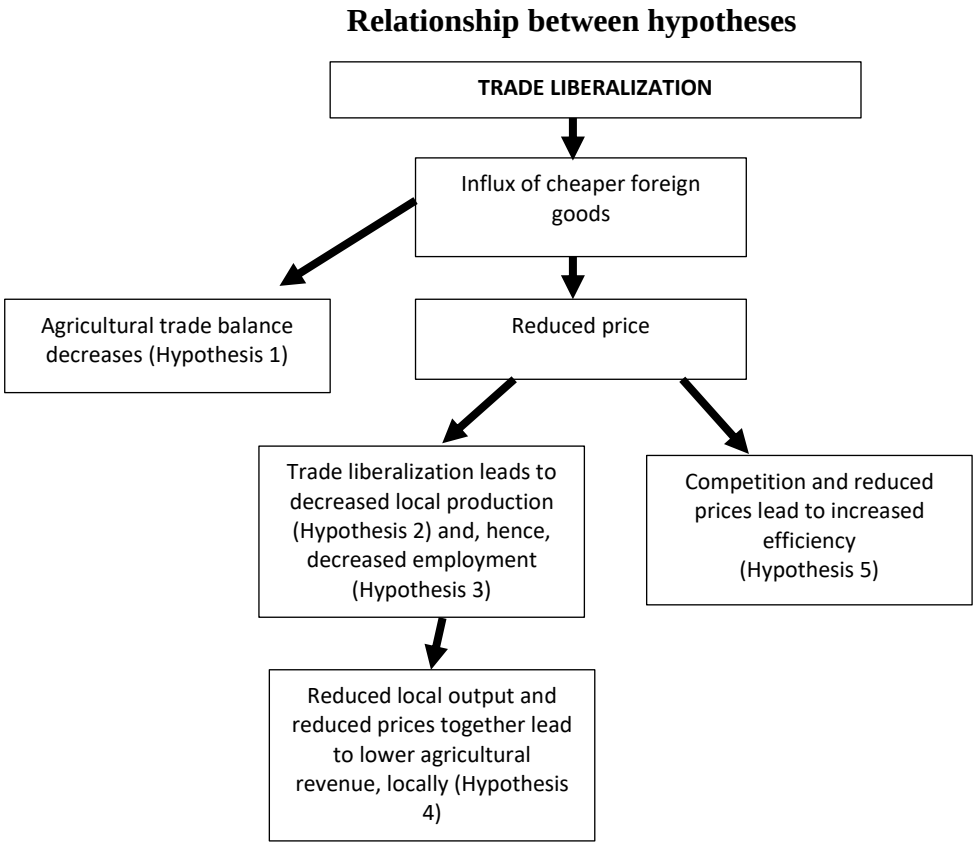


**Figure 3 –** Relationship between hypotheses

*Hypothesis 1: If trade is liberalized, the agricultural import to export ratio will increase.*

*Null-hypothesis: If trade is liberalized, the agricultural import to export ratio will not be affected.*

Liberalizing trade reduces the barrier for foreign produced goods to enter African markets, causing an expected increase of cheap imported agricultural goods. These foreign produced agricultural goods are expected to be cheaper than local produce, due to provision of government subsidies and use of more efficient technology in more developed countries.

Because less-developed countries historically consist of subsistence farmers and are relatively new to commercial farming, producers are not expected to be able to compete on the world market at these artificially low prices. That is because local producers' have limited access to the capital and technology necessary to invest in higher production and export, and insufficient infrastructure and institutions further limits their access to the world market. Hence, with an expected increase in agricultural imports and an expected level or decrease in exports, the agricultural trade balance is expected to decrease.

Research by El-Wassal (2012) in 20 Arab countries between 1995-2010 supports this hypothesis, showing a positive and statistically significant relationship between trade liberalization and imports. Similarly, Santos-Paulino and Thirlwall (2004) use panel data on 22 developing countries to determine the effect of trade liberalization in the mid-1970s on import and export growth and the resulting trade balance. They, too, conclude that trade liberalization caused imports to grow more than exports, worsening the trade balance.

*Hypothesis 2: If trade is liberalized, local agricultural output will decrease.*

*Null-hypothesis: If trade is liberalized, local agricultural output will not be affected.*

A shift of the supply curve to the right, caused by the influx of imported agricultural goods, results in an overall higher quantity of output. However, this increase in total output does not reflect domestic output, but rather the number of imported agricultural goods. On the contrary, domestic output is expected to decrease, because at the new and lower market price, quantity supplied by producers will be less. As illustrated in Figure 4, local agricultural output drops from Q to $Q_S$.

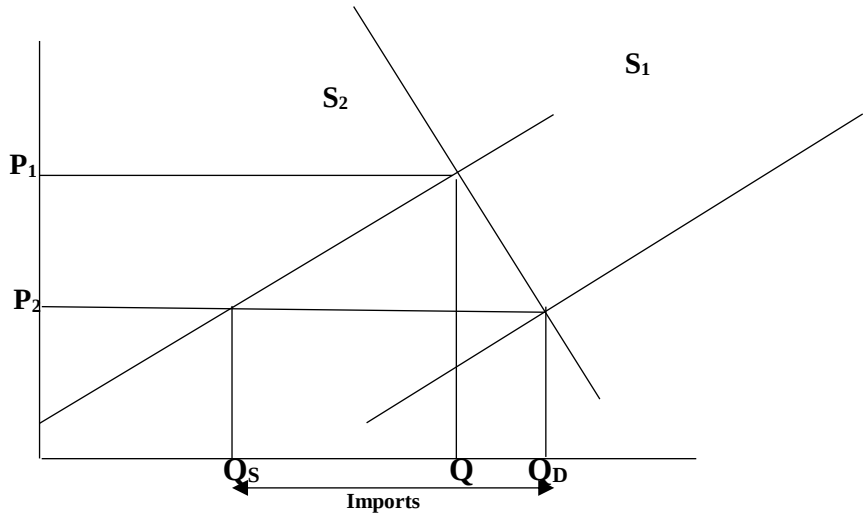


**Figure 4** – When trade is liberalized, the supply curve shifts from $S_1$ (representing domestic supply) to $S_2$ (representing domestic supply + imports). As a result, the price drops from $P_1$ to $P_2$. At $P_2$, some domestic suppliers decide to exit the market, because production is no longer profitable. Thus, the quantity of domestically produced goods drops from Q to $Q_S$. However, demand at $P_2$ is higher. The difference between quantity supplied domestically, $Q_S$, and quantity demanded, $Q_D$, is imported.

This hypothesis is supported by Despeignes (2004), who studies the effect of trade liberalization on the agricultural sector in Haiti. Despeignes' findings show that, despite the pivotal role of the agricultural production to the rural population and its role in ensuring food security, trade liberalization drastically decreased production of food crops and did not increase production of cash crops.

*Hypothesis 3: If trade is liberalized, the agricultural sector will see reduced employment.*

*Null-hypothesis: If trade is liberalized, employment in the agricultural sector will not be affected.*

Because a shift of the supply curve to the right, due to an influx of imported agricultural goods, results in a lower market price and not all producers can compete at a lower price, some agricultural producers are expected to drop out of the market. The least efficient are expected to exit, while those who are most efficient or have the means to increase efficiency, are more likely to continue producing. Thus, as a result of foreign competition and some producers'

inability to compete at lower prices, a decrease in overall agricultural employment is expected, freeing up labor for other more efficient economic activities.

No evidence was found in support of this hypothesis in the agricultural sector, but there is evidence from the manufacturing sector. Evidence from Revenga (1997), who conducted research on the manufacturing sector in Mexico, supports this hypothesis. Her research shows that trade liberalization reduced employment, as well as wages. Gaddis and Pieters (2017), who studied the impact of trade liberalization on employment of both men and women in Brazil, also find evidence supporting this hypothesis. Their findings show a negative effect on employment altogether, as workers lose their jobs and are reallocated to other sectors or remain unemployed or inactive. This negative effect on employment is found for both men and women, but is particularly concentrated on low-skilled workers.

*Hypothesis 4: If trade is liberalized, total domestic agricultural revenue will decrease.*
*Null-hypothesis: If trade is liberalized, total domestic agricultural revenue will not be affected.*

Total agricultural revenue is determined by the quantity of output times the price. Because trade liberalization would shift the supply curve from $S_1$ (domestic production) to $S_2$ (domestic production + imports), as illustrated in Figure 5, the price is expected to decrease. This is expected to lower the total domestic agricultural revenue for two reasons. For one, because food is a basic necessity and its demand is inelastic. This is illustrated by a steep slope of the demand curve. This means that a relatively low increase in demand does not compensate for the decrease in price. Thus, total revenue is lost. Secondly, in the case of an influx of foreign agricultural goods, although the total number of goods supplied to the local market increases, domestic producers supply and sell less, because profitability at the new and lower price is not worth producing for all potential suppliers (McCulloch, Winters and Cirera 2001). This means

that at the new equilibrium price, the total revenue of the local agricultural sector decreases (Perloff 2007). No previous research in support of this hypothesis was found.

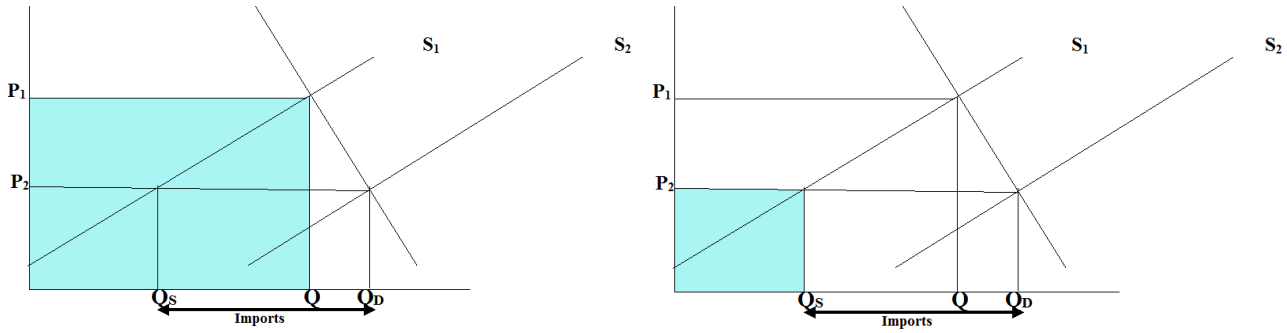


**Figure 5 –** When states liberalize agricultural trade, total domestic agricultural revenue is expected to decrease from the blue shaded area on the left (in a protected market) to the blue shaded area on the right (in an open market).

*Hypothesis 5: If trade is liberalized, agricultural production will become more efficient.*

*Null-hypothesis: If trade is liberalized, efficiency of agricultural production will not be affected.*

With the influx of cheap, foreign produced agricultural goods, competition increases for local producers. To remain profitable at lower prices, caused by a shift of the supply curve to the right and synchronization with global market prices, producers need to increase efficiency of production, producing more agricultural goods at a lower cost. While not all producers will be competitive, those who continue to produce are expected to increase productivity. This may be enabled through access to capital or extension services, for example. As a result, an increase in efficiency of agricultural production is expected.

Results from Salim and Hossain (2006), who conducted research on the effect of trade liberalization on Bangladesh's agricultural sector, support this hypothesis. They found that trade liberalization improved agricultural efficiency by 8 percentage points between 1977 and 1997, which they attribute to the improved access to, amongst others, new seed varieties and technology. Hart, Miljkovic and Shaik (2015) conducted research in the EU's agricultural sector, also finding that trade liberalization increases efficiency in the long-run. Pavcnik (2000)

and Njikam and Cockburn (2011) conducted similar research on the manufacturing sector. Pavcnik (2000) found that trade liberalization led to a reallocation of resources from less efficient to more efficient producers, which increased productivity of Chilean manufacturing plants. Njikam and Cockburn (2011) found comparable results in Cameroon's manufacturing sector, measuring a significant increase in total factor productivity after liberalization. This was especially the case amongst plants in the import-competing sector.

## 3. Methodology

### *Research Approach*

A large-N observational research will be conducted using cross-sectional time-series data to answer the research question, "What was the effect of trade liberalization on the agricultural sector in African countries?" The African continent was selected as a unit of analysis because, at the time of liberalization, all countries were labelled as developing countries (United Nations 2017). Studying the effect of liberalization on developing countries is particularly interesting, since although economists argue that free trade benefits all countries, having less developed infrastructure and institutions, and limited access to capital can limit producers' ability to exploit trade opportunities. Data will be collected from the World Bank's public database and used to conduct and analyze standard panel regressions.[5] The causal effects of trade liberalization on trade balance, efficiency, output, employment and total revenue of the agricultural sector will be inferred based on the significance of variation in the quantitative data. Because standard panel regressions control for both country-specific effects, which considers heterogeneity between countries, and time-specific effects common to all countries, measurements of trade liberalization's effect on the agricultural sector are sharpened.

[5] Some of the World Bank's data was collected by the UN Food and Agriculture Organization (FAO).

This is a deductive research in which positive empirical analyses will find evidence for or against theories on trade liberalization and its effects on the agricultural sector. Finally, once the regression analyses have been conducted, implications of the results will be discussed in light of the theory. Implications for food security will then also be discussed.

### *Unit of Analysis and Case Selection*

The treatment group includes all African nations that liberalized trade by the end of 1995, which are a total of 26 countries[6]. Alternatively, the control group will be African countries which did not liberalize trade until after 1995, a total of 27 countries.[7] The selected cases being analyzed include each country's agricultural sector between 1975 and 1995.

Table 1 gives an overview of the descriptive statistics of the treatment and control groups in 1975, pre-reform, and in 1995, post-reform. Unfortunately, the control group lacks significantly more observations in the pre-reform period than the treatment group. From the descriptive statistics, we see that although trade as a percentage of GDP started off higher in the control group than in the treatment group, it grew much more in the treatment group between 1975 and 1995. The ratio of agricultural imports to exports decreased in the control group, improving the trade balance, where as it rose in the treatment group. It should be noted, however, that the deficit was higher in the control group, both pre-reform and post-reform. Although the agricultural GDP per capita growth rate increased more in the treatment group than in the control group, the agricultural GDP growth rates increased in both. Furthermore, we see that the annual GDP growth is about 1 percent higher in the treatment group pre-reform than in the control group. GDP growth increases by 2 percent in the treatment group post-

[6] See Table 2

[7] Countries included in the control group are Algeria, Angola, Botswana, Cape Verde, Chad, Comoros, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Lesotho, Liberia, Libya, Madagascar, Mozambique, Namibia, Nigeria, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Zambia and Zimbabwe. Due to its late independence, data on South Sudan falls under that of Sudan.

reform, while hardly increasing at all for the control group. GDP per capita growth increased drastically in both groups, however.

The cutoff year 1995 was chosen to avoid interference with the implementation of other trade agreements, such as the WTO Uruguay Round. The WTO Uruguay Round, which was established in 1995, required an increase in agricultural liberalization across developing and developed countries. Though setting the cutoff line at 1995 limits the total number of observations, the advantage is that it prevents results from also capturing the effect of agricultural liberalization in wealthier countries.

For the purpose of this research, a country is classified as having liberalized trade if they completed a structural adjustment loan (SAL) from the World Bank, since SALs were a major contributor to liberalization of the agricultural sector in developing countries (Ostensson 2007). SALs were loans granted to governments of developing countries under the condition that they implemented certain structural changes. According to the World Bank, these were designed to help highly indebted and less developed countries to stabilize and encourage growth, as well as improve their debts (World Bank 1992). It included not only conditions on liberalizing trade, but also improved management of public services, social spending cuts, labor policies, restructuring of the banking system, currency devaluation and management of financial resources (World Bank 1992; Perkins et al. 2013; Goldsmith & Mander 2001). An overview of all countries that completed their loans in or before 1995 is provided in Table 2.

The choice to classify SAL beneficiaries as liberalized in trade is based on the conditions that were applied to the loans. The World Bank groups conditions into four different categories: a) improving investment efficiency and the business environment; b) improving factor markets; c) improving resource management in the public sector; and d) social sector reforms (World Bank 1992). Conditions to liberalize (agricultural) trade and let market forces rule are spread between these categories and include removing price controls so that prices

follow world market trends, privatization (i.e. sale of inputs), improving foreign direct investment, eliminating input subsidies (i.e. fertilizer, insecticide, phytosanitary products), removing licenses for and taxes on import and export, reducing tariffs, converting import tariffs to ad valorem taxes and simplifying import procedures (Perkins et al. 2013; World Bank 1992; Goldsmith & Mander 2001). Though execution rates could not be found per country, total implementation rates prior to receiving the final installment give a general indication of their progress. In Sub-Saharan Africa specifically, 86 percent of all conditions on trade policy, belonging to not only SALs but also other forms of World Bank assistance, were significantly implemented by the time they received their final installment of the loan. 73 percent were fully implemented. Similarly, 74 percent of all conditions on the agricultural sector were significantly implemented and 63 percent were fully implemented by the final installment (*ibid.*).

While these are conditions that explicitly affected the agricultural sector, conditions falling under other categories may still have indirectly affected the agricultural sector (*ibid.*). Conditions on the overvaluation of real exchange rates, for example, form an implicit tax on agricultural products. Similarly, conditions on government expenditure and subsidies fall under the category Improving Resource Management in the Public Sector, which constituted for 46 percent of the conditions placed. Hence, a significant number of SAL conditions affected trade and the agricultural sector, directly or indirectly, making SAL completion a valid characterization of trade liberalization (*ibid.*).

| | Control group in 1975 | | | | | Control group in 1995 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max |
| GDP growth (annual %) | 15 | 2.830 | 7.682 | -13.514 | 15.713 | 25 | 2.813 | 4.598 | -8.000 | 14.263 |
| GDP per capita growth (annual %) | 15 | 0.046 | 7.395 | -15.510 | 11.980 | 25 | 0.401 | 4.098 | -7.606 | 10.513 |
| Trade (% of GDP) | 16 | 73.228 | 34.903 | 34.798 | 134.292 | 24 | 74.465 | 35.376 | 14.772 | 159.418 |
| Ratio Agricultural Imports to Exports (USD) | 25 | 34.641 | 131.619 | 0.049 | 639.220 | 27 | 26.394 | 84.319 | 0.188 | 436.068 |
| Agricultural Value Added (USD/Hectare) | 26 | 60.220 | 221.442 | 0.000 | 1,139.075 | 27 | 409.144 | 1,134.003 | 0.000 | 5,302.422 |
| Real agricultural GDP growth rates (%) | 11 | 0.419 | 13.125 | -24.020 | 28.916 | 21 | 2.800 | 12.155 | -19.933 | 33.351 |
| Real agricultural GDP per capita growth rate (%) | 11 | -2.431 | 12.678 | -25.773 | 24.939 | 21 | 0.302 | 11.600 | -21.646 | 29.959 |
| Agriculture production index (2004-2006 = 100) | 25 | 57.770 | 22.440 | 24.100 | 124.340 | 27 | 77.554 | 20.683 | 48.050 | 151.620 |
| | **Treatment group in 1975** | | | | | **Treatment group in 1995** | | | | |
| Variable | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max |
| GDP growth (annual %) | 22 | 3.713 | 7.336 | -12.432 | 19.190 | 25 | 5.797 | 7.845 | -7.920 | 35.224 |
| GDP per capita growth (annual %) | 22 | 0.906 | 7.087 | -14.466 | 16.124 | 25 | 3.350 | 8.480 | -8.973 | 37.120 |
| Trade (% of GDP) | 23 | 57.905 | 25.882 | 19.566 | 99.635 | 25 | 65.732 | 27.584 | 30.972 | 128.313 |
| Ratio Agricultural Imports to Exports (USD) | 26 | 1.871 | 4.507 | 0.069 | 23.539 | 26 | 2.587 | 3.632 | 0.204 | 17.064 |
| Agricultural Value Added (USD/Hectare) | 26 | 58.173 | 48.616 | 0.000 | 174.587 | 26 | 265.556 | 681.486 | 0.000 | 3,573.418 |
| Real agricultural GDP growth rates (%) | 19 | 1.247 | 9.775 | -19.833 | 24.551 | 23 | 5.102 | 15.312 | -43.949 | 39.590 |
| Real agricultural GDP per capita growth rate (%) | 19 | -1.466 | 9.605 | -22.171 | 22.275 | 23 | 2.657 | 15.388 | -44.792 | 38.020 |
| Agriculture production index (2004-2006 = 100) | 26 | 50.698 | 17.944 | 24.010 | 88.900 | 26 | 72.504 | 13.758 | 51.920 | 108.440 |

**Table 1 –** Descriptive statistics pre-reform and post-reform

| | SAL Recipient | Year of Completion |
|---|---|---|
| 1 | Benin | 1990 |
| 2 | Burkina Faso | 1993 |
| 3 | Burundi | 1988 |
| 4 | Cameroon | 1991 |
| 5 | Central African Republic (CAR) | 1987 |
| 6 | Congo | 1989 |
| 7 | Côte d'Ivoire | 1982 |
| 8 | Democratic Republic of Congo (Zaire) | 1989 |
| 9 | Gabon | 1989 |
| 10 | Gambia | 1988 |
| 11 | Ghana | 1990 |
| 12 | Guinea | 1988 |
| 13 | Guinea Bissau | 1990 |
| 14 | Kenya | 1980 |
| 15 | Malawi | 1982 |
| 16 | Mali | 1993 |
| 17 | Mauritania | 1988 |
| 18 | Mauritius | 1982 |
| 19 | Morocco | 1989 |
| 20 | Niger | 1987 |
| 21 | Rwanda | 1993 |
| 22 | Sao Tome & Principe | 1990 |
| 23 | Senegal | 1987[8] |
| 24 | Togo | 1985 |
| 25 | Tunisia | 1990 |
| 26 | Uganda | 1994 |

**Table 2 –** Completed Structural Adjustment Loans (SAL) provided by the World Bank through 1995.

### *Research Design*

The regression equation can be written out as follows,

$$Y_{it} = \alpha_i + \rho_t + \delta\ Treat_{it} + \beta Treat_{it+1} + \Phi Treat_{it-1} + \pi\ X_{it} + \varepsilon_{it}$$

in which i indicates the country and t indicates the year for each observation. $Treat_{it}$ represents the independent variable, indicating whether or not a country receives treatment at a given point in time. $Treat_{it}$ is equal to 1 if a country has completed a SAL in a given year and is equal to 0 if it has not. Its coefficient, $\delta$, indicates the effect of treatment on the outcome variable. Y represents the dependent or outcome variable, which indicates development of the agricultural

[8] Senegal's second SAL is listed here, because their first was cancelled in 1983.

sector, measured by indicators of the trade balance, efficiency, employment, output or total agricultural revenue.

$\alpha_i$ measures the country-fixed effect, or the effect of that country on the outcome variable. Likewise, $\rho_t$ measures the time-fixed effect, or the effect of a specific year on the outcome variable. By not being able to randomly distribute the treatment and control groups, the internal validity of the study is challenged, because the treatment and control group may not be comparable in all other aspects than trade liberalization, such as political stability. They are not necessarily ceteris paribus. That could be because certain countries are more likely to receive treatment than others or because the year in which SALs were received or completed, representing treatment, may not be random. By controlling for fixed effects, the panel regression automatically controls for time-invariable characteristics, such as country size (total hectares) and geographical location. This increases the accuracy of the treatment coefficient.

However, variables that do vary over time and may influence the independent variable, or whether a country receives treatment, are controlled for separately in the model. This is represented in the above equation by $X_{it}$, which is measured for each country in each year. Its coefficient, $\pi$, indicates the effect of each variable on the outcome variable. These time-varying variables include GDP and GDP per capita. It is particularly important to control for GDP per capita, which indicates a nation's wealth in proportion to the size of its population, because it may have influenced whether or not a country received treatment in the form of a SAL. Because SALs were provided to help reduce government debt, less well-off nations may have been more likely to receive a SAL. If this control variable were excluded, the effect of treatment on the dependent variable may be over- or underestimated. Furthermore, each test will also control for a lead or lag effect of trade liberalization by using a dummy identical to the treatment dummy, but instead indicates that the loan was completed in a different year. The lead effect is represented in the equation by $\beta Treat_{it+1,}$ which captures any effects from trade liberalization

before the loan was completed, since some policy changes may have taken effect sooner. The lag effect of one year is represented by $\Phi Treat_{it-1}$. The coefficient $\Phi$ captures the delayed effect of trade liberalization, since some policies may take a number of years before showing their effect. Finally, $\varepsilon_{it}$ measures the error term, or deviations from the mean that cannot be explained by the independent variable.

Whether or not there is a relationship between trade liberalization and development within the agricultural sector will be determined by the coefficient, $\delta$, of the treatment variable, $Treat_{it}$, and its statistical significance. Where regression analyses indicate a statistically significant relationship between trade liberalization and the positive or negative development of an indicator, a relationship is defined. Similarly, the coefficient, $\pi$, will determine the effect of control variables and its statistical significance will be used to determine whether other factors may also have played a role in the development of the agricultural sector.

### *Addressing Threats to Inference*

The theories described above are tested in the form of a natural experiment, in which data that was previously collected is analyzed. Since data has been collected by the World Bank for decades in order to measure the status quo of the agricultural sector, this research design leaves no room for manipulation in data collection. Thus, interference is reduced and credibility is increased.

As mentioned earlier in this chapter, there may always be interference in the data through, for example, other trade agreements. However, the largest trade agreement that may have interfered with the results would be the WTO Uruguay Round, which was signed in 1995, or the Everything But Arms arrangement, which took effect in 2001. To minimize interference with the effects of the Uruguay Round, the analysis is only run through 1995. The Lomé Convention, which took effect in 1975, is not expected to interfere with the results, because so many agricultural goods were excluded (Blandford 2007).

Nevertheless, there may be other unmeasurable variables interfering in the results. Though the results from this research may be relevant for discussions on agricultural liberalization around the world, they should be interpreted with caution, as each country may be affected differently due to local circumstances (i.e. political stability or climate). Generalizability of these results across time periods should also be exercised with caution, due to developments and changing circumstances in the global economy.

### *Operationalization*

Table 3 summarizes which indicators will be used to test each hypothesis. In order to best measure the effect of trade liberalization on the agricultural sector, parameters and indicators were selected to measure both immediate outputs (agricultural output and employment) and results (total revenue and trade balance), as well as the indirect impact (efficiency of production) (European Commission 2015). To fully capture the effects of trade liberalization and increase the generalizability of the results, most hypotheses will test more than one indicator (Bryman 2008). These are presented in Table 3 and together measure the development of the agricultural sector after liberalization.

The ratio of agricultural imports to exports (current USD) and ratio of food imports to exports (current USD) were selected to measure the trade balance, because they express the surplus or deficit in monetary value. This gives a better indication of how well countries are able to finance their imports. Agricultural output is measured using production indices, because it indicates how production has developed over time within a country, while implicitly controlling for different output levels between countries with a smaller or larger agricultural sector. The effect on employment is measured by changes in the number of economically active population in agriculture, because it excludes subsistence farming. Developments in domestic agricultural revenue are measured using real agricultural GDP (per capita) growth rates, because it isolates growth in agricultural GDP from growth in other sectors of the economy.

Measuring growth per capita is also important, because it takes into consideration population growth. Efficiency of agricultural production is measured in both agricultural value added (USD) per hectare and per economically active population in agriculture, because productivity of these factors may differ over time. Efficiency is measured in USD, because it indicates their ability to turn land or labor into profits through agricultural production.

| **Indicators used to measure the effect of trade liberalization on the agricultural sector** |
|---|
| *Hypothesis 1: If trade is liberalized, the ratio of agricultural imports to exports will increase.*<br>Ratio of agricultural imports to exports (current USD)<br>Ratio food imports to exports (current USD) |
| *Hypothesis 2: If trade is liberalized, agricultural output will decrease.*<br>Agricultural Production Index (2004-2006=100)<br>Livestock Production Index (2004-2006=100)<br>Food Production Index (2004-2006=100)<br>Crop Production Index (2004-2006=100) |
| *Hypothesis 3: If trade is liberalized, the agricultural sector will see a decrease in employment.*<br>Economically active population in agriculture (#) |
| *Hypothesis 4: If trade is liberalized, total domestic agricultural revenue will decrease.*<br>Real agricultural GDP per capita growth rates (%) |
| *Hypothesis 5: If trade is liberalized, agricultural production will become more efficient.*<br>Productivity of land (Agricultural Value Added USD/hectare)<br>Productivity of labor (Agricultural Value Added USD/economically active population in agriculture) |

**Table 3 –** Indicators and their unit of measurement are indicated per hypothesis.

## 4. Analysis

*Hypothesis 1: If trade is liberalized, the agricultural import to export ratio will increase.*

In order to test the first hypothesis, 'Total agricultural imports' and 'Total agricultural exports' were used as dependent variables. Standard panel regressions were conducted for each, in which the effect of the independent variable, trade liberalization (determined by SAL completion), on each dependent variable was measured. Each regression controlled for the

GDP and GDP per capita of each country, as well as each individual year between 1975 and 1995. The regression also controls for lead or lag effects. The results per indicator can be found in Table 4.

In summary, trade liberalization did not have a significant effect on the ratio of agricultural imports to exports, nor did it have a significant effect on the ratio of food imports to exports. Thus, there is no evidence that the effect of trade liberalization on the trade balance is different from zero. Evidence from these results indicate that the null-hypothesis cannot be rejected.

| | **Ratio Agricultural Imports to Exports** | | | **Ratio Food Imports to Exports** | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| ***Independent variable*** | | | | | | |
| SAL Completion | 0.632<br>(4.113) | | | -14.991<br>(24.530) | | |
| SAL Completion $^{t+1}$ | | 1.731<br>(4.113) | 1.701<br>(4.123) | | 2.009<br>(25.004) | 1.429<br>(25.062) |
| SAL Completion $^{t-1}$ | | | -0.491<br>(4.121) | | | -9.333<br>(24.584) |
| | | | | | | |
| ***Control variables*** | | | | | | |
| GDP per capita (current USD) | 0.005***<br>(0.002) | 0.005***<br>(0.002) | 0.005***<br>(0.002) | 0.008<br>(0.010) | 0.009<br>(0.010) | 0.009<br>(0.010) |
| GDP (current USD) | -0.0001<br>(0.000) | -0.000<br>(0.000) | -0.000<br>(0.000) | -0.000<br>(0.000) | -0.000<br>(0.000) | -0.000<br>(0.000) |
| **Constant** | 1.628<br>(3.194) | 1.623<br>(3.194) | 1.623<br>(3.196) | -3.471<br>(19.054) | -3.527<br>(19.058) | -3.531<br>(19.067) |
| **Number of observations** | 1,015 | 1,015 | 1,015 | 996 | 996 | 996 |
| **Countries** | 52 | 52 | 52 | 51 | 51 | 51 |

**Table 4 –** Results on the trade balance (Hypothesis 1)
*Notes:* Statistical significance is indicated at the 1 (***), 5 (**) and 10 (*) percent level. Standard errors are indicated in parentheses below the coefficients. SAL Completion$^{t+1}$ measures the lead effect by one year. SAL Completion$^{t-1}$ measures the lag effect by one year. Models 1 and 4 show the results from a standard model regression controlling for GDP per capita, GDP and country- and time-fixed effects. Models 2 and 5 add controls for a lead effect of one year. Models 3 and 6 add controls for a lag effect of one year.

*Hypothesis 2: If trade is liberalized, agricultural output will decrease.*

In order to test this hypothesis, several different dependent variables were analyzed, including: a) Agricultural Production Index; b) Livestock Production Index; c) Food Production Index; and d) Crop Production Index. A standard panel regression was conducted, in which the effect of trade liberalization on each of the afore mentioned dependent variables was measured. Once again, GDP and GDP per capita were controlled for, as was each individual year from 1975 through 1995. The regression also controls for lead or lag effects. The results are found in Table 5.

In summary, trade liberalization did not show any significant effects on any of the four indices. Therefore, the null-hypothesis cannot be rejected.

*Hypothesis 3: If trade is liberalized, the agricultural sector will see reduced employment.*

In order to test this hypothesis, 'economically active people in agriculture' was used as a dependent variable. A standard panel regression was conducted, in which the effect of trade liberalization on the dependent variable was measured. Once again, GDP and GDP per capita were controlled for, as well as each individual year. The regression also controls for lead or lag effects. The results are found in Table 6.

In summary, trade liberalization did not have a statistically significant effect on employment. As no evidence is found in support of the hypothesis, the null-hypothesis cannot be rejected.

| | Agricultural Production Index | | | Livestock Production Index | | | Food Production Index | | | Crop Production Index | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| ***Independent variable*** | | | | | | | | | | | | |
| SAL Completion | -0.534 (1.582) | | | 0.158 (1.528) | | | -0.389 (1.554) | | | -0.345 (2.464) | | |
| SAL Completion $^{t+1}$ | | 1.154 (1.582) | 1.172 (1.586) | | -0.226 (1.528) | -0.255 (1.531) | | 1.429 (1.554) | 1.448 (1.557) | | 1.894 (2.464) | 2.024 (2.469) |
| SAL Completion $^{t-1}$ | | | 0.298 (1.585) | | | -0.484 (1.531) | | | 0.322 (1.557) | | | 2.151 (2.468) |
| | | | | | | | | | | | | |
| ***Control variables*** | | | | | | | | | | | | |
| GDP per capita (current USD) | -0.002*** (0.001) | -0.002*** (0.001) | -0.002*** (0.001) | 0.006*** (0.001) | 0.006*** (0.001) | 0.006*** (0.001) | -0.003*** (0.001) | -0.003*** (0.001) | -0.003*** (0.001) | -0.016*** (0.001) | -0.016*** (0.001) | -0.016*** (0.001) |
| GDP (current USD) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | -0.000** (0.000) | -0.000** (0.000) | -0.000** (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000 (0.000) | 0.000*** (0.000) | 0.000*** (0.000) | 0.000*** (0.000) |
| | | | | | | | | | | | | |
| **Constant** | 54.912*** (1.229) | 54.905*** (1.229) | 54.905*** (1.229) | 45.816*** (1.187) | 45.817*** (1.187) | 45.817*** (1.187) | 54.679*** (1.207) | 54.671*** (1.207) | 54.671*** (1.207) | 65.850*** (1.914) | 65.840*** (1.914) | 65.840*** (1.914) |
| **Number of observations** | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 | 1,003 |
| **Countries** | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 |

**Table 5 –** Results on agricultural output (Hypothesis 2)

*Notes:* Statistical significance is indicated at the 1 (***), 5 (**) and 10 (*) percent level. Standard errors are indicated in parentheses below the coefficients. SAL Completion$^{t+1}$ measures the lead effect by one year. SAL Completion$^{t-1}$ measures the lag effect by one year. Models 1, 4, 7, and 10 show the results from a standard model regression controlling for GDP per capita, GDP and country- and time-fixed effects. Models 2, 5, 8, and 11 add controls for a lead effect of one year. Models 3, 6, 9, and 12 add controls for a lag effect of one year.

| | Economically active population in agriculture | | |
|---|---|---|---|
| | **1** | **2** | **3** |
| ***Independent variable*** | | | |
| SAL Completion | -50,286.610<br>(86,590.460) | | |
| SAL Completion $^{t+1}$ | | 22,741.490<br>(88,576.770) | 20,019.390<br>(88,835.340) |
| SAL Completion $^{t-1}$ | | | -38.883.380<br>(86,818.960) |
| | | | |
| ***Control variables*** | | | |
| GDP per capita (current USD) | -198.065***<br>(44.930) | -196.839***<br>(44.952) | -196.925***<br>(44.978) |
| GDP (current USD) | -0.000<br>(0.000) | -0.000<br>(0.000) | -0.000<br>(0.000) |
| | | | |
| **Constant** | 2,587,877.000***<br>(73,856.500) | 2,585,878.000***<br>(73,828.120) | 2,585,875.000***<br>(73,870.130) |
| **Number of observations** | 773 | 773 | 773 |
| **Countries** | 52 | 52 | 52 |

**Table 6 –** Results on economically active population in agriculture (Hypothesis 3)
*Notes:* Statistical significance is indicated at the 1 (***), 5 (**) and 10 (*) percent level. Standard errors are indicated in parentheses below the coefficients. SAL Completion$^{t+1}$ measures the lead effect by one year. SAL Completion$^{t-1}$ measures the lag effect by one year. Model 1 shows the results from a standard model regression controlling for GDP per capita, GDP and country- and time-fixed effects. Model 2 adds controls for a lead effect of one year. Model 3 adds controls for a lag effect of one year.

*Hypothesis 4: If trade is liberalized, total domestic agricultural revenue will decrease.*

In order to test this hypothesis, 'real agricultural GDP growth rates' and 'real agricultural GDP per capita growth rates' were used as dependent variables. A standard panel regression was conducted, in which the effect of trade liberalization on both dependent variables was measured. Once again, GDP and GDP per capita were controlled for, as was each individual year from 1975 through 1995. The regression also controls for lead or lag effects. The results are found in Table 7.

In summary, trade liberalization, measured in the year of SAL completion, had a positive and statistically significant effect on both real agricultural GDP growth rates, as well as real

agricultural GDP per capita growth rates. These are statistically significant at the 5 and 10 percent level, respectively. These effects, however, were measured by with a lead variable, indicating that the effect took place before the SALs were completed. These results do not support the hypothesis, but rather contradict it. The evidence suggests that trade liberalization has a positive effect on real GDP (per capita) growth rates.

| | **Real agricultural GDP growth rates** | | | **Real agricultural GDP per capita growth rates** | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| ***Independent variable*** | | | | | | |
| SAL Completion | -2.390 **(**2.530**)** | | | -2.010 (2.473) | | |
| SAL Completion $^{t+1}$ | | 6.414** (2.522) | 6.364** (2.529) | | 6.682*** (2.463) | 6.643*** (2.469) |
| SAL Completion $^{t-1}$ | | | -0.807 (2.526) | | | -0.643 (2.467) |
| | | | | | | |
| ***Control variables*** | | | | | | |
| GDP per capita (current USD) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) | -0.000 (0.001) |
| GDP (current USD) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) | -0.000 (0.000) |
| | | | | | | |
| **Constant** | 7.393*** (2.191) | 7.342*** (2.183) | 7.342*** (2.184) | 4.550** (2.141) | 4.500** (2.131) | 4.500** (2.133) |
| **Number of observations** | 827 | 827 | 827 | 827 | 827 | 827 |
| **Countries** | 44 | 44 | 44 | 44 | 44 | 44 |

**Table 7 –** Results on domestic agricultural revenue (Hypothesis 4)
*Notes:* Statistical significance is indicated at the 1 (***), 5 (**) and 10 (*) percent level. Standard errors are indicated in parentheses below the coefficients. SAL Completion$^{t+1}$ measures the lead effect by one year. SAL Completion$^{t-1}$ measures the lag effect by one year. Models 1 and 4 show the results from a standard model regression controlling for GDP per capita, GDP and country- and time-fixed effects. Models 2 and 5 add controls for a lead effect of one year. Models 3 and 6 add controls for a lag effect of one year.

*Hypothesis 5: If trade is liberalized, agricultural production will become more efficient.*

In order to test this hypothesis, 'agricultural value added per hectare' and 'agricultural value added per employee' were used as dependent variables. A standard panel regression was conducted for each, in which the effect of the independent variable, trade liberalization, on both

dependent variables was measured. Once again, each regression was controlled for the GDP and GDP per capita of each country, as well as each individual year between 1975 and 1995. The regression also controls for lead or lag effects. The results per indicator can be found in Table 8.

In summary, trade liberalization does not have an immediately significant effect on the agricultural value added per hectare. There is evidence, however, for a statistically significant lagged negative effect on agricultural value added per hectare, at the ten percent level. Trade liberalization does not appear to have a significant effect on the agricultural value added per employee. Because no evidence was found in support of the hypothesis, the null-hypothesis cannot be rejected.

| | **Agricultural Value Added per Hectare** | | | **Agricultural Value Added per Employee** | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** |
| ***Independent variable*** | | | | | | |
| SAL Completion | -20.591<br>(38.759) | | | -25.041<br>(49.996) | | |
| SAL Completion $^{t+1}$ | | -10.578<br>(38.766) | -14.546<br>(38.800) | | -58.471<br>(51.094) | -60.193<br>(51.242) |
| SAL Completion $^{t-1}$ | | | -65.268*<br>(38.781) | | | -24.600<br>(50.079) |
| ***Control variables*** | | | | | | |
| GDP per capita (current USD) | 0.506***<br>(0.016) | 0.506***<br>(0.016) | 0.506***<br>(0.016) | 0.328***<br>(0.026) | 0.327***<br>(0.026) | 0.327***<br>(0.026) |
| GDP (current USD) | -0.000***<br>(0.000) | -0.000***<br>(0.000) | -0.000***<br>(0.000) | 0.000***<br>(0.000) | 0.000***<br>(0.000) | 0.000***<br>(0.000) |
| | | | | | | |
| **Constant** | -109.649*<br>(30.101) | -109.669***<br>(30.105) | -109.699***<br>(30.076) | 220.081***<br>(42.644) | 220.147***<br>(42.587) | 220.145***<br>(42.610) |
| **Number of observations** | 1015 | 1015 | 1015 | 773 | 773 | 773 |
| **Countries** | 52 | 52 | 52 | 52 | 52 | 52 |

**Table 8 –** Results on efficiency (Hypothesis 5)
*Notes:* Statistical significance is indicated at the 1 (***), 5 (**) and 10 (*) percent level. Standard errors are indicated in parentheses below the coefficients. SAL Completion$^{t+1}$ measures the lead effect by one year. SAL Completion$^{t-1}$ measures the lag effect by one year. Models 1 and 4 show the results from a standard model regression controlling for GDP per capita, GDP and country- and time-fixed effects. Models 2 and 5 add controls for a lead effect of one year. Models 3 and 6 add controls for a lag effect of one year.

## 5. Discussion

As is evident from the previous chapter, most tests did not give statistically significant results. The only indicators statistically significantly affected by trade liberalization, or the completion of their first SAL, are presented in Table 9. These findings each contradict their hypotheses on increased efficiency and decreased domestic agricultural revenue. The results indicating a negative effect on efficiency are particularly interesting, since theories on free trade emphasize that the increase in competition puts pressure on producers to lower their production costs and thereby be more efficient (Dunkley 2004). However, when considering that SALs required governments to stop providing subsidies for inputs, such as fertilizers and insecticides, and privatize the market for inputs instead, these results are no longer surprising (Perkins et al. 2013; World Bank 1992; Goldsmith & Mander 2001). This is because producers who once relied on these subsidized inputs may not have been able to afford them anymore (FAO 2003; Perkins et al. 2013). As a result, production per hectare decreased. Additionally, producers may not have had access to capital to invest in technology that could increase production.

| Dependent Variable | Effect (+/-) | Percentile of statistical significance (1%, 5%, 10%) | Lead or lag effect | Evidence in support of hypothesis |
|---|---|---|---|---|
| Agricultural value added per hectare | - | 10% | Lag | No |
| Real agricultural GDP growth rates | + | 5% | Lead | No |
| Real agricultural GDP per capita growth rates | + | 1% | Lead | No |

**Table 9 –** Summary of significant results

This decrease in efficiency could have negative consequences for food security. It reduces producers' competitiveness, and thereby their ability to survive on the global market. Because liberalization means prices are determined globally, they no longer reflect local production costs.

Therefore, producers' ability to survive on the global market is dependent on their ability to increase productivity at a faster rate than prices drop (Perkins et al. 2013). The decrease in efficiency shown in the results could mean that more producers later exit the market. This would mean that they also lose their livelihood, which they depend on to purchase food. Unless there are sufficient job opportunities elsewhere in the market, these individuals and households become vulnerable to food insecurity. Thus, a decrease in production efficiency threatens the future of a country's agricultural sector and agriculture-demand-led-industrialization, which developing countries often rely on in the early stages of economic growth (Perkins et al. 2013).

A threat to the domestic agricultural sector may also increase consumers' dependency on imports. This makes the population more vulnerable to fluctuations in the global market, as demonstrated in 2008 when inflation drastically increased food imports and millions of people were pushed into hunger (Perkins et al. 2013). This dependency on imports is particularly undesirable, yet evident during a crisis, due to the inelasticity of demand and because such a sizable percentage of household income in developing countries goes to food (Fabiosa 2008).

The statistical analyses, however, do not show any significant effect on employment, output and the trade balance on agricultural goods, which could be for several reasons. In the first place, the impact of liberalization may be delayed by more than the one-year lag measured in this study. The insignificant results could also be due to diversity amongst the 53 countries being studied. Consequently, some standard errors are exceptionally high. If a larger number of countries were to be observed, the results may likely be different. Regardless, it is important to reflect on the insignificant results and what these mean for the agricultural sector and food security. It is important to consider that even if the results on output, employment and the trade balance do not imply a negative effect on food security, they are not particularly favorable for food security either.

It should be noted, however, that there are always other factors, besides trade liberalization, that inhibit or increase food security, such as the logistics of food distribution.

Since the results measuring the effect of trade liberalization on various domestic production indices appear to be insignificant, food security may see limited improvement for those who do not have access to imported food. These insignificant results, thus, are not favorable. An increase in domestic production would have improved food security, since so many people in developing countries are food insecure and lack access to markets, due to a lack of infrastructure. Higher production could increase the availability and lower the price of food for those in more marginalized areas. Yet, if reduced efficiency due to liberalization does in fact lower domestic production in the long run and governments insufficiently facilitate markets, food insecurity could rise in the long run. It also means that producers are not able to increase their income, especially not as costs rise due to inefficiencies, limiting the income available to purchase more food or other goods and services.

While the insignificant effect of trade liberalization on employment in agriculture may not be of direct harm to food security and may be favorable for those employed in the agricultural sector, economists would argue that by retaining labor in inefficient production, the economic development of other sectors is also hampered as described by various theories on free trade (Potter et al. 2008; Robertson 2006). This is reinforced by the current results, which indicate that the deadweight loss due to producer inefficiencies persists and labor is not being made available for more productive activities. Economists would argue that this keeps food prices higher than necessary for consumers, which thereby makes food less affordable for the poor.

While the results of this research only show statistically significant negative effects of trade liberalization on efficiency, and no effect on the trade balance, output and employment, these

results may be different when measuring the long-term effects. Regardless, the results from this research are not promising for food security, despite the availability of cheap imports. That is primarily because a decreased production efficiency threatens the livability of producers, including those who are net-consumers, and their ability to purchase food. The lack of an increase in domestic production is also not positive for food security, because it means the poor in more remote areas, with limited access to imports, remain food insecure.

There are still more theoretical drawbacks of trade liberalization for food security in developing countries. Namely, that prices no longer reflect yield, which increases producers' vulnerability to fluctuations in their external environment. Because of the trade-off between stabilizing supply and prices for consumers, and ensuring profitability of domestic farmers, more research needs to be conducted on the long-term impact of trade liberalization for net-consuming producers.

## 6. Conclusion

Various tests on developments of the agricultural trade balance, output, employment, total domestic revenue and efficiency suggest that trade liberalization has a very limited effect on the agricultural sector in the short run. Only agricultural efficiency and total domestic agricultural revenue were, respectively, negatively and positively affected by trade liberalization. The drop in agricultural efficiency challenges the future of the agricultural sector and the limited effect on domestic output is not promising for food security, due to an unhealthy dependency on imports and limited access for those in more remote areas. Though all hypotheses were rejected, the lack of significant results for most indicators in this empirical research also calls into question economic theories on free trade and its effectiveness in stimulating economic development.

However, due to the limited time frame of the study and vast differences between the countries observed, a similar research conducted amongst a greater number of countries over a longer period of time may yield more accurate results. Finally, to understand the benefits and drawbacks of trade liberalization on a given country, a research on the distributional outcomes within countries will need to be conducted.

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# Annex I – Stata codenames

| Code | Label |
|---|---|
| *General Country Data* | |
| Country | Number |
| Country Name | Country Name |
| Country Code | Country Code |
| Year | Year |
| SAL Completed Before 1995 | Year SAL completed before 1994 |
| TotalPopulation | Total Population (number) |
| PopulationDensity | Population Density (people/hectare) |
| SPPOPGROW | Population growth (annual %) |
| *General Agricultural Data* | |
| AGLNDAGRIZS | Agricultural land (% of land area) |
| AGLNDAGRIHA | Agricultural land (hectares) |
| AGLNDTOTLHA | Land area (hectares) |
| *Economic Data* | |
| NYGDPMKTPCD | GDP (current US$) |
| NYGDPMKTPKDZG | GDP growth (annual %) |
| NYGDPPCAPCD | GDP per capita (current US$) |
| NYGDPPCAPKDZG | GDP per capita growth (annual %) |
| NETRDGNFSZS | Trade (% of GDP) |
| *Trade Balance* | |
| BMAGCRELCD | Cereal exports (FAO, current US$) |
| BMAGCRELMT | Cereal exports quantity (FAO, tonnes) |
| BXAGCRELCD | Cereal imports (FAO, current US$) |
| CrealImToExUSD | Cereal Imports to Exports (USD) |
| BXAGCRELMT | Cereal imports quantity (FAO, tonnes) |
| CerealImToExMT | Cereal imports to exports (Metric Tonnes) |
| BXFODAGRICD | Food exports excluding fish (FAO, current US$) |
| BMFODAGRICD | Food imports excluding fish (FAO, current US$) |
| FoodImToExUSD | Food Imports to Exports (USD) excluding fish |
| BXGSRAGRICD | Total agricultural exports (FAO, current US$) |
| BMGSRAGRICD | Total agricultural imports (FAO, current US$) |
| RatioAgImToExUSD | Ratio Agricultural Imports to Exports (USD) |
| *Efficiency* | |
| AgValueAddedUSDPerHA | Agricultural Value Added (USD/Hectare) |
| AgValueAddedUSDPerEmpl | Agricultural Value Added (USD/Economically active person in agriculture) |

| | |
|---|---|
| *Employment* | |
| ENAGREMPL | Economically active population in agriculture (number) |
| | |
| *Agricultural Production Indices* | |
| AGPRDAGRIXD | Agriculture production index (2004-2006 = 100) |
| AGPRDCRELXD | Cereal production index (2004-2006 = 100) |
| AGPRDCROPXD | Crop production index (2004-2006 = 100) |
| AGPRDFOODXD | Food production index (2004-2006 = 100) |
| AGPRDLVSKXD | Livestock production index (2004-2006 = 100) |
| | |
| *Agricultural Revenue* | |
| NVAGRTOTLZG | Real agricultural GDP growth rates (%) |
| NVAGRPCAPKDZG | Real agricultural GDP per capita growth rate (%) |

All raw data was retrieved from data.worldbank.org/indicator, which were used to create new variables.