

# **FACTORS AFFECTING URUGUAY'S BILATERAL TRADE FLOWS: GRAVITY FLOW MODEL**

**Jyväskylä University  
School of Business and Economics**

**Master's Thesis**

**2022**

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Subject: Banking and International Finance  
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## ABSTRACT

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Title Factors Affecting Uruguay's Bilateral Trade Flows: Gravity Flow Model	
Subject Banking and International Finance	Type of work Master's Thesis
Date 23.1.2022	Number of pages 46
<p>Abstract</p> <p>This paper focused on a study of factors affecting to Uruguay's bilateral trade flows. Uruguay, a small country in South America, is an export-oriented country with sectors focusing on agriculture products. Its major trading partners have been throughout the history the neighbouring countries Brazil and Argentina, with whom Uruguay is one of the founding members of Mercosur. Lately, also China, the United States and the European Union have become one of the major trading partners of Uruguay. Previous literature shows that trade agreements, especially Free Trade Agreements, increase the trade flows between countries. In addition, countries cultural similarities, governmental actions and geographical location have impact on the trade between countries. This research focused on estimating what variables are affecting to Uruguay's trade flows. The study was executed with estimating six country pairs impact on Uruguay on seven time periods. The estimation was executed in Stata software with atheoretical gravity flow equation with two cross-sectional datasets. The estimations were executed of countries in FTA with Uruguay; Argentina and Brazil, and of the countries which are not in FTA with Uruguay; China, the United States, Germany, and Spain. These two different estimations gave results to analyse the main aim of the study, the factors impacting on the bilateral trade flows of Uruguay, and its trade potential. The main findings of this study are aligned with the previous literature conducted about FTAs importance on trade flows. The main finding of the research is that Uruguay's trade flows are mostly affected by the Mercosur trade agreement and the Mercosur countries bring the most trade flows to Uruguay. Other important variables which rose in the research have been GDP and distance of capitals. It can be summed up from the study, that as previous literature and this study shows, the regional trade agreements, especially free trade agreements, have a major impact on the trade flows between countries. Although, it should be noted that different agreements in different sectors and country pairs may always differ. This should be kept in mind when conducting further research about the topic.</p>	
Key words International trade, gravity flow model, bilateral trade agreements	
Place of storage Jyväskylä University Library	

## TIIVISTELMÄ

Tekijä Vera Kröger	
Työn nimi Kauppasopimuksien vaikuttavat tekijät Uruguayn kauppavirtoihin: Gravitaatiomalli	
Oppiaine Taloustiede	Työn laji Pro gradu -tutkielma
Päivämäärä 23.1.2022	Sivumäärä 46
<p>Tiivistelmä</p> <p>Tämän työn tarkoituksena on selvittää Uruguayn kauppavirtoihin vaikuttavat tekijät, erityisesti tutkimalla kauppasopimuksien vaikutusta kauppavirtoihin. Uruguay on pieni valtio Etelä-Amerikassa, jonka talous on keskittynyt vientiin ja maatalouteen. Historiallisesti Uruguayn suurimmat kauppakumppanit ovat olleet naapurimaat Brasilia ja Argentiina, jotka ovat Uruguayn lisäksi Mercosur kauppavyöhykkeen perustajajäseniä. Viime vuosien aikana Uruguayn merkittäviksi kauppakumppaneiksi ovat nousseet myös Kiina, Yhdysvallat ja Euroopan Unioni. Aikaisemmat tutkimukset ovat osoittaneet, että kauppasopimukset, erityisesti vapaakauppasopimukset, lisäävät kauppavirtoja maiden välillä merkittävästi. Tämän lisäksi tutkimukset ovat osoittaneet, että kulttuurilliset sekä hallinnolliset yhtäläisyydet sekä maantieteellinen sijainti vaikuttavat positiivisesti kauppavirtoihin kahden maan välillä. Tämä työ on keskittynyt selvittämään mitkä tekijät ovat vaikuttaneet Uruguayn kauppavirtoihin. Tutkimus on toteutettu regressioanalyysillä kuu- den maan ja Uruguayn välillä, seitsemänä ajanjaksona. Estimaatit on toteutettu Statassa ei-teoreettisen gravitaatioyhtälön avulla, käyttäen poikkileikkausaineistoja. Estimoinnit on tehty kahdella eri poikkileikkausainestolla. Ensimmäinen estimointi on toteutettu vapaakauppasopimusmaiden Brasilian ja Argentiinan kanssa, ja toinen estimointi on tehty muiden maiden, Yhdysvaltojen, Kiinan, Saksan ja Espanjan kanssa. Estimoidessa kaup- pavirtoja eri aineistolla, saadaan tutkimuksella selville, että vapaakauppasopimukset ovat tilastollisesti merkittävä tekijä Uruguayn kauppavirroissa. Tämä tulos linjaa myös aikai- sempia tutkimuksia kauppasopimuksien vaikutuksesta kauppavirtoihin. Muut tekijät, kuten bruttokansantuote ja maiden pääkaupunkien välimatka, ovat myös merkittäviä te- kijöitä Uruguayn kauppavirtoja estimoidessa. Tulevia tutkimuksia tehtäessä tulisi huomi- oida, että vaikka tämän tutkimuksen tulos, sekä aikaisempi kirjallisuus osoittavat, että vapaakauppasopimukset vaikuttavat positiivisesti kauppavirtoihin, tulisi tämä aina esti- moida huomioiden eri sektorit ja maaparit.</p>	
Asiasanat Kansainvälinen kauppa, gravitaatiomalli, alueellinen kauppasopimus	
Säilytyspaikka Jyväskylän yliopiston kirjasto	

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# 1 INTRODUCTION

## 1.1 Background of the study

Economic co-operation and integration have a long history, and formal and informal trade agreements have been existing wherever people have traded (Plant & Taghian, 2008). According to Baier et al. (2008) a numerous amount of trade agreements has been executed between countries during the recent decades to control international trade. The popularity of trade agreements has been booming during the past twenty years and the ongoing negotiations are growing all the time. Their aim has been to unify the world and make an impact on trade and investment worldwide. Although, the latest research has shown deceleration on the globalisation (Baier et al., 2019).

During the recent years, the tension of international trade and different crises have been impacting on the trade and trade agreements negatively (Baier et al., 2019). On global level, the United Kingdom has left the European Union and the trade war between the United States and China's is impacting to tremendous number of countries. Also, the COVID-19 pandemic has had a huge impact on the world economy and trade worldwide. When considering the relationship between Europe and Latin America, the crises which could be mentioned are new terms between Cuba and the United States, and China's impact on the economy.

Baier et al. (2019) state that the trade agreements have been impacting the trade flows positively during the recent years. One of the major developments that has been executed is the creation of regional trading zones in which tariff and nontariff barriers are reduced or eliminated for countries within the trading zone. The common thought has been that the liberalisation will increase trade.

Today we are more aware than ever how events in the global economy influence each country's economic fortunes, policies and political debates, and international trade has a huge importance to increase growth, development and reduce poverty. Since the 1980s, almost all Latin American countries have gone through a process of reformation of their economy, including trade, financial and capital liberalization. International trade has revolutionized the economy and globalisation has had impact also to these countries, including Uruguay.

Uruguay is one of the most stable countries in South America considering corruption, education, and economy. Throughout the years it has kept a good relationship with its trading partners, and it is also one of the founding countries of Mercosur, the Southern Common Market, which was founded in 1991. Mercosur has increased the trade between its trading partners and promotes free trade, and efficient movement of goods, people, and currency.

Uruguay has been chosen to be the analysed country since it provides excellent trading and business opportunities for other countries. Uruguay is one of the strongest economies in South America, and according to OECD (2021)

Uruguay's tax to GDP ratio is 29 percent, when the average of Latin America and Caribbean's is 22.9 percent. The research (OECD, 2021) also states that Uruguay has had one of the fewest changes in the tax to GDP during 2018 to 2019. These are one of the reasons why Uruguay can be considered to be one of the most stable trade partners in Latin America. Uruguay has a strong economy in agriculture, textiles, and leather, and it has a natural resource in arable land, minerals, and hydropower.

Comparing Uruguay to other Latin American countries, it provides stable trade possibilities. During recent years, the international trade has been growing in Uruguay, and the country is globalising every year more. Globalisation is providing more opportunities and challenges to the nation and its people. This paper is conducted to analyse what are the major factors impacting on the trade flows of the globalising Uruguay.

The results of this thesis are aligned with the previous studies conducted of the topic. Various research before has proven that trade agreements increase the trade flows between countries. This thesis has got similar results, by stating that Uruguay has the highest trade flows with its neighbouring countries Argentina and Brazil, which are also Mercosur countries alongside Uruguay. The results of this thesis are credible, but further research with more variables and researched countries, will give an excellent further research topic, and will also provide more credible results.

## 1.2 Research aims and objectives

The aim of this paper is to determine what factors are impacting on the bilateral trade flows of Uruguay and what is its trade potential. Therefore, the primary research question can be defined as such:

“What kind of impact do variables, especially Free Trade agreement, studied in gravity flow model have on Uruguayan trade?”

In order to answer the research question, this paper lays a foundation to understand the empirical literature regarding to theories based on international trade, bilateral trade agreements, Uruguayan economy, and gravity flow model. The research question will be analysed with quantitative methods using cross-sectional data. The estimations are analysed by regression model.

To achieve the aim of the paper, the study also examines the following specific objectives:

- i. Define factors which influence bilateral trade flows between Uruguay and its major trading partners
- ii. Predict Uruguay's bilateral trade potential and performance
- iii. What is the degree of trade integration with the major trade partners?

### 1.3 Research structure

This study is organised in five different chapters, with first chapter introducing the reader to the motivation and background of the research, and explaining the research question, aim and objective. The second chapter presents the literature review. The literature review is divided into five parts, of which the first one includes international trade theories. Ricardian model (1817), Heckscher-Ohlin theorem (1919) and Leontief's paradox (1953) will give the basic understanding of how international trade theories have been developed throughout the years. After that the regional trade agreements and gravity model will be presented which give crucial understanding for the rest of the study. Next, the literature review gives an overview of Uruguayan economy and trade. This will help the reader to understand the previous and current state of the country. The last part of the literature review presents the previous studies executed of the topic of the research.

The next chapter of the paper starts the empirical part. Chapter three explains the data and methodology used in the empirical part. It explains how the estimations will be executed, what are the variables and presents the different atheoretical and theoretical gravity flow model equations used in the study. The fifth chapter of the paper presents the estimations and analyses the results from them. The last chapter ends the paper with conclusions.



## 2 INTERNATIONAL TRADE THEORIES

### 2.1 Ricardian model

Countries have various reasons to trade including its positive impact to proximity, resources, and absolute advantage (Feenstra & Taylor, 2017, p. 85). The Ricardian model identifies the impact of the technological differences as one of the reasons to trade and it is on the focus of the model (Feenstra, 2016, p. 1). It also introduces the principle of comparative advantage in which an agent, under free trade, will produce more of and consume less of a good for which they have a comparative advantage.

To explain the Ricardian model, it can be identified through an example by Feenstra and Taylor (2017, p. 89-102). In the example, two countries, home country and a foreign country are producing two different goods, wood  $Q_w$  and cheese  $Q_c$ . When the countries are not trading, the optimum home production can be seen in figure 1 at point A and the optimum foreign production from figure 2 at point A\*. The relative price of wood in home country is 0,5 and foreign relative price is 1. The relative price of cheese is in home country 1 and in foreign country 2. The production possibilities frontiers (PPFs) are different for both countries, since home country produces wood efficiently in relation to cheese, and foreign country produces cheese more efficiently than wood.

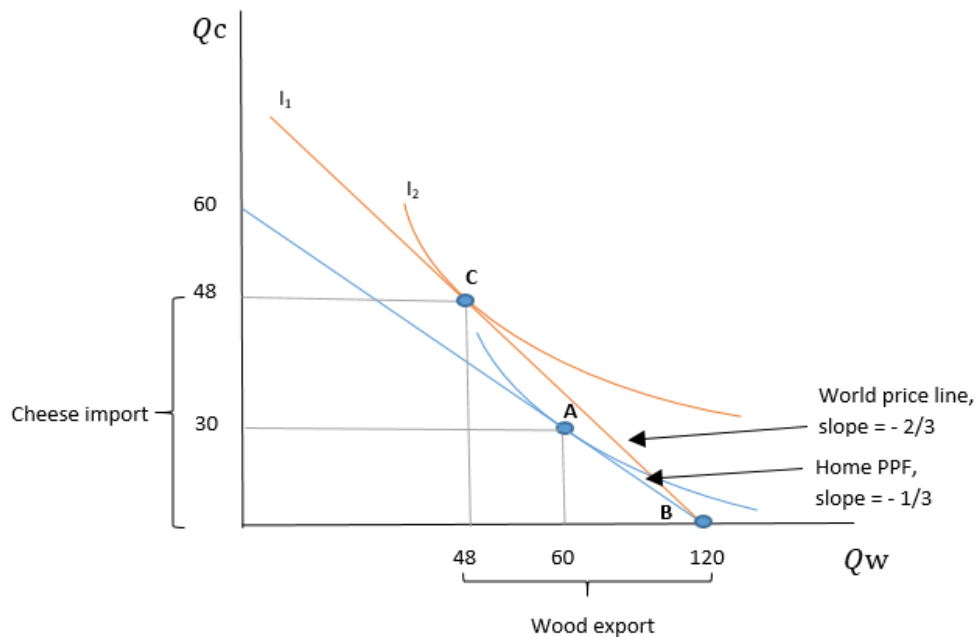


Figure 1: Home equilibrium with trade, Ricardian model (Feenstra & Taylor, 2017, p. 100)

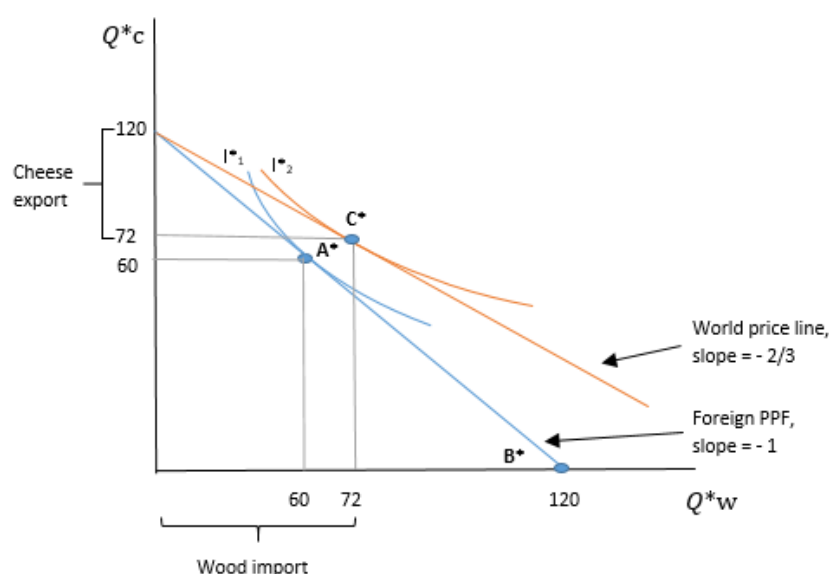


Figure 2: Foreign equilibrium with trade, Ricardian model (Feenstra & Taylor, 2017, p. 103)

International trade would benefit both countries since with trading they would both reach new optimums for consumption, for home country it would be point C in figure 1 and for foreign country point C\* in figure 2. In international trading, home country would be producing only wood in point B in figure 1 and foreign country would produce only cheese in point B\* in figure 2. When the countries do not trade, the production possibilities frontier can also work as a budget constraint.

In the two-country world, everything leaving one country must arrive in the other. In this case then home country is exporting wood in which it is having a comparative advantage, and foreign country is exporting cheese in which it has comparative advantage. This outcome is the pattern of trade is determined by comparative advantage, which is the first lesson of the Ricardian model (Feenstra & Taylor, 2017, p. 102).

## 2.2 Hecksher-Ohlin theorem and Leontief's paradox

Unlike the Ricardian model, Hecksher-Ohlin theorem separate with the perception of technological disparity and instead shows how factor endowments (labour, capital and land) form the basis for trade (Feenstra, 2016, p. 1). Assuming that there are only two countries and two factor endowments, the model examines that a country's exports will be based on the resources the country has in abundance. (Feenstra & Taylor, 2017, p. 164-166)

The Heckscher-Ohlin theorem is explained through an example (Feenstra, 2016, p. 167-179). In the example, we are assuming that there are two countries, home and foreign country, and two different factors, labour and capital. One country produces two goods, computers  $Q_C$ , and shoes  $Q_S$ . There are also constant returns on scale. Home country has more capital, so they are producing more of computers than shoes. Point A in figure 3 is the no-trade equilibrium.

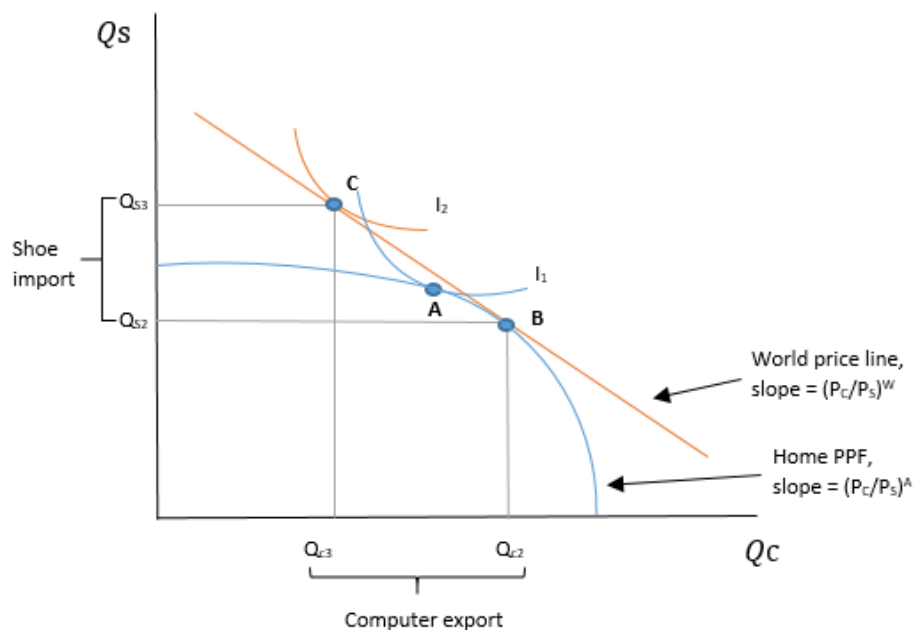


Figure 3: International free-trade equilibrium in home, Heckscher-Ohlin theorem (Feenstra & Taylor, 2017, p. 176)

When the world price is higher than in the home country, the production of computers is moving from point A to point B. It will lead to that home will produce more computers than there will be demand for without international trade. The computers in home country will decrease when the prices rise, but the demand of shoes will rise when their price decreases. With international trade the home consumption will rise from A to C.

On a contrary, foreign country has a lot of labour. This is the reason why they are producing more shoes than computers. In figure 4 the point  $A^*$  is the no-trade equilibrium.

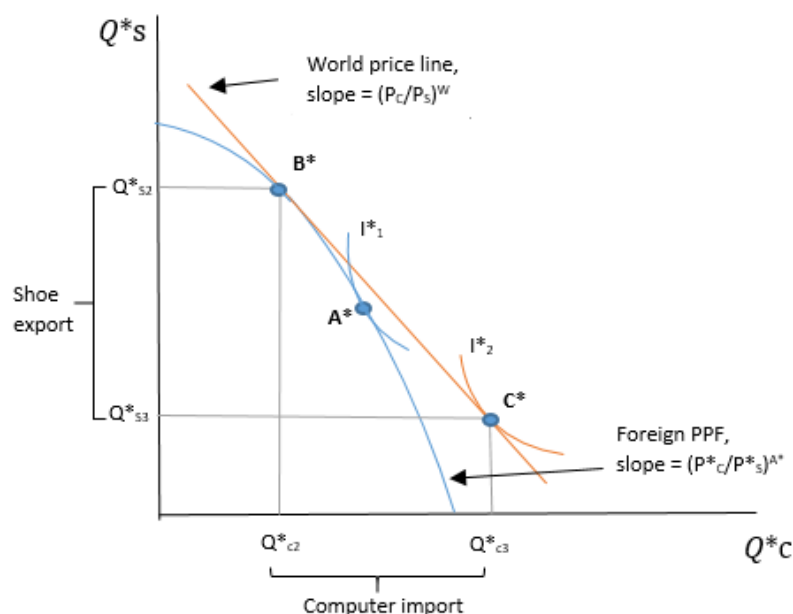


Figure 4: International free-trade equilibrium in foreign country, Hecksher-Ohlin theorem (Feenstra & Taylor, 2017, p. 177)

When the world prices are less than in the foreign country, the foreign country shifts to produce more shoes, point  $B^*$ , and consume less computers. Foreign consumption shifts from point  $A^*$  to  $C^*$ .

Leontief (1953) has proven that international trade does not always function as in Hecksher-Ohlin model. In 1947 the United States was abundant in capital relative to the rest of the world. Thus, Hecksher-Ohlin theorem, Leontief expected that the United States would export capital-intensive goods and import labour-intensive goods. What he found out was that the United States was importing capital-intensive goods and exporting labour-intensive goods. This is called Leontief's paradox (Feenstra & Taylor, 2017, p. 182). Intensive and extensive margin have impact also on trade creation. Extensive margin stands for the number of companies exporting, and intensive margin refers to exports per exporting company (Fernandes et al. 2018).

Feenstra (2016, p. 1) states that the Hecksher-Ohlin theorem is not trustworthy theory due to historical or modern trade patterns unless we accept technological differences across countries. This is a reason why the Ricardian model is still more trustworthy today when comparing the old traditional trade models.

The traditional international trade theories by Ricardo and Hecksher-Ohlin model explain international trade theories by comparative advantage, productivity difference and factor endowment differences, and the models give an explanation why countries trade. Although, economists have pointed out that these traditional theories do not explain why countries with identical factor endowments would not trade and produce domestically. Intra-industry trade

explains the exchange of similar products belonging to the same industry. It is to suppose that intra-industry trade comes because different commodities are produced and traded to fulfil consumer's need (Brander, 1981). Also, New trade theories (NTT) were established in the 1980s (Ethier 1982; Krugman 1984, 1986; Brander and Spencer 1985; Eaton and Grossman 1986; Grossman and Horn 1988; and Grossman and Helpman 1991). New trade theories were established to take into consideration that many countries which are similar in development, structure and factor endowment, trade with each other (Deraniyagala & Fine, 2001).

## 2.3 Regional trade agreements

Regionalism has a long history since for as long as there have been nations with trade policies, there have also been discrimination or favouring between the counterparties. Different attempts of regional trade agreements have been set throughout the years with different rates of success. (Frankel, 1997, pp. 1-2).

Regional trading agreements can cover various different arrangements from small tariffs to economic integration, and five levels can be distinguished: preferential trade agreements, free trade areas, customs unions, common market, and economic unions (Frankel, 1997, p. 12-17).

Regional trade agreement	Definition
Preferential Trade Agreements (PTA)	Trading bloc which gives partial preferences to a set of trading partners.
Free Trade Area (FTA)	Eliminating all tariffs and restrictions between trading partners. Retain varying levels of barriers against non-members.
Customs Union	Similar to FTA but also set a common level of trade barriers to outsiders.
Common Market	Similar to Customs Union but also entails free movement of factors of production: labour and capital.
Economic Union	Same as Common Market but in addition entails free movement of harmonizing national economic policies, including taxes and common currency.

Table 1: Five levels of regional trading agreements

The table shows different regional trade agreements by their amount of liberation, the lowest being the most liberate. Preferential trade agreement is the loosest type and only agreement which is granting partial preferences to a set of trading partners. These agreements can become one-way concessions in which a country can

give to another country a preference. In many cases the more developed country has set these for a less developed country. (Frankel, 1997, p. 12-13)

Free trade area and customs union are differing in a way that the countries of free trade area commit to eliminate all tariffs and quantitative import restrictions among others, but the customs union members also commit to set a common level of trade barriers vis-à-vis outsiders. These types of agreements main goal is to strengthen the domestic economy and to create employment due to the increase in trade flows between the participating countries. These first three stages fall within a range which has been characterized as shallow integration. The direct effects of these arrangements are working when there is international trade. (Frankel, 1997, p. 13-16)

The more advanced, deep integration, stages are common market and economic union. Common market is an arrangement which entails the free movement of labour and capital in addition of free exchange of goods and services among member countries. Migration in common market is difficult. In economic union on the other hand, migration is allowed as well. Economic union includes creating similar national economic policies, like taxes and a common currency for the countries. (Frankel, 1997, p. 16-17)

Baier et al. (2008) state that these all five different types of regional agreements are economic integration agreements. They are treaties between economic units and nations and aim to reduce policy by controlling barriers to the flow of goods, services, capital, and labour (Baier et al. 2008). According to WTO (2020) there are 306 regional trade agreements in force in autumn 2020.

Economic integration agreements and other trade-policy liberations have an impact on countries economic growth and development, and the trade agreements can help to decrease poverty (Baier et al. 2018). However, the economic effects are varying across countries different economic structures. Baier et al. (2018) state that developing countries face higher fixed trade costs due to higher government border-crossing costs and weaker infrastructure.

### **2.3.1 Factors impacting in the creation of trade agreements**

As mentioned, the countries that wish to enter a trading bloc with each other will have to make some sort of economic integration agreement. If the integration agreement will be negotiated with various countries, it will be called as a multilateral agreement. If the agreement is between two countries, it is a bilateral agreement.

In many cases the economic integration agreements can be seen as a consequence rather than reason for increased trade flows. Many times, the countries that share an agreement are geographically located close to each other or are wealthy nations who already trade with each other (Baier et al., 2008).

Baier and Bergstrand (2004) have been studying the factors that are impacting on the decision to create a trade agreement between the countries. They have

found out that the following factors have a likelihood of a trade agreement between a pair of countries

- 1) the distance of two trading partners
- 2) remoteness between countries and rest of the world
- 3) the similarity of the economies (GDP and economics of scale)
- 4) the greater difference in capital-labour endowment ratios between the countries
- 5) the less the difference is in capital-labour endowment ratios of the member countries relative to the rest of the world

Krugman (1991) states that the possible trading blocs consist more or less of neighbouring countries who would be each other's main trading partners even without special arrangements. Also, the geographic location of the country is important since the closer the countries are, the less are the transportation costs which boosts the trading (Baier & Bergstrand, 2004). This situation also leads to the removal of tariffs which boosts consuming.

The possibility of trade agreement creation also rises when the two countries are located remotely from the rest of world. The higher the average GDPs are and the less differences in the real GDP's, the economies are more likely to create trade agreement (Baier & Bergstrand, 2004). Also, the factor endowments from Heckscher-Ohlin model, capital, and labour, have an impact on the creation of trade agreements. Baier & Bergstrand (2004) have found out that the greater the difference in capital-labour ratios between countries, the more likely they are to enter into a trade agreement. In this situation, the countries will focus on the production of the goods the main factor will produce the best. Baier & Bergstrand (2004) also found out that the smaller the difference of the members' capital-labour ratio in respect of the rest of the world's, the more likely the countries will enter into trade agreement to block the trade diversion.

## 2.4 Trade agreements impact on trade flows

According to Viner (1950) trade creation and trade diversion are economical terms which are describing a situation where rest of the world possess customs with each other, but two countries have made a customs union or are part of free trade area. In a situation where the countries are in customs union or part of free trade area, the countries might benefit or suffer from it. The country will benefit if the trade is diverted from a more efficient exporter towards less efficient one. It means that the country will export the goods in a cheaper price than they would produce the good in their own country. This is beneficial and is called trade creation.

The opposite of trade creation is trade diversion. Trade diversion will occur when the trade flow is diverted from less cost-efficient partner to less efficient

one. In other words, trade diversion will happen when a country in customs union or free trade area will change their trade partner from a country which has low cost of trade but is not in the same custom union or free trade area, to a country which is in the same customs union or free trade area but has higher cost compared to the rest of the world. In trade diversion the overall effectiveness will suffer, and it is not cost-effective solution. (Viner, 1950.)

Baier and Bergstrand (2009) state that both trade creation and trade diversion are growing the trade flows between countries with trade agreements. On the other hand, some researches have proved something else. Ghosn and Yamarik (2004) have studied if economic integration agreements are trade creating or trade diversion. They state in their research that the usual concept is that trade agreements are trade creating. They find out that trade creation is fragile and unstable, and that gravity model literature leads to trade creation hypotheses easier than a robust statistical relationship.

Krugman (1991) has stated that trade agreements are more harmful than beneficial to world trade due to trade diversion. Although, in his study he finds out that in general trade agreements are beneficial to countries. The study about economic geography proves that usually countries that share trade agreements are located close to each other, especially if they are in customs union or free trade area. Even without trade agreements they would most probably trade with each other. When comparing the trade diversion to the benefits getting from trade agreements, the benefits are bigger.

It can be stated now that economic integration agreements and other trade-policy liberalizations have a positive impact to nations' growth, trade, and development (Baier et al. 2018). For most of the countries the economic integration agreements are believed to raise economic welfare.

Baier et al. (2018) also found out that the average extensive margin effects are larger than the average intensive margin effects for lower levels of trade liberalization which are free trade agreements and customs unions. On the other hand, for common markets and economic unions, the average intensive margin effects are larger than the average extensive margin effects. This can be explained by the fact that there has been a deeper level of economic integration which have already overcome export fixed costs in earlier stages of integration.

Kohl (2014) has stated that the most important factors of the trade agreements impact on trade flows is the date of signature of the agreement, the number of countries in the agreement, if the countries are part of WTO, the quality of the agreement. Baier et al. (2018) on the other hand state that one of the most important factors is the geographical location, culture, institutions, and development of the countries in the agreement. According to Kohl (2014) the agreements which have been implemented before year 1990 have been accelerating the trade flows more than trade agreements implemented after. Also, Kohl has noticed in his research (2014) that when all of the member countries are part of WTO, the trade agreement is more profound and the members are more engaged.



## 2.5 Gravity model

### 2.5.1 Background

Modelling and predicting trade flows has been one of the main tasks of international economics. Many different models have been executed to explain the trade, but gravity model has become particularly popular during the recent years. Gravity model is a good tool to use real data to explain trade flows with respect to policy factors.

It can be stated that there are three reasons for the success of the gravity model in the past three decades (Baier & Bergstrand, 2007). Firstly, economic explanations to gravity have been identified already at the 1980s although it was not unacknowledged yet. Secondly, gravity model usually matches to the data. Thirdly, policy relevance was high during the past decades when gravity modelling only was able to analyse new free trade agreements.

Also, Dunn and Mutti (2004) state that gravity model works since there is a strong empirical relationship between the size of a country's economy and the volume of both its imports and exports. Large economies tend to spend large amount on imports since they have income. They also attract large shares of other countries spending, since they produce so much. In other words, the trade between any two economies is larger, the larger is the economy.

Gravity model has been criticized as well. A few previous studies have shown that countries tend to spend much of their income at home. One of the most notable studies was by McCallum (1995) who found out using the gravity model that Canadian provinces traded 20 times more with each other than with the United States after controlling for distance and size. The result gained a lot of attention since both countries share the same language, are culturally similar and the tariffs are negligible. More papers were written to solve this issue.

Shortly, Helliwell (1995) confirmed that McCallum's results were accurate considering only Quebec region of Canada. Later Helliwell (1997) agreed with the results of McCallum's Canada-USA data. Later, these papers have been reconsidered to be flawed. The exclusion of any kind of relative price variables was later shown to result as bias in estimation. To make sense of trade flows, we need to consider the factors limiting international trade (Dunn & Mutti, 2004, pp. 45).

### 2.5.2 Description of the basic model

Gravity model is rooted on the Newton's Laws of Gravitation. This so-called traditional gravity model was founded over 300 years ago and it considers that countries trade in amount to their respective market size and proximity (Yotov et al., 2016, pp. 12). The equation for universal gravitation is

$$F = G \frac{m_1 m_2}{r^2} \quad (1)$$

where  $F$  is the gravitational force between objects,  $m_1 m_2$  are the masses of the objects,  $r$  is the distance between the centers of their masses, and finally  $G$  is the gravitational constant (Feenstra & Taylor, 2017, pp. 194).

Dutch economic Jan Tinberg later has stated the model to present bilateral trade flows and immigration based on the economic sizes and distance between two units (Feenstra & Taylor, 2017, p. 300). He was the first one to formulate the mathematical equation of gravity-type model and apply it in an empirical setting (Shahriar et al. 2019). The traditional gravity equation is the following

$$trade_{ij} = B \frac{GDP_i GDP_j}{dist^n} \quad (2)$$

where  $trade_{ij}$  is the value of bilateral trade between country  $i$  and  $j$ ,  $GDP_i$  and  $GDP_j$  are country  $i$  and  $j$ 's national incomes. Distance is a measure of the bilateral distance between the two countries and  $B$  is a constant of proportionality (Feenstra & Taylor, 2017, p. 194).

The initial applications to Newton's Law of Gravitation are so called a-theoretical models (Yotov et al. 2016, p. 12). These a-theoretical models, as described Tinberg's model (1962), and Ravenstein's model used gravity to study immigration and trade flows respectively. Andersson (1979) was the first one to offer a theoretical economic foundation for the gravity equation under the assumptions of product differentiation by place of origin and Constant Elasticity of Substitution (CES) expenditures. Also, another early theoretical gravity theory was by Bergstrand (1985).

### 2.5.3 Gravity model's theoretical foundations

As already mentioned, despite of the theoretical developments, the gravity model of trade struggled to make impact until late 1990s and 2000s. Arkolakis et al. (2012), published a study which demonstrated that a large class of models create isomorphic gravity equations which preserve the gains from trade. It is demonstrated in the figure below that the gains from trade are invariant to a series of alternative micro foundations including a single economy model with monopolistic competition, a Heckscher-Ohlin framework, a Ricardian framework, entry of heterogeneous firms, selection into markets, a sectoral Armington-model; in which each country produces a different good, and consumers would like to consume some of each country's goods, a sectoral Ricardian model, a sectoral input-output linkages gravity model based on Eaton and Kortum, and a dynamic framework with asset accumulation (Yotov et al. 2016, p. 13). Most recently Allen et al. (2014) published a study about universal power of gravity by deriving sufficient conditions for the existence and uniqueness of the trade equilibrium for a wide class of general equilibrium trade models.

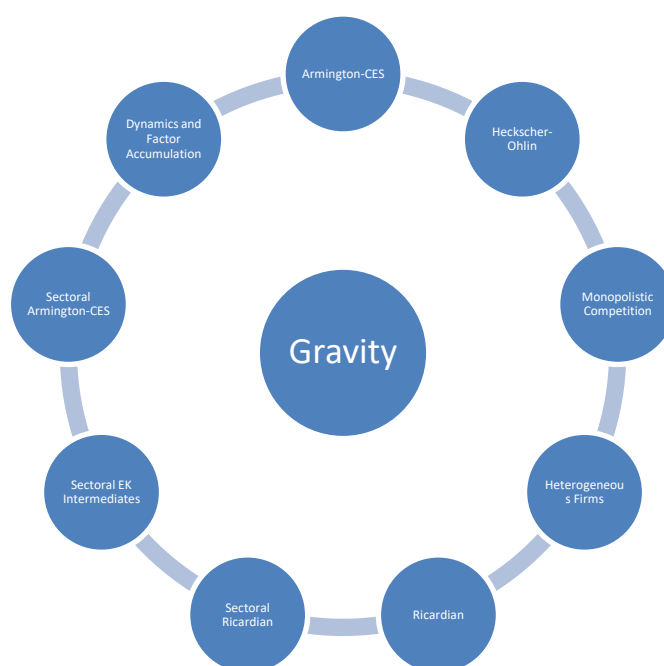


Figure 5: Gravity model's strong theoretical foundations (Yotov et al. 2016, p. 13)

## 2.6 Economy in Uruguay

Uruguay, officially the Oriental Republic of Uruguay, is a small economy located in South America. Sharing borders with Brazil and Argentina, Uruguay is a small country with estimated 3.51 million inhabitants. It has a high-income economy and is ranked first in Latin America considering democracy, government, and low corruption. It could be described as one of the most developed and socially progressive countries in South America.

Uruguay has largest middle class in Latin America which is represented by 60 % of the population (World Bank, 2021). The poverty indicators are below the Latin American average and the income distributions are considerably better. Comparative analysis shows that poverty is lowest in its region and income distribution is comparable to developed countries (Borraz et al., 2011).

Although, Uruguay has been one of the stable nations in Latin America, in 1999 to 2002 it experienced a major financial crisis. During the crisis, its economy decreased by 11 %, unemployment rose to 21 %, and over one third of the country's population lived in poverty (Mayer, 2010). The crisis was related to the collapse of Argentine economy, and banking and debt crises associated with it (Che, 2021). Economic stability returned in 2004, but due to fear of economical crash, Uruguay signed a three-year arrangement with International Monetary Fund (IMF) which committed Uruguay to a substantial primary fiscal surplus, low inflation, considerable reductions in external debt, and several structural reforms

designed to improve competitiveness and attract foreign investment (Mayer, 2010).

Following the financial crisis, Uruguay reached its biggest economic boom in 2000-2014. Over this 10-year period, the annual growth in real GDP per capita averaged 4.9 percent which was higher than the average 2.3 percent growth in rest of Latin America and the Caribbean (LAC). The economic boom in Uruguay was caused by several factors, including a bounce back from the financial crisis from the early 2000s and the growth in external demand of commodities that boosted agricultural export prices and emergence of new export sectors (Che, 2021).

Prior to the boom, for 50 years, Uruguay's GDP per capita had been growing with an average pace of 2 percent. It can be noticed from the table below, that growth has slowed down after 2014.

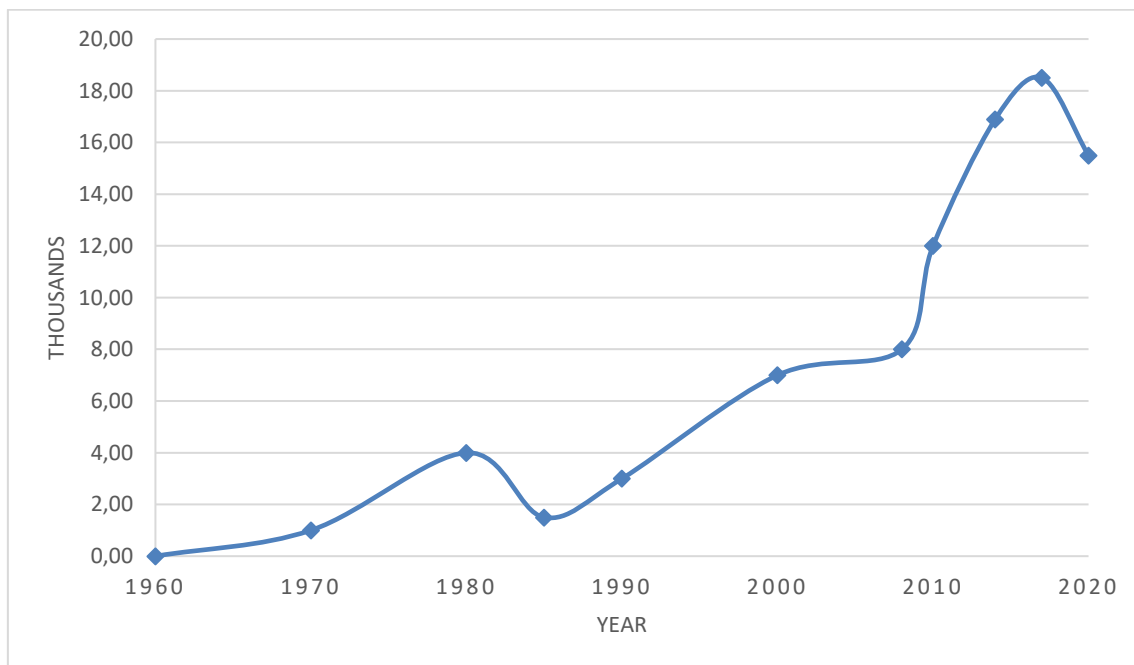


Figure 6: GDP per capita (current US\$) – Uruguay (The World Bank, 2021)

To grow the GDP and sustainable growth in the future, Che (2021) states in her research that Uruguay's main advantage will be its institutional strengths and ongoing infrastructure projects. Also, Uruguay's strength is its strong public governance and stable regulatory environment for trade and foreign investment. Other important factors for future growth are:

- i. Strong labour market, especially in Uruguay which has low population growth and declining labour force
- ii. Quality education
- iii. Increasing female and immigrants into the labour market
- iv. Diversification out of commodity sector
- v. Keeping crime statics low

### 2.6.1 Trade

Uruguay is an export-oriented economy. In 2020 Uruguay exported a total of \$13.607B. The exports were decreased by \$3.385B from year 2019. The peak year of exports was 2018 when exports were in total of \$17.03B.

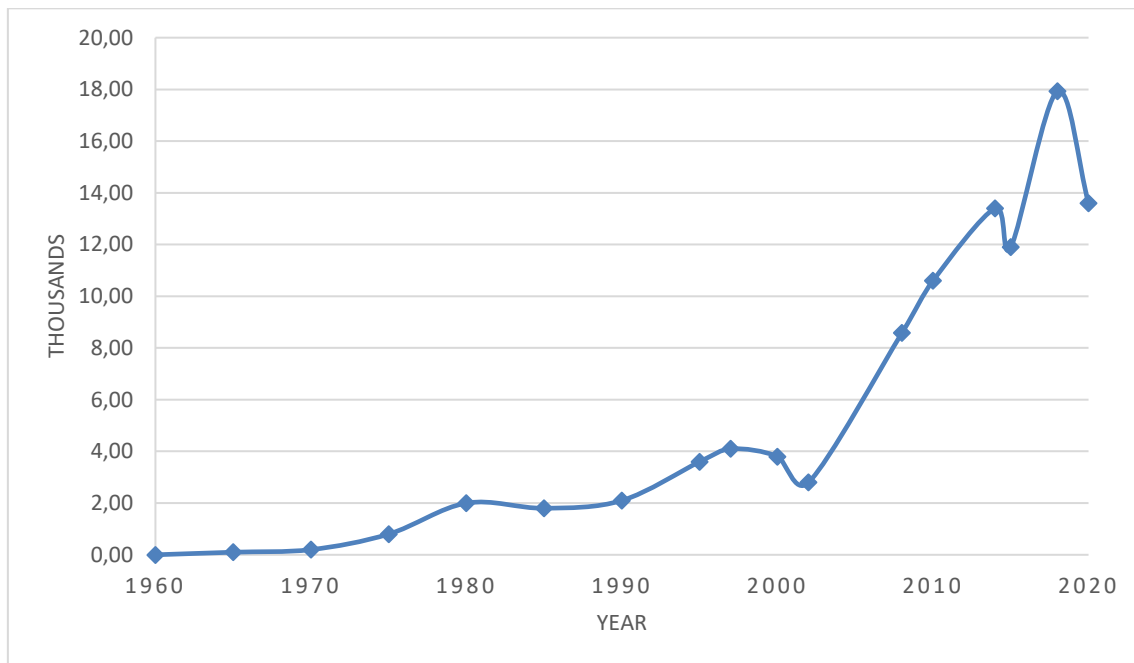


Figure 7: Exports of goods and services (World Bank, 2021)

Uruguay's the leading economic sector is agriculture with meat processing, agribusiness, wood, and wool. It can be seen from the figure below that the highest sector in exports is agriculture, texture, and leather. Also, one of the exports is also plastics. Plastic-based products take almost 4 % of Uruguayan exports.

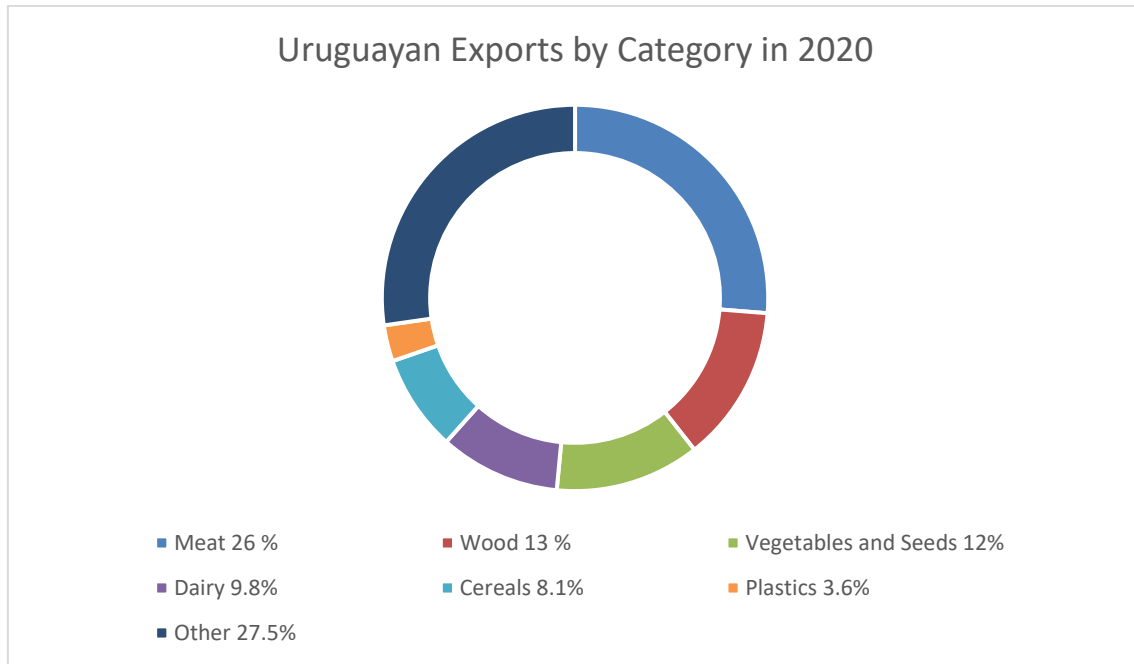


Figure 8: Uruguayan exports by category in 2020 (Trade Economics, 2021)

Uruguay has diversified its export market to reduce the dependency on the neighbouring countries, Argentina, and Brazil. Its main trading partners in 2020 were China (24%), Brazil (18%), the United States (9.2%), and Argentina (5.2 %) (Trading Economics, 2021).

In 2020 Uruguay imported in total of \$11.259B. As can be seen from the Figure 9, the imports have been decreasing since 2018 when the imports were \$13.825B. The peak of imports has been reached in 2013 when the total imports were \$15.168B.

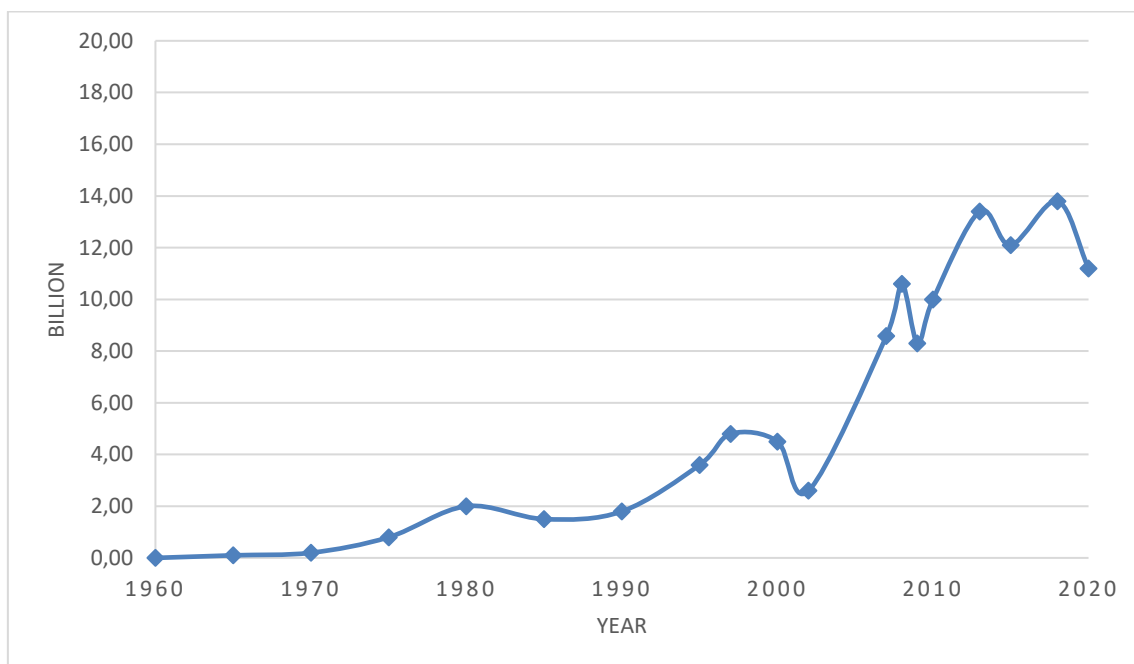


Figure 9: Imports of goods and services (World Bank, 2021)

The main sectors for Uruguayan imports are industrial suppliers, crude and refined oils, machinery and equipment, and food and beverages. The highest sector in 2020 was industrial suppliers by covering more than 20% of the imports. Uruguay is also world's biggest importer of Mate (OEC, 2021).

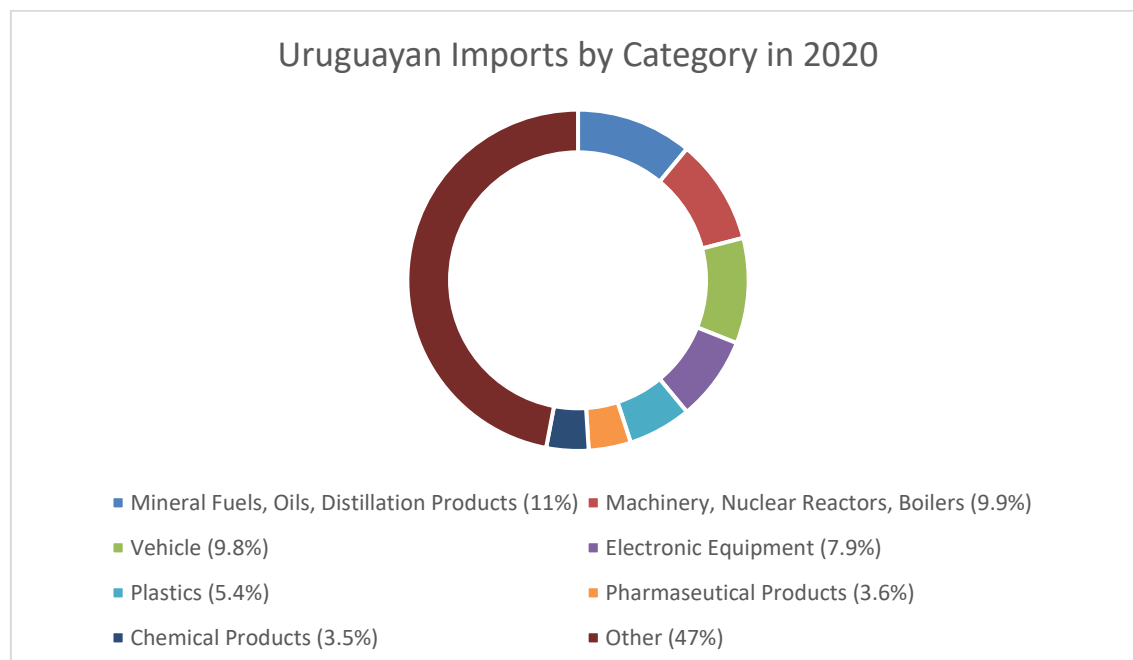


Figure 10: Uruguayan imports by category in 2020 (Trade Economics, 2021)

The main import partners were in 2020 Brazil (20%), China (19%), Argentina (13%), the United States (12%) (Trading Economics, 2021).

### 2.6.2 Trade agreements

Throughout the history Uruguay has had strong political and cultural ties with the European countries and the Latin American countries. With increasing globalisation and growing economy, also its links with the United States have strengthened. Historically Uruguay has shared basic values with Western world such as democracy, political pluralism, and individuals' liberty. Also, Uruguay's good reputation as a stable country has made it ideal and reliable trading partner which has led to the possibilities to participate to different trading associations. Participation to different associations has increased the visibility and trading possibilities for Uruguay.

Uruguay is a member of World Trade Organisation (WTO) since 1995 and member of GATT since 1953. Also, Uruguay is one of the founding members of two important associations taking part in Latin American economy: Latin American Integration Association (LAIA/ALADI) and Southern Common Market (Mercosur).

In 1960 LAFTA, which became in 1980 the LAIA was instituted. Its founding members were Argentina, Brazil, Chile, Paraguay, Peru, Uruguay and Mexico. Later also Colombia, Ecuador, Venezuela and Bolivia joined. LAIA was

created to improve more free trade in Latin America (Malamud, 2010). Currently Uruguay holds numerous bilateral trade agreements in different scopes with different LAIA partners including special preferential access with Bolivia, Chile, Colombia, Cuba, Ecuador, Mexico, Peru, and Venezuela.

It can be noticed though that majority of Uruguay's trading agreements are under Mercosur in the table below. Mercosur has signed trade agreements with most of the Latin American countries and as well with Israel (2007), India (2004), SACU (2008), Egypt (2010) and Palestine (2011). Uruguay has also bilateral trade agreement with Mexico (2002).

<b>Multilateral Agreements</b>	
Agreement/Partner(s)	Date of Signature
WTO member	01 January 1995 (Contracting Party to GATT 1947 since 06 December 1953)
<b>Customs Unions</b>	
Agreement/Partner(s)	Date of Signature / Date of Entry into Force
MERCOSUR members	26 March 1991
<b>Free Trade Agreements</b>	
Agreement/Partner(s)	Date of Signature / Date of Entry into Force
MERCOSUR - Colombia AAP.CE N° 72	21 July 2017
Chile	04 October 2016 / 13 December 2018
MERCOSUR - Egypt	02 August 2010 / 01 September 2017
MERCOSUR - Israel	18 December 2007
MERCOSUR - Peru (ACE 58)	30 November 2005
Mexico (ACE 60)	15 November 2003 / 15 July 2004
MERCOSUR -Bolivia (ACE 36)	17 December 1996 / 28 February 1997
MERCOSUR -Chile (ACE 35)	25 June 1996 / 01 October 1996
<b>Framework Agreements</b>	
Agreement/Partner(s)	Date of Signature / Date of Entry into Force
MERCOSUR - Morocco	26 November 2004 / 29 April 2010
MERCOSUR - Mexico (ACE N° 54) - framework agreement	05 July 2002 / 05 January 2006
<b>Preferential Trade Agreements</b>	
Agreement/Partner(s)	Date of Signature / Date of Entry into Force
MERCOSUR - Southern African Customs Union (SACU)	15 December 2008 / 01 April 2016
Colombia - Ecuador - Venezuela - MERCOSUR (AAP. CE No 59)	18 October 2004



MERCOSUR - India	25 January 2004 / 01 June 2009
Argentina -Auto Sector (ACE 57)	31 March 2003 / 01 May 2003
MERCOSUR - Mexico (ACE N° 55) - auto sector agreement	27 September 2002
Brazil (AAP.CE N° 2)	30 September 1986 / 01 October 1986

Table 2: Uruguay trade agreements in force (Foreign Trade Information System, 2021)

### 2.6.3 Mercosur

Latin America has a long history with economic integration. Before forming Mercosur in 1991, Latin American countries tried to build integration but unsuccessfully. The Latin American Free Trade Association (LAFTA) was founded in 1960 and the Latin American Integration Association (ALADI/LAIA) was founded in 1980. Both associations brought many good things to Latin America but were failed attempts. According to Kaltenhaler & Mora (2010) the associations remained limited due to 1980s debt crisis which led to macroeconomic imbalances such as budget deficits and hyperinflation. Also, weak authoritarian regimes facing socioeconomical crises did not build a solid base for economical integration.

In mid-80s the Latin American countries started to focus on building more liberal democratic regimes and addressing the problems the debt crisis caused (Kaltenhaler & Mora, 2010). The countries adopted new economic models and especially Argentina and Brazil took the first steps towards integration process which created then created the Southern Cone Common Market (Mercosur) in 1991. In addition of Argentina and Brazil, also Paraguay and Uruguay joined Mercosur and the countries agreed in the Treaty of Asuncion in 1991 to establish a common market including common external tariff and no internal tariffs.

In 1994 The Ouro Preto Treaty was signed, and it established the institutional structure, defined general procedures and created a body to monitor the application of the common trade policy instruments (Borraz et al. 2011). Mercosur started to work as a customs union.

In 2012 Venezuela joined Mercosur's four founding members as a full member but was suspended in 2016. Bolivia, Chile, Colombia, Ecuador, Guyana, Peru and Suriname are associate members. They receive tariff reductions when trading with full members but do not have full voting rights nor free access to their markets. Bolivia has been invited as a full member, but the decision still has not been confirmed.

Mercosur's ideology has been to enable small trading partners to get access to the larger market. Borraz et al. (2011) have studied what has been the response of Uruguayans as "the smaller trading partner" towards Mercosur. In their study they found out that integration processes responding mostly to specific interests from industrial lobbying groups from Brazil and Argentina. The largest countries have not been diligent to remove various industrial policies. In other words, Mercosur has brought both trade benefits for all participants, but it also brought vulnerability to the volatility with Argentina and Brazil.

Nowadays Mercosur is the fifth largest economy in the world (World Economic Outlook Database IMF, 2021).

## 2.7 Previous Literature

This chapter will give an overview of the previous studies conducted about trade flows in Mercosur area. It will also give overview of previous literature of studies about FTA and customs union's impact on trade flows which this study will be based on.

One of the previous studies about Mercosur's impact on the trade flow is conducted by Garcia et al. (2013) who studied if Mercosur has increased or decreased trade between the member countries. Their study was executed with OLS method and with panel fixed effects, and the study led to positive of trade between Mercosur countries. Mercosur has had positive trade flows between the member countries, and it is noted to deepen the relationship and entry of new trading partners. Also, Gardini (2011) proves in his study that Mercosur's impact on trade flows is positive between its trading partners. He also states that Mercosur has increased democratic stability and international visibility.

The previous results of FTAs and customs union's impact on trade flows have been varying a lot. A reason argued for the different results has been the Tinberg's (1962) gravity model which has given biased results. According to the study by Baier and Bergstrand (2007) the results have been underestimated by 75 to 85 percent due to unbiased estimations.

The study by Baier and Bergstrand (2007) suggests theoretical equations with statistical methods which they recommend researchers to use when estimating trade flows. By using the methods presented in their study, they find out that FTAs and customs unions approximately double the amount of trade for two countries which have been in a FTA or customs union for more than ten years. Also, Baier and Bergstrand (2009) gets similar results. Although, Baier et al. (2019) question the result by stating how the amount of trade can be doubled.

Anderson and Yotov (2016) have got similar positive results in their study, but by finding out that the trade flows vary by sectors. They also state that the trade flows are increasing for countries which had high tariffs before entering FTA or customs union. Overall, Anderson and Yotov (2016) find out that entering FTA and customs union increase the trade flows between countries.

Baier, Yotov and Zylkin (2019) found out in their study that 53.9 percent of the FTAs are positive and have significant importance on the trade flows. Like Anderson and Yotov (2016), and Baier et al. (2019) highlight, the FTAs and customs unions impact on trade flows is heterogeneous between different pairs of countries. Baier et al. (2019) notice that the previous FTAs or customs unions and distant geographical location reduce the trade and sharing a border and similar governance increase the trade flows.

To sum up, FTAs and customs unions have impact on trade flows but are varying between sectors, pairs of countries and countries.

### 3 DATA AND METHODOLOGY

Two main research design methods are the quantitative and qualitative research methods. The qualitative method mostly involves information that is not quantifiable. The information can be formed by words, emotions, expressions, attitudes which cannot be measured (Lewis, Thornhill & Saunders, 2016). The quantitative method on the other hand measures data which is measurable and accurate. It provides information that could be analysing the phenomena and helps the researchers needs to get descriptive information (Pickhard, 2007).

This study is executed with quantitative method. The quantitative study analyses how trade agreements are impacting on the trade flows between two countries, one of the countries being Uruguay. Looking into the previous studies conducted of trade agreements, one of the most important one is by Baier and Bergstrand (2007). They are studying that if free trade agreements (FTAs) are increasing member countries' trade flows.

This study will be using Baier and Bergstrand's study as a foundation, and analyses if Uruguay's FTA trading partners are increasing or decreasing trade comparing to countries with absence of FTA. The study will be executed with creating a traditional gravity model in Stata software.

As mentioned before, Uruguay is part of FTA Mercosur. For this research two countries chosen are from Mercosur. The other four are not part of any FTA or customs union with Uruguay. The objective is to analyse if countries which are in FTA have different trade flows than countries that are not in FTA or customs union with Uruguay.

The countries chosen from Mercosur are Brazil and Argentina. Other countries chosen to this research are Germany, Spain, the United States and China. These countries are chosen since all of them trade relatively much with Uruguay. Germany and Spain are European Union countries, and Uruguay, as part of Mercosur, has made a Framework Cooperation Agreement in 1992 with the European Union. It is not considered as a free trade agreement in this research. Other countries, the United States and China, do not also share FTA or customs union with Uruguay. The total number of countries studied in this research is six.

These countries are chosen based on the fact, that all of them trade relatively much with Uruguay. As mentioned in the previous chapter, Uruguay largest importer and exporter partners are Brazil, Argentina, China and the United States. Spain has been chosen since Uruguay used to be part of Spanish colonization and nowadays the countries still share same language and have many cultural similarities. Germany has been chosen, since it is one of the major economies in the European Union, and Uruguay has been increasing the trade flows recently with the EU.

Country	Customs Union or FTA with Uruguay	Exports to Uruguay in U.S. dollars (millions) in 2020	Imports from Uruguay in U.S. dollars (millions) in 2020
Brazil – Mercosur	Mercosur	1122,198606	1460,32366
Argentina - Mercosur	Mercosur	366,533832	872,50985
Germany	-	86,286163	195,405616
Spain	-	54,94295	138,803558
The United States	-	542,750983	804,546485
China	-	1343,981426	1528,848421

Table 3: Countries studied in the empirical part

The data will be collected in total of six country pairs and the years chosen are 1990, 1995, 2000, 2005, 2010, 2015 and 2020, making the time period to be in total of seven. The data will be collected from different sources. The export and import data of Uruguay is collected from International Money Fund's Direction of Trade Statistics, nominal GDPs from World Bank's World Development Indicator, the distance between capitals from Kristian Skrede Gleditsch Database, a dummy variable for language and common border from CIA Factbook, a dummy variable for FTA from WTO Regional Trade Agreement Database.

As mentioned, the years chosen for this study are 1990, 1995, 2000, 2005, 2010, 2015 and 2020. This makes the year dataset to be interval. Eggert et al. (2021) have criticised that using the interval data when estimating gravity equations might lead to downward-bias effect in the estimation results. This should be noted when conducting the estimations.

According to Bachetta et al. (2012, p. 120) gravity equations can be estimated for either cross-sectional or panel data sets. When considering cross-sectional data, the unit of observations is a pair of countries; meaning that with  $n$  countries there are  $n(n-1)$  observations. When considering the panel data, the unit of observation is a pair of countries in a year, meaning there are  $Tn(n-1)$  observations with  $T$  being the number of time periods covered by the panel. The estimation for cross section in this research would be 30 since there are six countries. When estimating with panels of countries there are 42 observations when the number of countries is six and time period is seven.

### 3.1 Variables

The chosen variables for this research are country  $o$  trade to country  $u$ , countries GDPs, the distance between capitals, language, and common borders. Baier and

Bergstrand (2007) have set a dummy variable for both FTAs and customs union. This is not done in this paper. This paper has divided the data of FTA countries and not FTA countries into two different datasets, which presents two different estimation results. To keep the study simple, the export and GDP will not be deflated as real values.

By using a dummy variable in gravity flow model, it gives a crude measure of trade agreement's impact on the trade (Anukoonwattaka, 2016). Dummy variables can be set to take value of common language or presence of common history. In statistics, a dummy variable is the one variable that takes the value of 0 or 1 to indicate the absence or presence of some categorical effect that might be expected to shift the outcome. In this study the dummy variable is set for two different variables. For the common language and border.

Uruguay's official language is Spanish. When browsing the chosen countries for the study, it can be noted that two countries are sharing the same language with Uruguay, Spain and the United States. Spain's official language is Spanish and in the United States around 13 percent of the population speaks Spanish, so in this study the United States will also be considered with the language dummy variable.

## 3.2 Methods

The empirical part will estimate how variables statistical importance will vary when estimating regression analysis with gravity flow equation with two different cross-sectional datasets. The estimation will be done with using Stata software.

Using both two different cross-sectional datasets will give a wider result of the empirical research in order to analyse the trade flows of Uruguay. Although, when choosing one of them to predict trade flows, Yotov et al. (2016) suggest that panel dataset should be chosen to obtain structural gravity estimates. They point out various reasons for this statement; using panel data leads to improved estimation of efficiency, panel data dimensions enable to apply the pair-fixed-effects method to address the issue of endogeneity of trade policy variables, and the use of panel data provides a good treatment and estimation of the effects of time-invariant bilateral trade costs with pair fixed effects. The downside on the other hand is that panel data might not always be available. In this paper panel dataset is not used due to the limited data.

Traditionally gravity models are estimated with OLS method assuming that the variance error is constant across observations (homoskedasticity) or using panel techniques when assuming the error is constant across country-pairs or countries (Gomez Herrera, 2012). Economists, like Santos Silva and Tenreyro (2006) have stated that when there is heteroskedasticity, these methods should not be used. Another challenge is about zero values. A various alternative methods have been created to estimate gravity models to exclude these problems.

Recently, the research by Burger et al. (2009), Martin and Pham (2008), Martínez-Zarzoso et al. (2007), Siliverstovs and Schumacher (2009) and Westerlund and Wilhelmsson (2009) have given excellent results when using alternative estimation methods. Some of these methods are very advanced, so in this research the traditional methods are considered to estimate the gravity equations.

The theory behind a gravity equation includes a supply and demand which leads to the volume of trade between two countries to be directly proportional to their economic mass (Ruiz & Vilarrubia, 2007). The volume of the trade between the two countries does not only depend on their cost of trading with each other, bilateral trade resistance, but also how difficult for them is to trade with rest of the world. This leads to the term multilateral resistance.

The multilateral resistance terms are the vehicles that considers the partial equilibrium effects of trade policy at the bilateral level to country specific effects on prices (Yotov et al., 2016). It can be noticed in the next chapter that multilateral resistances are only added into theoretical gravity equations. Atheoretical gravity equations do not include multilateral resistance variables.

When including multilateral resistance variables into a theoretical gravity equation, the equation will control the biases from different trade costs. In practise the equation with a multilateral resistance can be also estimated theoretically by replacing multilateral resistance with exporter and importer fixed effects (Feenstra, 2014, p. 161-163). By doing this replacement, analysing the equation will get easier.

In Stata it is possible to estimate with fixed effects in many ways, but in this research the estimation is done without setting a dummy variable for each exporter and importer. After this the equation is analysed with OLS method. It should be noted that in cross-sectional dataset exporter and importer fixed effects, will not be possible to estimate the coefficients on a country-specific variables, like GDP, due to perfect collinearity (Bachetta et al., 2012, p. 123).

### 3.3 Gravity equations

According to Baier and Bergstrand (2007) the fixed effects estimation of an atheoretical gravity equation ignoring multilateral prices with a cross-sectional dataset can be estimated with the following equation

$$\ln X_{ij} = \beta_0 + \beta_1(\ln GDP_i) + \beta_2(\ln GDP_j) + \beta_3(\ln DIST_{ij}) + \beta_4(\ln LANG_{ij}) + \beta_5(BORD_{ij}) + \beta_6(\ln FTA_{ij}) + \varepsilon_{ij} \quad (3)$$

Where  $X_{ij}$  is the value of the merchandise trade flow from exporter  $i$  to importer  $j$ ,  $GDP_i$   $GDP_j$  are the nominal gross domestic products in countries  $i$  and  $j$ .

$DIST_{ij}$  is the distance between the economic centres of countries  $i$  and  $j$ ,  $LANG_{ij}$  is a binary variable assuming the value 1 if  $i$  and  $j$  share a common language and 0 otherwise,  $BORD_{ij}$  is another binary variable assuming the value 1 if  $i$  and  $j$  share a border and 0 otherwise.  $FTA_{ij}$  is a binary variable assuming the value 1 if  $i$  and  $j$  have a FTA or customs union and 0 otherwise, and  $\varepsilon_{ij}$  is assumed to be a log normally distributed error term.

A study about theoretical equation for cross-sectional dataset is by Anderson and Van Wincoop (2003) in which they have illustrated the omitted variables bias by ignoring prices in cross section gravity equation. The theoretical estimation with cross-sectional data can be measured with the following equation

$$\ln \left[ \frac{X_{ij}}{GDP_i GDP_j} \right] = \beta_0 + \beta_3(\ln DIST_{ij}) + \beta_4(LANG_{ij}) + \beta_5(BORD_{ij}) + \beta_6(FTA_{ij}) - \ln P_i^{1-\sigma} - \ln P_j^{1-\sigma} + \varepsilon_{ij} \quad (4)$$

This equation shares the same variables compared to the atheoretical equation (3) and adds the multilateral resistance terms  $P_i^{1-\sigma}$  and  $P_j^{1-\sigma}$  to the equation.

The atheoretical equation for panel data is the following (Baier and Bergstrand, 2007)

$$\ln X_{ijt} = \beta_0 + \beta_1(\ln GDP_{it}) + \beta_2(\ln GDP_{jt}) + \beta_3(\ln DIST_{ij}) + \beta_4(\ln LANG_{ij}) + \beta_5(BORD_{ij}) + \beta_6(\ln FTA_{ijt}) + \varepsilon_{ijt} \quad (5)$$

Compared equation (5) to equation (3) it can be noticed that it is similar except equation (5) includes variable  $t$  time.

When adding the multilateral resistance terms to equation (5) we can get the theoretical equation when estimating with panel data (Baier and Bergstrand, 2007)

$$\ln \left[ \frac{X_{ijt}}{GDP_{it} GDP_{jt}} \right] = \beta_0 + \beta_3(\ln DIST_{ij}) + \beta_4(LANG_{ij}) + \beta_5(BORD_{ij}) + \beta_6(FTA_{ijt}) - \ln P_{it}^{1-\sigma} - \ln P_{jt}^{1-\sigma} + \varepsilon_{ijt} \quad (6)$$

Equation (6) can also be restructured when estimating FTA dummies and other variables impact on trade flows. In this case, the constant can be the exports by the country's size or exports from country  $i$  to country  $t$ . Baier and Bergstrand (2007) suggest that when doing this kind of estimation, the GDP variables are set in the equation the following

$$\ln X_{ijt} = \beta_0 + \beta_1 GDP_{it} + \beta_2 GDP_{jt} + \beta_3(\ln DIST_{ij}) + \beta_4(LANG_{ij}) + \beta_5(BORD_{ij}) + \beta_6(FTA_{ijt}) - \ln P_{it}^{1-\sigma} - \ln P_{jt}^{1-\sigma} + \varepsilon_{ijt} \quad (7)$$



When comparing theoretical equations (4) and (6) it can be noticed that when estimating with cross-sectional data, the multilateral resistance terms are considered to be time constant, and with panel dataset the estimation gives a possibility for the trade barriers to change within time. Trade barriers might change during a certain time period, which can cause estimation bias when analysing with equation (4) states Bayer and Bergstrand (2007).

Baier and Bergstrand (2007) have presented a problem about multilateral resistance terms when estimating equation (4). They state that multilateral resistance terms are not changing when estimating with different time periods. The problem arises mostly when estimating with cross-sectional data. When estimating with panel data, it considers variable  $t$  time, which will fix the problem.

With panel data, it will also be easier to control the endogeneity of trade policy. When estimating with cross-sectional data (4) Baier and Bergstrand (2007) have set fixed costs to control the bias coming from ignoring prices between countries. Although, the equation does not consider the bias which arises from the fact that countries decide if they will have a customs union agreement or not. In other words, the equation cannot estimate if trade policy's endogeneity nor exogeneity. When estimating with panel data, the problem is fixed naturally since there has been set fixed variables for pairs of countries.

Unbiased estimation of FTAs and customs union's impact on trade flows can be estimated with panels data with FTA dummy variable, fixed time effect for exporter and importer country, and country pair fixed effect. Baier et al. (2018) have suggested that to consider the mentioned variables, they can be put into an equation

$$\ln X_{ijt} = \beta_0 + \theta_{it} + \Psi_{jt} + \psi_{ij} + \beta_4(FTA_{ijt}) + \varepsilon_{ijt} \quad (8)$$

Where  $\theta_{it}$  is a exporter-year fixed effect,  $\Psi_{jt}$  is an importer-year fixed effect,  $\psi_{ij}$  is a pair fixed effect. This gravity-equation specification is using OLS method. In this study, equation (7) is used to get unbiased results.

## 4 RESULTS AND ANALYSIS

### 4.1 Results with cross-sectional dataset

To answer to the research question of this thesis,

“What kind of impact do variables, especially Free Trade agreements, studied in gravity flow model have on Uruguayan trade?”

the gravity flow model was estimated with cross-sectional data. The estimations are done with the equations presented in the previous chapter.

The estimations were executed with cross-sectional data by equation (3). The cross-sectional data was retrieved from the sources mentioned in the previous chapter. Due to the limited data and number of observations, it was decided to execute the estimations with only atheoretical equation and cross-sectional data. The data was divided into two different datasets, one including the data with FTA and one of countries not in FTA with Uruguay.

After retrieving the data, it was organised in Excel before downloading it to Stata. To start the regression model analysis, the constant needed to be chosen. It was decided that the constant of the analysis is the natural logarithm value of exports from country  $o$  to Uruguay, country  $u$ . As seen from the table below also GDPs of countries take natural logarithm in this study.

While conducting the regression model, also changing the distance values to non-logarithmic was tried, because non-logarithmic values were more robust, and it was thought this would give higher r-squared value for the gravity model. When conducting the study with non-logarithm distance values, the result became more difficult to interpret they were not aligned with other variables' results. It was chosen to use logarithm values for distance to interpret the results easier.

It is usual that the estimated gravity equations take a log-linear form. While taking logarithm of continuous variables, except dummy variables, the zero trade flows drop out. According to Bacchetta et al. (2012, p. 127) when majority of variables are expressed as natural logarithms, the coefficients can be read as elasticities. The elasticity of trade compared to distance is usually between -0.7 and -1.5, so for example a 10 percent increase in distance between two countries cuts their trade on average 7 to 15 percent. The elasticity is a good way to understand the coefficients, but it is not used in this paper. The estimations are analysed by the results gravity equations present. When concerning the distance, from table (2) it can be interpreted that distance has quite significant importance for countries which are not in FTA with Uruguay. For countries which have entered FTA with Uruguay, we can see that distance does not have that much importance. In general, it should be also noticed that the countries which have

entered FTA with Uruguay are also its neighbouring countries and share a border. This also impacts on the low importance of distance.

The estimations in this thesis are executed with data divided with different FTAs with Uruguay. Although, if the data would be larger, FTA could also be one of the variable of gravity model. In this case, Baier et al. (2019) suggest that the average impact of FTA can be calculated with equation

$$(e^{ATE} - 1) * 100 \quad (9)$$

where  $e$  is the Euler's number and  $ATE$  is the average treatment effect. This equation helps to analyse the result if the FTAs importance has increased or decreased in a certain time period.

To analyse other variables from the model, we can see that the GDP of Uruguay's trading partners is a significant factor when concerning estimations of countries not in FTA with Uruguay. On the other hand, for FTA countries, their GDP is not significant variable, but it has more importance compared to Uruguay's GDP or distance of FTA countries and Uruguay. The low results of FTA countries and Uruguay's trade can be explained mostly by the common similarities and history, which are not variables in the estimation.

Language variable gives results only for countries not in FTA with Uruguay. The common language has a low importance in the trade. When considering the border variable of all countries and the language variable of countries with FTA, the results are not significant since there is collinearity. Collinearity is a special case when two or more variables are exactly correlated. When analysing regression model, it means that the variables which have collinearity are not uniquely determined. This is the reason why border and language variables do not provide results in this estimation.

DEPENDENT VARIABLE $\ln X_{ij}$	NO-FTA	FTA
lnDIST	1.179** (0.482)	0.00387 (0.238)
lnGDPo	0.680*** (0.0918)	0.761 (0.429)
lnGDPU	0.353 (0.368)	0.182 (0.747)
LANG	0.160 (0.290)	
o.BORD	-	-
o.LANG	0.0704	-
Constant	-34.10*** (8.918)	-18.84* (9.875)

Observations	28	14
R-squared	0.790	0.839

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

NO-FTA refers results of countries not in FTA with Uruguay; China, the United States, Germany and Spain. FTA refers to results of countries in FTA with Uruguay; Brazil and Argentina.

Table 4: Atheoretical gravity model with cross-sectional datasets.

A problem arises when estimating with equation (3), since this equation does not consider the multilateral resistance terms. Anderson and van Wincoop's (2003) study shows that controlling for relative trade cost is crucial for good gravity model. Their theoretical results show that bilateral trade is determined by relative trade cost. These trade costs are referred as multilateral resistance terms which are important factors in the gravity flow model to receive accurate results.

Baldwin and Taglioni (2006) call missing the multilateral resistance terms as the gold medal of classic gravity model mistake. The gold medal mistake stands for not considering the multilateral resistance terms which correlate with the trade-cost terms. This error might lead to biased estimation results and less robustness. When estimating with equation (4) it uses country fixed effects to account as multilateral price terms.

To estimate with equation (4), the constant of equation (3) should be modified. In equation (3) the natural logarithm is the value of exports from country  $o$ , to Uruguay, country  $u$ . When estimating with equation (4) the dependent variable is modified. Instead of using the logarithm value of exports of trade as a dependent variable, the constant is the value of logarithmic export divided by GDPs of both countries. This modification helps to control the heteroscedasticity of the model (Yotov et al, 2016, p. 20). Controlling heteroscedasticity is important since the estimates of the effects of the trade costs are both biased and inconsistent when gravity model is estimated in log linear form (Santos Silva & Tenreyro, 2006). For this method the size of the country is the only variable causing heteroscedasticity. Santos Silva and Tenreyro (2006) used Pseudo Poisson Maximum Likelihood (PPML) estimator, and their research points out that it should be robust estimator.

The data of this thesis was limited, and the estimations were not able to be executed with equation (4). With using multilateral resistance terms, the results would have been more significant and given more robust results. By robustness, this paper refers that the results are less significant and reliable. Robustness in statistics describes the strength of the model and test. When the robustness is low, the model provides less relevant results and when robustness is high, the model provides more relevant results.

## 4.2 Estimating with panel dataset

According to Yotov et al. (2016, p. 20), it is recommended to use panel dataset when estimating trade flows. Panel dataset gives more robust estimation results and is a good way to analyse and estimate trade between countries. In this paper, the same problem arose as with theoretical equation (4) with cross-sectional data. The estimations with panel datasets were not able to be executed due to the limited data and low number of observations. If the dataset would be larger, this method would have given excellent and robust results in order to estimate the trade.

To estimate with panel dataset, the same preparations should be made than with the cross-sectional data. First, the data should be downloaded into Stata, but different commands should be described for the patterns of panel data, for example if the panel is balanced or not. The reason for this is that panel data refers to a situation when information of bilateral trade flows are available over time (Bacchetta et al. 2012, p.126).

The estimations with panel data could be executed with equation (5) and equation (8). Equation (5) considers the time and country effects, which are included to control the global economic effects like booms or slowdowns in the economy (Bacchetta et al. 2012, p. 124). Still, it does not consider the multilateral resistance terms. Multilateral resistance terms should be considered to get credible results. Equation (8) and panel data considers the multilateral resistance terms with fixed time and country effects. This equation (8) should give more significant results. This estimation is the theoretical gravity model with panel dataset. Theoretical gravity model with panel data can also be called the fixed effects model (Baier et al. 2018). As described before, theoretical equations which consider the multilateral resistance terms, and estimation with panel dataset, should give the most credible estimation results.

## 4.3 T-test

To give more credibility for the results, a t-test was conducted. T-test is a statistical test which is used to compare to means of two groups. It can be stated that t-test is the most widely used statistical test in academic research (Anesthesiol, 2015). T-test is usually used when the data is divided into two independent groups. One group can be identified as group A and another as group B. In this research the two data groups are divided as whether they are in FTA with Uruguay, or not.

T-tests can be identified in two different kinds of types (Anesthesiol, 2015). First type can be stated as independent t-test, which is used when two groups are independent of each other. The second type is paired t-test which is used when

two groups are dependent of each other. In this research t-test is done as independent t-test since the used data samples are independent of each other.

FTA 0 or 1	Number	Mean	Std. Deviation	Std. Error	Mean
0	28	262,8980163	319,136	60,311	
			0		
1	14	587,2734	382,1882	102,44	
			5	0	

Table 5: T-test; Group Statics (Exports from Uruguay)

As seen from Table 5, Uruguay's exports to countries which are in FTA has averagely larger mean than the countries without FTA. To make this result more credible, it can be tested that if the result is statistically significant. Since the data samples are not large, Levene's test is used to tell if the variances are equal for all samples.

As seen from Table 6, the Levene's test tells us that sig=0.384. The value should be greater than 0.05 (Anesthesiol, 2015). Since in this study it is, it can be stated that the equal variance is met, and the samples have equally high variances. It can be summed up that Levene's test verifies that the condition of equal variance is met which makes the t-test result more statistically significant.

To confirm our result, a two-tailed test is executed. This test confirms the statistical significance of results. Two-tailed test is a common method in which the critical area of distribution is two-sided, and it tests if the data sample is greater than a certain range of values. As seen from Table 6, the two-sided p value is 0.006. This states that there is a significant difference between these two data samples when concerning the exports from Uruguay between FTA countries and non-FTA countries.

Export from Uruguay	Levene test for Equality of Variances		t	df	T Test for Equality of Means				95 % Confidence Interval of Difference	
	F	Sig			Significance One-sided p	Significance Two sided p	Mean Difference	Std Error Difference	Lower	Upper
Equal variances assumed	0,903	0,348	-2,907	40	0,003	0,006	-324,375464	111,588848	-549,905	-98,845
Equal variances not assumed			-2,735	22,337	0,006	0,012	-324,375464	118,6205682	-570,164	-78,586

Table 6: Independent Samples test (Exports from Uruguay)

Lastly, a Cohen's d can be tested. Cohen's d is used to compare two groups and it takes the difference between two means and expresses it in standard deviation units (Anesthesiol, 2015). Cohen's d explains how many standard deviations are between two means.

			95% Confidence Interval	
	Standardizer	Point Estimate	Lower	Upper
Cohen's d	340,909561	0.952		
	7			

Table 7: Independent Samples Effect Sizes (Exports from Uruguay)

In Table 7 the point estimate is 0.952. When the point estimator is above 0.8, the effect is large. This proves that the t-test's result that Uruguay's exports are higher to countries which are in FTA with Uruguay, is statistically significant result. This result supports our previous results conducted with gravity model.

#### 4.4 Analysis of the results

To sum up the results, it can be stated that after estimating with different datasets and equation (3), the most credible results were got with data from countries in FTA with Uruguay. This estimation had the highest r-square value of 0.839 compared to countries without FTA with r-square value of 0.790. Despite of the high r-square value, the estimation of countries in FTA gave limited results. It occurred collinearity with border and language variables and did not have significant results with many variables. The countries without FTA with Uruguay on the other hand estimated highly significant results in GDP of the other countries and distance. Also, estimation of countries without FTA did not present collinearity for the language variable. Still, it can be summed up that the countries in FTA with Uruguay do trade more with Uruguay than the ones without FTA. This can be stated by the different r-squared values and previous research. Also, the result from t-test also stated that Uruguay trades more with countries in FTA.

To compare these results to previous research, firstly we can point out Garcia et al. (2013) and Gardini (2011) who have stated, that Mercosur has a positive impact on the trade flows between its member countries. This research gives excellent answer to the higher r-square value of countries in FTA with Uruguay and proves that FTAs importance is major.

Compared to the results what Baier and Bergstrand (2007) have got, the results differed slightly. They have got a result that usually FTA's impact on trade flows is around 0.46 which is around 58 percent. In this research though, the focus is in one country and not in general, so it explains the large difference between results. In addition, compared to the Baier and Bergstrand's (2007), in this research the exports and GDPs are not deflated as real values. It can be also noted that when comparing research, the time periods and number of countries have also impact on the comparison and cause differences in the results. To sum it up, the differences can be explained by different samples of research.

Baier et al. (2018) have shown result that the trade agreements between developing countries increases the trade flows. This can be agreed based on this research. Uruguay can be considered as a developing country, and the study shows major impact on the FTAs impact on the trade.

As previously mentioned, Kohl (2014) states that trade agreements tied after year 1990, do not escalate the trade flows. This study does not consider any trade agreement which would have been created before year 1990. Mercosur was created in 1991, so Kohl's results cannot be compared to this research.

Although the results of this study do vary from the Baier and Bergstrand (2007), it does not mean that neither of the studies are biased. Baier et al. (2018) and Kohl (2014) do state that the advantage of trade agreements is very heterogeneous between country pairs. For example, the country pairs increased trade has been noticed to vary between countries geographical location, cultures, and governmental features, in addition the development of the country. Kohl (2014) also agrees that 26.5 percent of trade agreements had increased the trade between countries and only 9.6 percent it has decreased the trade. For 63.9 percent of country pairs trade agreements have not got any impact on the trade.

From these studies it can be concluded that since Uruguay has very close geographical locations, cultures and governmental features with its FTA partners Argentina and Brazil, the high impact of FTA can be explained to be correct compared to the previous studies.



## 5 CONCLUSIONS

The motivation for this study was to increase awareness of the different variables affecting on the Uruguay's trade flows. Latin America, including Uruguay, has been suffering from various economical and governmental crises during the years. The history has a large impact on the development of the trade agreements, which has slowed down their development on the globalisation. Although nowadays globalisation has been increasing throughout Latin America, especially in Uruguay.

One of the major factors when increasing trade in Latin America has been the creation of Mercosur. The four founding partners; Argentina, Brazil, Paraguay, and Uruguay, have made several trade agreements with various countries in Latin America and with rest of the world in order to promote free trade, and free movement of people, goods, and services. Uruguay, as part of Mercosur, has increased its international trade due to Mercosur according to various research.

Previous research has been conducted about the impact of trade agreements impact on the trade flows. Viner (1950) has also created terms trade creation and trade diversion to specify if a trade agreement is increasing or decreasing the trade. When two countries are geographically located next to each other, Krugman (1991) states that the nations are trade creation especially if they are in trade agreement. Trade agreements can cause in addition of trade creation and diversion, also exporters intensive margin, and extensive margin. Free trade agreements and customs unions are affecting positively to both intensive and extensive margin and are calculated to increase the trade flows between two countries (Baier et al. 2018).

The empirical part of this paper examined which are the factors impacting on the trade flow of Uruguay. The variables were chosen to be distance, GDPs, exports of countries, common language and if the countries share a border. The regression model was then estimated in Stata software with cross-sectional dataset and with atheoretical equation. The data was organised into two datasets, one dataset of the countries in FTA with Uruguay; Argentina and Brazil, and other dataset of the countries not in FTA with Uruguay; the United States, China, Germany, and Spain. After the estimations were conducted, the results were compared and analysed with each other.

The results of the empirical study show that FTAs play a major factor in Uruguay's trade flows. Variables that were impacting on the trade were GDP and distance, but only for the countries which are not in FTA with Uruguay. The result of the study is aligned with previous research conducted about different variables impact on the trade flows.

This study differed from the Baier and Bergstrand's (2007) in some ways which can cause a small bias to the comparison. This paper was only focusing on one country and its trade flows, and Baier and Bergstrand (2007) were studying FTAs impact on worldwide level. Also, in this study the exports and GDPs values

were not deflated, and they were studied as nominal values. To sum it up, this research's results were aligned with Baier and Bergstrand (2007), and with Kohl et al. (2016) and Baier et al. (2018) who state that trade agreements do increase trade.

It has been previously pointed out by Gomez Herrera (2012) that when there is heteroskedasticity and zero values, traditional gravity model estimations should not be executed with OLS method. Due to the advanced methods difficulty, the traditional methods were only used in this research. This might have affected the estimation results by making them biased. Also due to the limited data, the estimations are very narrow.

To conclude the findings of this study, trade agreements have a major positive impact on the countries trade and economic growth, and they increase trade creation. In some cases, trade agreements can also have negative effects, like trade diversion, but as various research show, trade diversion occurs less than trade creation. When considering Uruguay, trade agreements have been boosting the trade, and they are playing a major and positive part on the Uruguayan economy without considering any component trade.

The suggestion for further study is to conduct more in-depth study about different trade agreements impact on Uruguayan economy. The study is suggested to be done with larger dataset and considering more countries and variables. Also, then the theoretical equations and multilateral resistance terms should be in use, which would give more robust estimation results. This would also give possibility to conduct similar analysis with panel dataset.

This research only considered free trade agreements and customs union, but a further study could be also conducted about different regional trade agreements, like preferential trade agreements (PTAs) and common market. This kind of research would offer a wider analysis of regional trade agreements impact on Uruguayan trade.

Last recommendation for further research would be to include variables like legal origin, religion, and currency conversion rate to the estimations. By adding more variables to the gravity model, the results are more accurate, and the estimations will provide more information to interpret and analyse the trade flows.

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