The Impact of Meat Self-Sufficiency Ratio on GDP

Analysis on Nine Latin American Countries

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This thesis investigates the impact of the meat self-sufficiency ratio (MSSR) on GDP in nine Latin American countries for the years 1996-2011, using a linear regression model. Expected results were that MSSR would have a positive effect on GDP because of its direct benefits-providing protein to the population, and its indirect benefits-creating exports and employment. However, it was found that in all countries studied, MSSR had a negative impact; it is more important to have a stable government and the ability to successful implement governmental programs in the meat industry to enhance production systems and benefit the smaller shareholders.

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1. Introduction

Food security has long been an issue but in recent years the concerns have been rising, as humans witness unprecedented growth in human population and socioeconomic resource demand. (Erb, et. al, 2012) The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life." (WHO, 1996) It is a complex and multidimensional problem consisting of many causes at different levels of aggregation (Pieters, et al, 2014) based on four pillars which are availability, access, utilization, and stability, with several determinant factors. (FAO, 2009) One aspect of food security is often measured by both calorie supply per capita and protein supply per capita. (Djokoto, 2012) The most common way of consuming protein is through livestock; although expensive sources of energy and often criticized for its production being environmentally destructive, animal-source foods are one of the best sources of high quality protein and micronutrients. Protein is essential for normal development and good health and also enhances food and nutrition security, providing income to pay for education and other needs. Livestock helps poor children to develop into healthy, well-educated and productive adults. (Smith, 2013)

Second, increased production will keep livestock product prices down and allow low income groups access to such food. (Sansoucy, et. al, 1995) Producers should gain in the face of lower prices because livestock products are both price and income elastic, so lower prices should increase demand, total production and farm revenue. Increased production and low prices may allow consumers on low incomes to increase consumption of livestock products and help overcome the energy-protein deficiency simultaneously. (Lipton, 1988)

Animal products are also a source of disposable income for many small farmers in developing countries, as livestock are often the most important cash crop in many small holder mixed farming systems. (Sansoucy, et. al, 1995) In addition, growth in income and population has increased the demand for high-value food products such as meat and dairy products. (Meade, et. al, 2011) This means that a higher GDP results to higher meat consumption, especially in developing countries.

Hence, it can be assumed that having domestic access to meat can have an impact on the GDP and the countries' economic performance, and that countries which have a higher GDP should benefit from its domestic production.

In order to investigate the impact of meat production on GDP, this study will utilize a linear regression model conducted on nine middle-income Latin American countries that have large meat production for the years 1996-2011. The nine countries will be divided into three groups according to their meat self-sufficiency ratio. (See Figure 1)

Figure 1: Meat Self-Sufficiency Ratio of the Nine Countries, Average 1996-2011 with Grouping
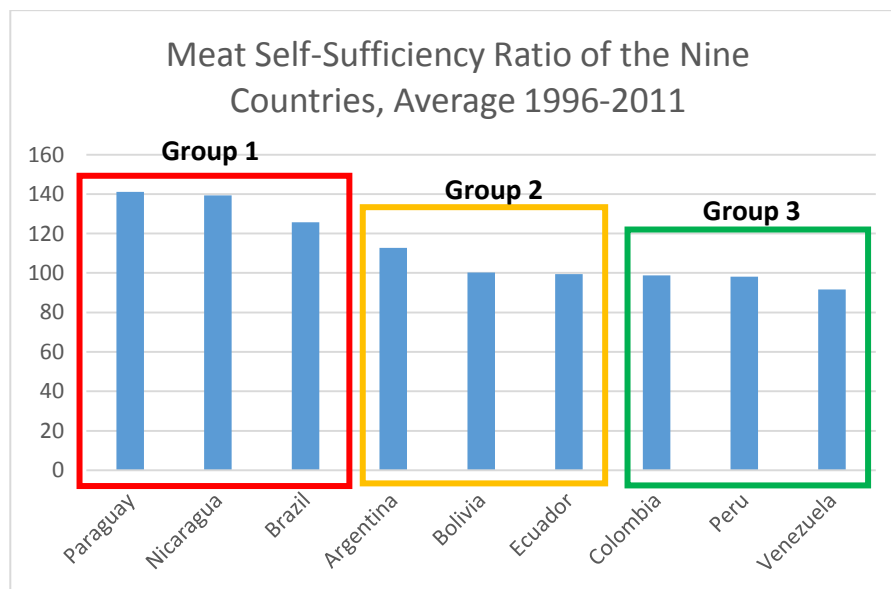
Source: FAOSTAT

This work is organized as follows. The first section explains the role of livestock in development, clarifies some specific terms used in this work and gives a background of the meat industry in Latin America as well as the background of each country studied. In the second section, some previous studies relative to this study are presented, which this paper has based itself on. The third section clarifies the objective of this research and what makes it innovative. The fourth demonstrates the model and method incorporated in this research, the fifth explains the data used and the results expected to achieve for the calculations. In section six, the results are analyzed in accordance to the trends and situation of each country group. Finally, section seven gives the conclusion of this work and give suggestions to future studies to improve what has been conducted and to take this discussion to the next step.

1.1 Food Self-Sufficiency Ratio

Food self-sufficiency ratio expresses the magnitude of production in relation to domestic utilization. It can be calculated by the following formula (FAO, 2001):

$$\frac{\text{Production}}{\text{Production} + \text{Imports} - \text{Exports}} \text{ X100}$$

As mentioned in the introduction, there are several aspects to food security, but what seems to not be taken into much consideration outside of Japan is the food self-sufficiency ratio of a country. Bouet and Laborde (2008) state that food security exists if people have access to food to meet their dietary needs and does not have much to do with the method in which this is reached. If food is produced domestically or not is not an argument herein. (Noleppa, 2013) However, this seems to be a topic of concern in

many works in Japan and improving the food self-sufficiency ratio of Japan is the highest priority target of the Japanese Ministry of Agriculture, Forestry and Fishery (MAFF). Food self-sufficiency rate is the lowest in Japan among the major advanced nations and according to MAFF estimations, the food self-sufficiency ratio for the 2011 fiscal year was 60% on a production value basis and 39% on a calorie value basis. (Godo, 2013) In addition, Japan is prone to natural disasters such as earthquakes and tsunami, which has also negatively affected the domestic production. The case in Japan is not widely taken known globally, this shows the importance of a high food self-sufficiency ratio for a country. The low percentage of Japan's food production for the domestic market is an issue for the reason that when a food crisis occurs like it did in 2008, there will be a sharp hike in food prices. This also occurred when the USA implemented an embargo on soybean exports in 1973. In short, when a country has a high food self-sufficiency ratio, it can provide for its population in such cases of emergency without having to disrupt the outputs of labor and causing panic.

1.2 Meat Industry in Latin America

Latin America has witnessed great economic and political instability in the 70s and early 80s, as military governments took over most countries and the countries were faced with conflict and drastic measures. However in the mid-80s nearly all the Latin American republics discarded their military regimes and returned to democracy. This has not solved the problem of corruption and chaos but the situation seems brighter[1] and especially the larger countries such as Brazil and Argentina have been experiencing rapid growth.

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[1] http://www.historyworld.net/wrldhis/PlainTextHistories.asp?ParagraphID=npb

A large, modern and successful livestock industry is an important feature of all Latin America countries. (Roman, et. Al, 2006) The largest economies in Latin America, Brazil and Argentina, are also the largest consumers and exporters of meat in the region. The smaller countries are also developing rapidly and seen as potential markets for the US meat and poultry industry. (Interagency Agricultural Projections Committee, 2013) Countries in the Andean region that include Chile, Peru, Bolivia, Colombia and Venezuela have been known for political and economic instability but in the last decades, democratic governments have been elected and inflation rates have been controlled. (Romero-Sanchez, undated) The major industry in all of the nine countries is meat production, and although the biggest countries such as Argentina and Brazil export a large amount of their production, much of it is left for domestic consumption. The average meat self-sufficiency ratio for years 1996-2011 is as below: (See Figure 2)

Figure 2: Meat Self-Sufficiency Ratio of the Nine Countries, Average 1996-2011
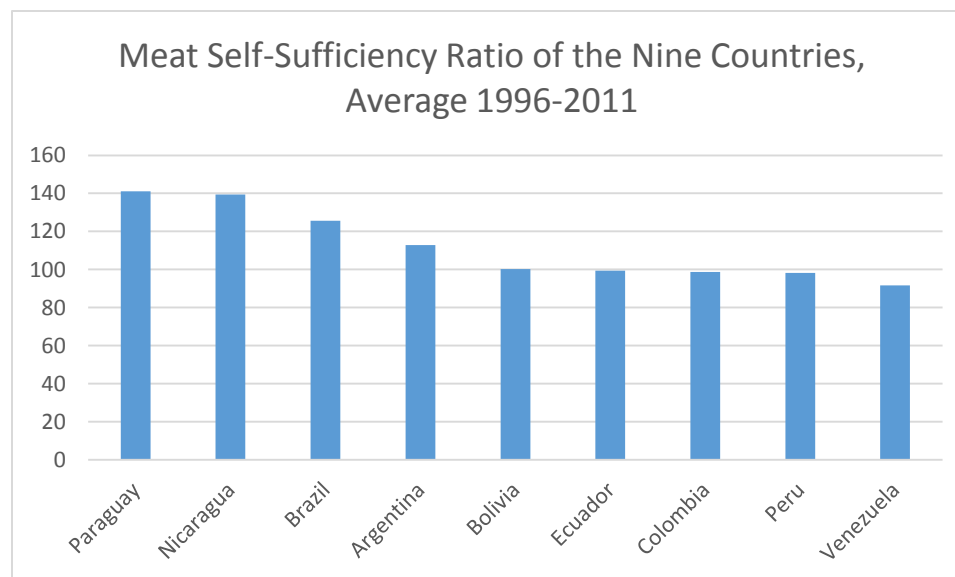
Source: FAOSTAT

The meat self-sufficiency ratio in the 9 countries are all over 90 percent, the highest being Paraguay with approximately 141 % and the lowest being Venezuela with approximately 92%. Brazil and Argentina, the two top economically advanced countries in South America do not necessarily have the highest meat self-sufficiency ratio, as they are more export and import oriented.

1.3 Background of the countries

Figure 3: Map of Latin America and the Countries

Source: World Development Indicators
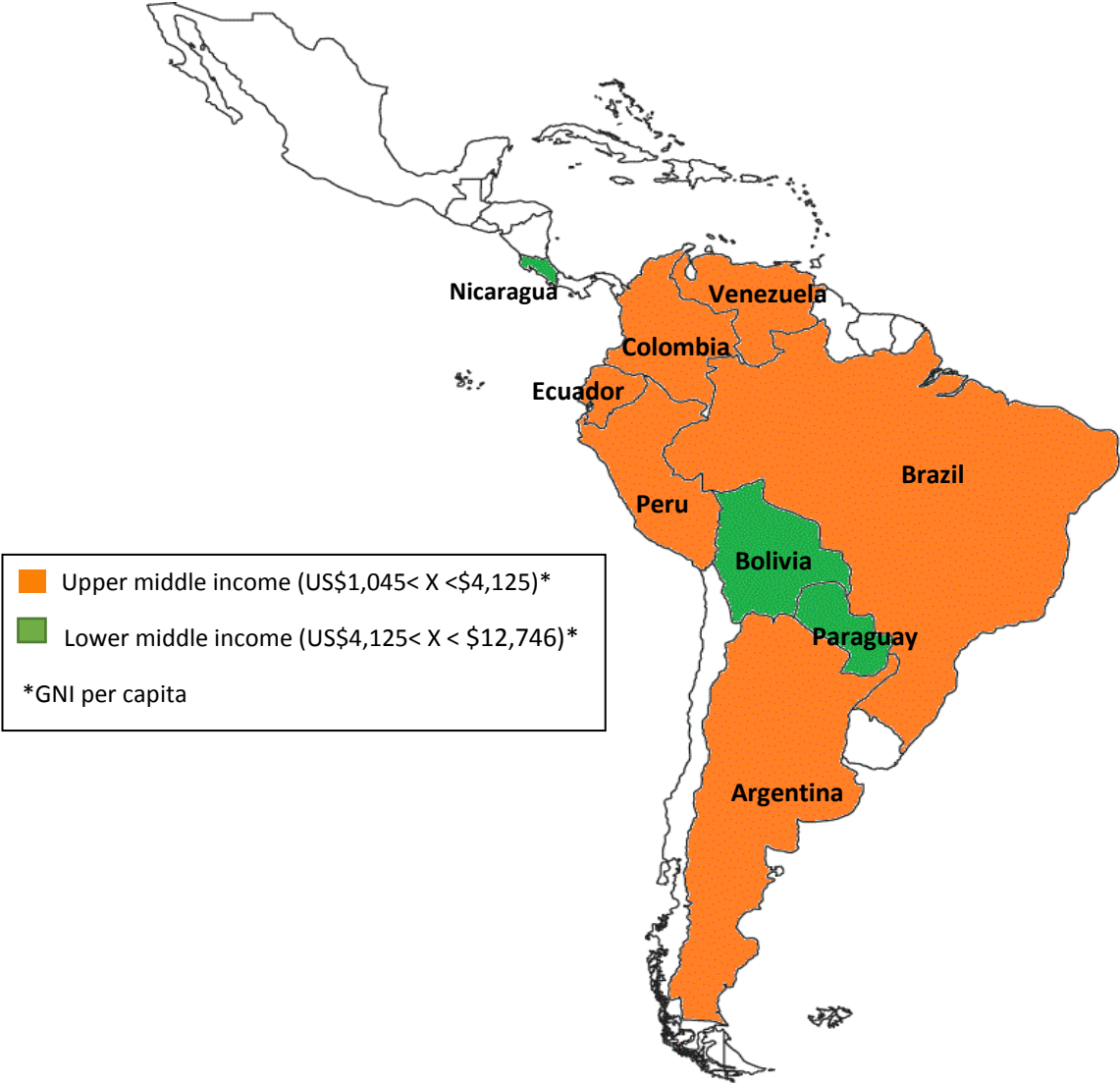
Group 1: Paraguay, Nicaragua and Brazil

The Paraguayan meat industry witnessed hardship after the foot and mouth disease outbreaks in 2011 and 2012, but revived the year due to the reopening of the foreign markets and as demands became stronger. The country is very dependent on beef exports which generally account for more than half of the production.

There are about 115,000 cattle ranches in Paraguay with 13.1 million head, and over 300 thousand square kilometers of land devoted to cattle production. That is about 75% of the entire area of Paraguay, considering that the total area is 406,752 square kilometers. (Index Mundi, 2014) Although with an improved sanitary status and a larger presence in world markets coupled with low cost production have promoted the expansion and the improvement of the sector, many problems are arising locally. In a recently released report by Lovera (2014) the negative social impacts of the livestock sector is stressed. It is emphasized that the small farmers are the country's most vulnerable population caused by the gradual loss of food sovereignty, high concentration of land in the hands of a few, devoted to the production of export commodities and low-waged, terrible labor conditions in the ranches.

Beef production is the largest in the meat industry of Nicaragua, and has traditionally had a strong orientation towards exportation. Extensive beef production started in the 1950s but decreased a great amount during the revolutionary 1980s, when the country experienced the violent Contra War from 1981-1990. However, after the Sadinista regime was voted out of office, the beef sector was revived. (Schütz, 2004) Until today coffee and beef remain to be Nicaragua's most important exports. In the early 1990s, the production and retail sale of beef was mainly directed towards the local market but by the late 1990s as demand from the US rose, the export quantities

surpassed that of what was sold in the local market. Interestingly, the local demands of other types of meat including pork and chicken are high, making markets competitive, thus limiting sales of beef.

In August 2004, the US signed the Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR). Central America includes the countries Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua. This treaty eliminated tariffs, opened up markets and reduced barriers to services, which allowed the US to import beef from Nicaragua at very low prices. (Hawks & Thow, 2008) In addition, with large American supermarket chains such as Wal-Mart entering the country and competing directly with the local sellers, the Nicaraguan economy is threatened as the benefits go directly to the US retail corporations and not to the local people. (Valle, 2014)

The Brazilian meat sector is one of the largest worldwide and rank at number two in the world and number one in international trade as of 2011. (Agra FNP and Informa Economics, 2011) Although Brazil is famous for its beef, unlike Paraguay and Nicaragua, poultry exports now lead in meat protein products. (Agra FNP and Informa Economics, 2011) This is mostly because of the low cost of raw materials such as corn and soybean meal used to feed the chickens. Moreover, the domestic population consumes 70% of poultry meat. A substantial traditional beef-cattle industry still exists but productivity remains low and is suffering from serious livestock diseases and management problems. (Somwaru & Valdes, 2004)

Group 2: Argentina, Bolivia and Ecuador

Beef has traditionally been the main industry in Argentina and is the number one producer of South America, as about 61 kilograms of beef is consumed per capita, the second most in the world. (Arlevorich, Bravo, Martinez) However, the country is suffering from declines in beef exports in recent years; in order to raise domestic food consumption, former President Kirchner raised export taxes from 5 to 15 percent on beef. (Campbell, 2013) This decimated the export industry, and now Uruguay and Paraguay—the much smaller neighbors are catching up.

Bolivia has a lower middle-income economy, with the livestock sector accounting for 6 % of its GDP. Like Argentina, beef is the main industry in Bolivia but produced in lower amounts considering the population difference, followed by large productions in poultry. Meat consumption has steadily increased in the last decades, especially poultry meat whereas red meat consumption has been decreasing. (FAO, 2005) However meat production remains unproductive due to lack of livestock support services such as training, technical assistance and technology transfer, resulting in them missing out on market opportunities.

Livestock is widespread also in Ecuador, with beef cattle being the main, but also pork and sheep and goat being concentrated in the Andean region. Almost all of what is produced is for the domestic market, with exports being close to zero. Oil, cut flowers and shrimp are the largest Ecuadorian exports. (New Agriculturist, 2012) The Ecuadorian market has recently opened its markets to US beef and offal (The Cattlesite Newsdesk, 2014) which may be a threat to the domestic market and production.

Group 3: Colombia, Peru and Venezuela

In Colombia, the agricultural sector makes up approximately 14% of the GDP, with the bulk of it being coffee and livestock production. (Delgado, undated) As of 2008, Colombia has the fourth highest beef herd among all Latin American countries, and seventh worldwide. (Pro Export Colombia & Fedegan, 2010) From 2000 to 2007, meat consumption in Colombia grew by 24% and the country is now facing great challenges to improve the meat production system, especially for smallholder livestock producers, which are often lacking sufficient resources or knowledge. (Bukart, et. al, 2011)

Although Peru produces meat domestically and its meat self-sufficiency ratio is close to 100%, poultry and sheep/goats make up for most of the meat production. Although beef is produced, the country lacks the modern beef production system that doesn't allow sufficient production for the domestic market. Furthermore, because of the poor system, technology and mechanisms, most of Peru's beef comes from old animal which lowers the meat quality. Therefore, Peru is perceived as a considerable potential export market for the US and in fact, US beef exports to Peru have increased sharply in the last four years as of 2013. (USDA, 2013)

Cattle has traditionally been the main industry in Venezuela, but livestock numbers have been declining in recent years as fixed price policies applied to the agriculture and livestock sectors and other factors generated an imbalance between domestic supply and demand, resulting in the necessity of imports to cover the differences. (USDA, 2012) In addition, difficult economic conditions as well as personal and legal insecurity issues are putting constraints on further production. Colombia was the main exporter of meat to Venezuela until 2009 when a crisis caused them to severe all diplomatic relations and was replaced by other neighboring countries such as

Argentina, Uruguay and Brazil. However, now large amounts of meat is being smuggled in reverse into Colombia from Venezuela due to large price differentials of meat. (Bargent, 2014) With the demand for meat rising each year, the United States Department of Agriculture forecasts that more imports will be needed as the country will not be able to meet its demands. (USDA, 2012)

2. Literature Review

To my knowledge, there were no works directly linking the food self-sufficiency ratio and GDP and/or economic growth. However, there were several works on the topic of agricultural exports on GDP and some on the food self-sufficiency ratio itself.

Shombe (2008) investigated the casual relationships among agriculture, manufacturing and exports in Tanzania for years 1970-2005 and results showed that in both sectors there is Granger causality where agriculture causes both exports and manufacturing. In addition, exports also cause both agricultural GDP and manufacturing GDP although there is also some evidence that manufacturing does not cause exports and agriculture. Vaezi and Moghaddasi (2009) did a similar study on the relationship between total exports with agricultural and manufacturing GDP in Iran for years 1959-2007 but results were different; in Iran exports proved not to cause any of agricultural nor manufacturing GDP and agricultural GDP did not cause exports nor manufacturing GDP. As the case for East Asia, Xing and Pradhanaga (2013) did a study on how important exports and FDI are for economic growth in the People's Republic of China. The research was done for the year 2001, and years 2005-2007 and results revealed that they were very important; estimates have shown that the recovery of the PRC economy is mainly thanks to its growth in exports and FDI.

There were very few studies on the food self-sufficiency ratio and only two could be found which directly handled this topic. Noleppa and Cartsburg (2013) did a statistical analysis on agricultural self-sufficiency of the EU. They discovered that the EU is capable of producing huge volumes of agricultural raw materials and products; however it uses its comparative advantages for exporting while replying on trade partners for importing commodities that cannot sufficiently be produced within the EU. Another prominent study discussing food self-sufficiency was done by Luan (2013) on the historical trends of food self-sufficiency in Africa. Africa's food self-sufficiency ratio is lower today than it was throughout the entire study period, which is most likely the result of demographic expansion, leading to a greater increase in food demand than in food production.

Kako (2009) explained the trends of the self-sufficiency ratio in Japan and a brief historical background regarding this topic, followed by an explanation of recent policies and future projects. He reached the conclusion that extreme and rapid dietary changes, along with the drastic appreciation of the yen against the dollar were the reasons for its decrease in the self-sufficiency ratio.

3. Objective and Value-Added

The objective of this thesis is to examine the impact of meat self-sufficiency ratio on GDP in nine middle-income Latin American countries from years 1996-2011. The reason why Latin American is the subject of this study is because meat has been traditionally been produced and eaten in these countries, and the countries chosen all have a meat self-sufficiency ratio of more than 90%. Furthermore, it was important to

focus on middle-income countries, as there is a strong positive relationship between the level of income and the consumption of animal protein, and because of the recent steep decline in prices, meat consumption in developing countries are getting higher at much lower levels of GDP than in the industrialized countries a few decades ago. (WHO, 2003) Moreover, the focus was put on one region as they have similar cultures, eating habits and climates. This work is innovative in the sense that as far as I am concerned there has been no other work directly studying the relationship between food self-sufficiency and GDP, less to say one that focuses on meat.

4. Model and Method

4.1 Model

Kowalski (2000) conducted her research using the linear regression model (1) to investigate the determinants of growth in sixteen East Asian countries over the time period of 1983-1997.

$$GROWTH = a_0 + a_1 EXP + a_2 FDI + a_3 SPEND + a_4 INVEST + a_5 INFL + a_6 DEBT + a_7 Countrydummy + e \text{ -- (1)}$$

GROWTH is GDP growth, EXP is net exports (% of GDP), FDI is foreign direct investment (% of GDP), SPEND is government spending (% of GDP), INVEST is total investment (% of GDP), INFL is the inflation rate (annual %) and DEBT government debt (% of GDP). EXP and FDI are both forms of money inflow, SPEND and INVEST are government indicators, as according to the structuralist theory, government intervention and economic stimulation have a positive impact on growth. Finally, INFL and DEB indicate the macroeconomic stability in a country. The country dummy

variables controls the model for the multitude of other variables that can have an effect on a particular country's economic growth rate, which was not specified in this thesis. However this allows an equal comparison as this study is done on countries with different economic conditions, ranging from low-and middle-income economies of Southeast Asia to the more affluent countries such as Japan, Korea and Singapore.

In order to understand what impact the meat self-sufficiency ratio has on GDP, model (1) was taken into consideration and changed into a new linear regression model to explain the determinants of GDP with the key indicator being the meat self-sufficiency ratio. The model is as below (View 2):

$$GDP_{it} = b_0 + b_1 ME_{it} + b_2 ODA\_A_{i(t-1)} + b_3 FDI\_P_{i(t-1)} + b_4 MSSR + e_{it} \text{-------------------------(2)}$$

GDP: Gross domestic product per capita

ME: Meat exports, per capita

ODA_A: Official development assistance in agriculture, per capita

FDI_P: Foreign direct investment in the primary sector, per capita

MSSR: Meat self-sufficiency ratio

i: country

t: time

Time for ODA and FDI is lagged in order to measure the impact of money inflow of the previous year to the year after. GDP per capita is the explained variable of the equation measures the wealth of a country. Unlike model (1) the objective of this model (2) is to discover how the explanatory variables affect the *wealth* of a country and not the actual economic growth. Although there are many different determinants of GDP, this model focuses on the determinants that directly provide income domestically. Exports provide direct income to the country and FDI as well as ODA are both inflows of

money from other countries. Outward orientation is one of the key indicators of

economic growth suggested by neoclassical theory (Kowalski, 2000), and in this model

the variable of meat exports applies to that. On the other hand, inward orientation

helps the development of a country directly; developing countries with low income are

highly dependent on capital inflows from foreign countries for their development

strategies; FDI and ODA apply to this category. Meat Exports, ODA and FDI are all

divided by the population of each country and transformed into per capita, allowing an

equal comparison. Although there are income differences in the countries, since the

countries are not divided by income but by their meat self-sufficiency ratio, this is not

taken into consideration.

4.2 Method

All countries studied have a food self-sufficiency ratio of more than 90% (View Table 2).

The nine countries are divided into three groups according to their meat self-sufficiency

ratio (view Table 1) and data are pooled for a span of sixteen years from 1996-2011. This

grouping of the countries allows us to measure how the impact on GDP differs according

to the level of meat self-sufficiency. Pooling data solves the problem of the lack of data

available, as data for FDI are available only for years 1995-2010.

5. Data and Expected Results

Data for GDP per capita was taken from the World Development Indicators, data for

meat exports and FDI inflows in the primary sector[2] were taken from FAOSTAT, and

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[2] The primary sector is the sector of an economy that makes direct use of natural resources, including
agriculture, forestry, fishing and mining.

data for agricultural ODA was taken from the OECD database. Meat exports, FDI and ODA were divided by population in order to make them per capita, and the data for population was also taken from the World Development Indicators. Data for FDI in agriculture would have been more precise but due to lack of data, here it is substituted with FDI in the primary sector. Data for meat self-sufficiency ratio was not directly available so it has been calculated according to the food self-sufficiency ratio formula released by the FAO using the data of meat production, imports and exports, available in the FAOSTAT. Government expenditure in agriculture would have been another appropriate variable as government spending specifically directed to programs targeted at food security would promote food security. (Djokoto, 2012) However, there was a significant lack in data so it is omitted in this study.

There are mainly two forms of money inflow that play a significant role in the development of the host countries- official development assistance (ODA) and foreign direct investment (FDI). ODA is provided by official agencies and is administered with the promotion of the economic development and welfare of developing countries. (OECD) Foreign aid is known to have both negative and positive effects on the economy; on the positive side it has helped boost GDP through structural transformation of the economy, provided technical assistance, policy advice and modern technology, helped overcome budget deficits and also funded projects for further development. On the negative side, it can increase debt burden when it is substituted for domestic savings. (Mohey-ud-din, 2005) In the study of Ekanayake and Chatrna (undated) they found that foreign aid was negative for low-middle income countries.

On the other hand, FDI is not governmental but is investment made by companies or entities based in a country to another company or entity in the host country. Unlike

ODA, this is not charitable and investments are made with the purpose of gaining profits in the host country. (Investopia, undated) The meat self- sufficiency ratio is the main focus of this thesis, as domestic access to meat is thought to have a positive impact on the wealth of a country, as explained earlier.

The expected results are the following (See Table 1):

Table 1: Expected Results

Variable	Definition	Expected Results
GDP	GDP per capita (current US$)	N/A
ME	Meat Exports per capita(1000 tonnes)	+
ODA_A	ODA in the agricultural sector per capita (current US million $)	+/−
FDI_A	FDI in the primary sector per capita	+
MSSR	Meat Self-Sufficiency Ratio per capita	+

6. Results and Analysis

6.1. Group 1 (Paraguay, Nicaragua and Brazil)

For Paraguay, Brazil and Nicaragua, the meat self-sufficiency ratio had a negative impact on GDP. (See Table A-1) An explanation for this could be problems in the efficiency of the production; this is necessary to be more efficient in supplying internal and external demands. Another factor is the price of meat. In Brazil where beef

and poultry are the main in the meat industry, prices as of 2013, especially for beef, have gone up significantly compared to approximately 10 years ago. (De Zen and Dos Santos, 2013) If prices rise, less people would be able to afford them, meaning that although there is adequate supply (*availability*) for the population, it is no *accessible* for all. The same goes for Paraguay and Nicaragua; the domestic price of meat is influenced not just by the international price of beef, but also the impact of diseases such as foot-and-mouth disease at home or in the neighboring countries. (Monfort and Peña, 2008, 5)

Group 1 has the highest meat self-sufficiency ratio but also has the highest number of meat exports on average, as it can been seen from the graph below. (See Figure 4)

Figure 4: Percentage of Meat Exports in the Nine Countries, Average 1996-2011
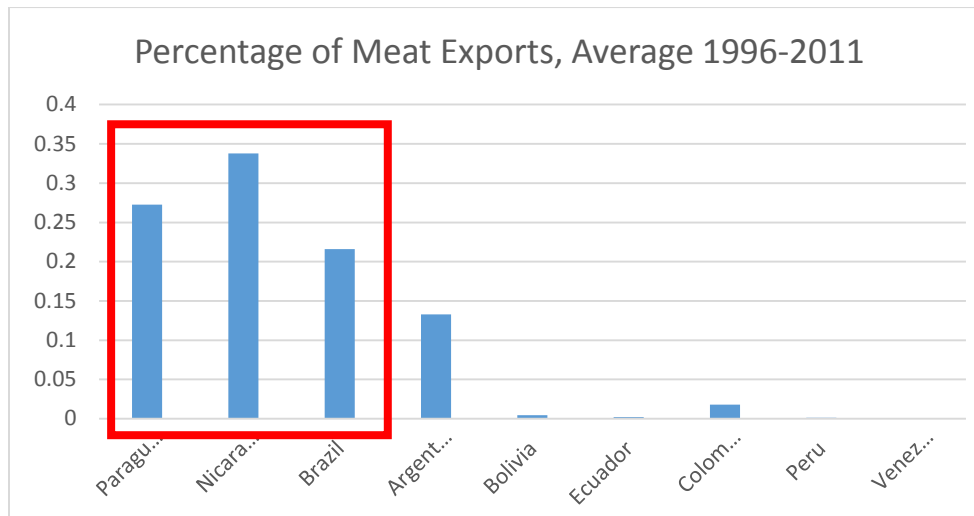
Source: FAOSTAT

These countries export more than 20% of their domestic production, with Nicaragua topping the list with a little over 30%, Paraguay with an almost 30% and Brazil with circa 20%. Evidently, since the three nations depend heavily on exports as a source of income, the results match the expected results that exports have a great impact on GDP.

Brazil has traditionally been a large exporter of beef, but in 2013, the Argentine government imposed trade restrictions on overseas sales of beef, turning Paraguay into the third largest exporter in the Mercosur area. (MercoPress, 2013) Another aspect that showed to have an impact on GDP is inward FDI in the primary sector. This result was expected, as FDI not only helps to integrate developing countries into the global market and increases the capital available for investment, but also is a means of transferring production technology, skills, innovative capacity and organizational and managerial practices between locations. (Mallampall & Sauvant, 1999) Although the relationship between FDI and exports remains controversial, it is widely believed that FDI promotes exports for the same reasons that it has a positive impact on GDP; it augments domestic capital for exports, transfers technology and know-how and facilitates access to new and large foreign markets. (Zhang, 2005) Zhang and Song (2002) have found from their regression analysis that FDI and exports could be simultaneously related, meaning that in one direction, FDI promotes exports, and vice versa. On the other hand, Hirschman (1958) emphasized that there may be differences between sectors, as each sector has a different potential to absorb foreign technology and create linkages with other foreign markets, especially in mining and agriculture. There are many other factors to consider but will be omitted, as this is a topic of the relationship between FDI and exports, which is not the main focus of this study. Interestingly, ODA turned out to be insignificant. Although ODA was expected to have both positive and negative results, it is odd considering the fact that there has been a great amount granted to these countries, especially Brazil, which about 350 million USD have been granted to as ODA to the Brazilian agriculture since 2000. However finding the reasons for this outcome is another topic of discussion and will be omitted.

6.2. Group 2 (Argentina, Bolivia, Ecuador)

Results have shown the meat-exports variable has a very significant impact on GDP, matching my hypothesis. (See Table A-2) This result supports the theory of Bouet and Laborde (2008), that even if (European) agriculture is close to self-sufficiency for numerous finished agricultural products, trade plays a major role as far as agricultural inputs are concerned.

In contrast, the meat self-sufficiency ratio and agricultural ODA showed to have a negative significant impact on GDP for the three countries. The meat self-sufficiency ratio in these three countries are all above 100% meaning that day have a surplus of meat in the country, which is not resulting into income. In the case of Argentina, when the global demand of beef rose in the early 2000s, the domestic beef prices also went up, and along with the default and subsequent inflationary problems at the time, meat became much more expensive. In response, the former Prime Minister Kirchner implemented strict measures by raising taxes on beef exports and later taking a more extreme measure of banning exports completely for 18 days. (Quartz, 2013) In Bolivia, the problem lies in the absence of a professionalized, meritocratic bureaucracy within most public sector organizations (Fairfield, 2004), that hinder any attempts to successfully implement effective public policies in the livestock sector. Moreover, organization proliferation and instability prevents public sectors to have effective relations with the private sector and from the governmental programs to benefit the small producers. In Ecuador, several factors such as have prevented greater growth rates and the subsector's ability to meet higher levels of consumer needs at affordable costs; high risk and high cost seem to characterize the livestock sector in this country (Sarhan, 1988)

FDI did not have such a significant positive impact as predicted but the value is between 1 and 1.5, meaning that it may somewhat have a positive impact on GDP. This can be explained by the fact that while FDI to Argentina has been steadily increasing, Bolivia and Ecuador do not receive the same treatment. Ecuador is relatively open to FDI but FDI rates are very low in comparison with other countries in Latin America and the investment climate is very uncertain due to frequent changes and contradictions in economic, commercial and investment policies. (US Department of State, 2014) Net FDI inflows to Bolivia increased greatly in the late 1990s thanks to privatization, but as its wave ended, it decreased rapidly, with investors leaving the country for fear of renationalization. (Brauch, 2014)

6.3. Group 3 (Colombia, Peru and Venezuela)

For this group, meat self-sufficiency showed to have a strong negative impact on GDP, the value being relatively high. (See Table A-3) On the other hand inward agricultural FDI proved to have a positive impact on the GDP of these countries. Meat exports was somewhat significant, agricultural ODA showed insignificant. One of the main characteristics of this group is that they have the lowest number of meat self-sufficiency ratio and exports that are close to zero of their meat production. The fact that they do not export explains why the results for this variable wasn't as significant as the other groups. This means that investment from other countries mainly affect the wealth of these countries. The reasons why the meat self-sufficiency ratio has such a negative impact on these countries can be explained by the inefficient production and marketing system, and because of the low income of the farmers due to lack of international competition and inflows from exports. Moreover, Colombia and Venezuela,

as already mentioned previously, suffer from the problem of illegal meat smuggling. As a result of government price controls and extreme currency fluctuations, low-cost Venezuelan groceries can be sold for as much as 10-times its price in neighboring Colombia. (Otis, 2014) It can also be assumed that because of inflation, although the self-sufficiency ratio may be high, the population may not actually have access to the meat.

The poultry industry of Peru has been on the rise in recent years, with the national per capita consumption of chicken meat has showing significant growth. This has strongly impacted the yellow corn industry which is the second largest in Peru, which is used as chicken feed and represents approximately 90 percent of poultry mear production. (Jara & Ganoza, 2014) This has caused national yellow corn prices to rise and although the government has implemented import policies, the informal boiler producers, in other words, producers who are not legally established and do not pay taxes remain a major problem. They account for about 25% of the industry and are not able to import corn due to the lack of appropriate registration with the tax authority, thus reply solely on local corn. This has caused domestic prices of yellow corn and chicken meat to increase. (Jara & Ganoza, 2014) Evidently, the national consumption, especially for the lower class will drop, meaning that less people have access to food. Such issues explain why having a relatively high meat-sufficiency ratio does not necessarily impact the GDP positively.

The results for each group can be summed up as below: (See Table 2)

Table 2: Results for Each Group

	Group 1	Group 2	Group 3
Meat exports*	+	+	Somewhat +
ODA in agriculture*	-	-	Insignificant
FDI in primary sector*	+	Somewhat +	+
Meat self-sufficiency ratio	-	-	-

*per capita

7. Concluding Remarks and Suggestions for Further Research

This work analyzed the impact of the meat self-sufficiency ratio on the GDP in nine

Latin American countries, divided into three groups according to their meat self-sufficiency

ratio, for years 1996-2011. Using data from various databases, results that for all groups

demonstrated that the meat self-sufficiency ratio had a negative impact on GDP. The main

finding is that although Latin American countries have a high meat self-sufficiency ratio,

they lack the successful implementation of governmental programs and policies as well as

the lack of a healthy and efficient production system that hinders the population to benefit

from it. The main contribution of this paper is that it shed a light on the impact of the meat

self-sufficiency ratio in middle-income developing countries on country wealth. Other results

have shown that FDI in the primary sector has a positive impact on the GDP of all groups,

meaning that investment directly leads to growth in all of these countries. In addition, for

Groups 1 and 2, meat exports had a positive impact as they export much of the meat they

produce, directly resulting into income, whereas for Group 3 results were relatively

insignificant as the amount they export is close to zero. One interesting result was that the

ODA results were insignificant or negative for all groups, but here it should not be

interpreted as it having no impact or harms economic development; but rather that the countries lack good governance to maximize the benefits of foreign aid. Knack (2001) emphasizes that ODA improves economic growth only in developing countries with a healthy political and economic environment policies and institutions; Jaoudai and Hermassi (2013) explain that governance is a concept that can influence economic growth through the creation of a favorable climate for public and private investment. Other aspects that should be taken into consideration in further studies are government expenditure in agriculture, political situation, inflation, food prices, freedom of trade and tariffs, as well as a longer time period of study. The price of meat differs from country to country and depends heavily on the economic and political situation. Another suggestion is that the type of meat produced should be specified in the model. Although beef is the main sector of the meat industry in most Latin American countries, there are some that also have large poultry and pork production. Since poultry production tends to be cheaper than beef and requires less space, the consumption prices are also relatively cheaper, thus making it more accessible to the public. There is the issue here that to my knowledge, these data are not easily accessible, especially for developing countries that have experienced extreme political instability in the past; however these data will enable a more precise analysis of this study.

8. Annex

Results for Group 1: Paraguay, Brazil and Nicaragua

Table A-1: Results for Group 1

Regression Statistics	
Multiple R	0.8407338
R Square	0.7068333
Adjusted R Square	0.679562
Standard Error	1524.1926
Observations	48

ANOVA

	df	SS	MS	F	Sig F
Regression	4	240852204.9	60213051	25.91856	5.65E-11
Residual	43	99896014.3	2323163		
Total	47	340748219.2			

	Coefficient	Standard Error	t stat	P-value
GDP	9781.1794	1598.938115	6.117297	2.47E-07
Meat Ex*	178266954	33531601.6	5.316386	3.57E-06
ODA_A**	-51077084	48340927.73	-1.0566	0.296594
FDI_P*	55850993	18329678.79	3.047025	0.003941
MSSR**	73.063989	14.02454283	-5.20972	5.08E-06

*t=positive, **t=negative

Results for Group 2: Argentina, Bolivia and Ecuador

Table A-2: Results for Group 2

Regression Statistics	
Multiple R	0.868811
R Square	0.754833
Adjusted R Square	0.732027
Standard Error	1830.6
Observations	48

ANOVA

	df	SS	MS	F	Sig F
Regression	4	4.44E+08	1.11E+08	33.09766	1.29E-12
Residual	43	1.44E+08	3351095		
Total	47	5.88E+08			

	Coefficient	Standard Error	t stat	P-value
GDP	18035.38	8031.488	2.245584	0.029925
Meat Ex*	5.12E+08	75246578	6.80998	2.43E-08
ODA_A**	-2.4E+07	15099112	-1.59828	0.117303
FDI_P***	5345021	3955251	1.351373	0.183643
MSSR**	-160.702	80.18475	-2.00415	0.051379

*t=positive, **t=negative, ***t=somewhat positive

Results for Group 3: Colombia, Peru, Venezuela

Table A-3: Results for Group 3

Regression Statistics	
Multiple R	0.872957
R Square	0.762055
Adjusted R Square	0.73992
Standard Error	1391.584
Observations	48

ANOVA

	df	SS	MS	F	Sig F
Regression	4	2.67E+08	66670917	34.42846	6.83E-13
Residual	43	83269763	1936506		
Total	47	3.5E+08			

	Coefficient	Standard Error	t stat	P-value
GDP	42813.28	3402.676	12.58224	5.23E-16
Meat Ex***	3.94E+08	3.89E+08	1.012623	0.316904
ODA_A	34930870	1.86E+08	0.187658	0.852027
FDI_P*	28224642	6338736	4.452724	5.94E-05
MSSR**	-409.835	36.55554	-11.2113	2.4E-14

*t=positive, **t=negative, ***t=somewhat positive

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