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A CURRENCY UNION'S EFFECT ON INTERNATIONAL TRADE

- EMU membership effect on international trade for Slovenia, Cyprus, Malta and Slovakia

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Abstract

This thesis investigates if there is an increase in international trade from joining a currency union. This is done by looking at the European Monetary Union with a focus on four countries that became members in 2007-2009: Slovenia, Cyprus, Malta and Slovakia. By using an augmented version of the gravity model of trade that has become one of the signature models for looking at international trade, a time period of 1999-2017 is observed. Fixed effects are applied alongside a pooled OLS. The fixed effects are added to the model in order to isolate the time-invariant factors influencing trade, which is the recommended model by previous researchers Glick and Rose. The results show an increase in international trade by 13.6 percent for individual countries. The conclusion to this investigation is that EMU as a currency union increase trade.

Keywords: Common currency areas, Currency union, Optimal Currency Area, EMU, EU, Export, Gravity Model, International trade.

Abbreviations

CEPII: Centre d'Etudes Prospectives et d'Informations Internationales

CES: Constant Elasticity of Substitution

CIA: Central Intelligence Agency

COMTRADE: United Nations International Trade Statistics Database

ECB: European Central bank

EEA: European Economic Area

EMS: European Monetary System

EMU: European Monetary Union

ERM: European Exchange Rate Mechanism

EU: European Union

EU15: Countries that encompassed the EU for the expansion 2004

Euro-12: First 12 countries that started using the euro

FOB: Free on board

FDI: Foreign Direct Investments

FTA: Free trade agreement

GDP: Gross Domestic Product

IMF DOTS: International Monetary Fund: Direction of Trade Statistics

OCA: Optimal Currency Area

OECD93: Organization for Economic Co-operation and Development in 1993

OLS: Ordinary Least Square

RTA: Regional Trade Agreement

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1 Introduction

The economic consensus regarding common currency areas[1] before the year 2000 was that they had a limited effect on international trade (Rose, 2000). Rose studied how currency unions affect international trade and came to a conclusion that opposed the general consensus. In his study he found that common currency areas do affect international trade: countries in currency unions would trade up to three times as much compared to when they were using their own national currency. His results produced a scientific debate regarding common currency areas' effect on trade. Although not without its critics, Rose's paper seems to have been, at least in spirit, correct. There does seem to be an increase in international trade from joining a currency union,[2] but the increase seems to be around 10-20 percent (Micco, Stein and Ordoñez, 2003; Tsangarides et al, 2008; Davis, 2017). The effect on trade from joining a currency union is more pronounced the longer they have been a part of the union, making the EMU, and its later joining countries especially, young members and therefore the effects on trade relatively small (Glick, 2016).

In order to investigate whether two countries joining a currency union will have an effect on their trade or not, this paper will focus on four countries in particular: Slovenia, Cyprus, Malta and Slovakia over a time frame 1999-2017. The Optimal Currency Area (OCA) theory is used, which explains the economic underpinnings of a currency union and the criteria which makes an area optimal for a currency union (Krugman, Obstfeld and Melitz, 2015). An augmented version of the gravity model of trade is applied, which has become one of the signature models for looking at international trade.

1.2 Contribution and Purpose

Most of the previous studies have been done on a global scale which brings some variation in the estimates because of the large differences in economies in the world (Nitsch, 2002). The studies which have focused on the EMU have been limited to only the 12 founding countries in a limited number of years, or on the 12 founding countries and some of the newer members but with the time frame of only a few years, the latest being to the year 2013.[3] Thus only

[1] The terms "currency union" and "common currency area" are used interchangeably in this thesis.
[2] The investigated currency unions in these studies were: EMU and if a currency union would benefit Africa.
[3] For example, Glick and Rose (2016) and Davis (2017) are the latest research and the latest observations were from 2013.

Greece of the later joinees in the EMU has been observed for more than 10 years. Slovenia, which is the country that joined after Greece, became an official member of the EMU the year 2007, hence Slovenia has been observed for six years. Hereby this study will contribute to the research by examining four of the newer countries in a larger time frame and by more time relevant data. This should provide more information regarding how non-funding members of the EMU and smaller economies have experienced this economic cooperation.

1.3 Research question

Does joining the EMU increase the level of international trade between member countries in the EU?

1.4 Delimitations

In order to investigate whether countries joining a currency union will have an effect on their trade or not, this paper will focus on four countries in particular. They are Slovenia, Cyprus, Malta and Slovakia. These are four European countries that joined the European Monetary Union in the years 2007 to 2009. The reason these countries have been chosen are because they joined after the establishment of the union but before 2010, meaning the effect of joining an existing currency union can be observed with about ten years of data worth of observations from the effect of joining the EMU after the fact. As argued by Glick (2016) the full effect of joining a currency union takes many years to be seen, but it is the immediate to medium term effect that are observed in this paper. While observing the long-term effects on trade it becomes harder to distinguish the actual effect of joining the union, as opposed to the general increase of trade between countries as an effect of integration and globalization.

To measure the increase in intra EU trade for the chosen countries, this essay will be measuring their bilateral real export trade with the rest of the EU from the year 1999 (founding of the EMU) to 2017. This will then provide information regarding how Slovenia, Cyprus, Malta and Slovakia's intra EU trade has been affected by EMU membership.

In this essay, being in a currency union means that money is interchangeable between two countries at a 1:1 par for an extended time period. Hereby there are no converting prices when trading between the country pair. Note also that hard fixes (e.g. Denmark's DKK to the euro) do not qualify as a currency union in this thesis.

2 Historical background

2.1 European Monetary Union (EMU)

A currency union is heavily reliant on freedom of movement (Mundell, 1961). In order to create a currency union in the European Union, a program was adopted in 1985 to remove all barriers to free movement of people, capital, goods and services. The main reason for this was to create an internal market within the EU. This would create pressure to create a common currency for the countries using this internal market, since at that time several economists were of the opinion that these monetary policies would not be combinable with national monetary autonomy (European Commission, 2015). Another reason for the creation of the euro according to Krugman, Obstfeld and Melitz (2015) was to increase the importance of Europe's role in the context of the international monetary system.

Krugman, Obstfeld and Melitz (2015) also bring up four reasons as to why the creation of the euro was a goal for the EU. Firstly, a single currency was viewed as a necessity to the creation of a continent-wide market. This was because a single currency should produce a greater market integration and remove the trade barriers that come from currency fluctuation. Secondly, the goal regarding freedom of movement for capital was according to the EU at the time best achieved through a common currency. Thirdly, the previous iteration European monetary system (EMS) was a German dominated system, where German macroeconomic policies were sometimes viewed as coming before the other members' interests. The creation of the euro and the EMU was viewed as giving the other members a more significant role compared to the EMS. Fourthly, the common currency would be a marker for political stability within Europe. Hence the past political rivalries that had plagued Europe in the twentieth century would be eradicated and hopefully the idea of cooperation would take its place (Krugman, Obstfeld and Melitz, 2015).

In order to ensure a stability of the euro the Maastricht convergence criteria were created, working as a gateway for countries before they could join the EMU and adopt the currency. The potential members were to adopt policies unifying the governing of the central banks and national law. The other four convergence criteria set by Maastricht were price stability, sound and sustainable public finances, exchange rate stability and durability of convergence. *Price stability* exacted an inflation roof of 1.5 percent above the average inflation rate of three-

member countries' lowest inflation rate (European Commission, 2015).[4] *Sound and sustainable public finances* demanded a government deficit to be no more than three percent of their GDP, and the government debt to be below 60 percent of the country's GDP. *Exchange rate stability* meant a potential member had to maintain a stable exchange rate and participate in the ERM for two years without any attempts to devalue their own currency. A *durability of convergence* was defined by an interest rate no higher than two percent above the mean of the three best performing EU countries in terms of price stability (European Commission, 2015).

2.2 Slovenia's membership in the eurozone 2007

Slovenia went from a socialist planned economy to a member of the eurozone in less than two decades. Formally Slovenia was a part of the Yugoslav republic and gained its independence in 1991, which ended the socialist rule in Slovenia.

Slovenia joined the EU in 2004 and during the same year entered into the ERM II which is the first step into joining the eurozone. Two years later, Slovenia fulfilled all of the Maastricht convergence criteria, making them eligible to join the eurozone. The year 2006 became a preparatory year for the introduction of the euro. One part of the preparation was to use a dual display of prices (euro and tolars), this was to make consumers more used to the euro but also to avoid unfair pricing around the changeover. The changeover caused only a consumer price inflation around 0.3 percent according to Eurostat, and Slovenia's own financial institution put it around 0.24 percent (European Commission, 2013a).

Slovenia was the first country that joined the eurozone which used the "big-bang" scenario to introduce the euro in the country (European Commission, 2013a). This scenario is where coinage of euro is introduced on the same day as the euro becomes the official currency. In contrast, the original members had a three-year transition period in the creation of the eurozone. However, this big-bang scenario still allowed the usage of the former national currency (tolars) between the 1st of January and the 14th of January 2007 which were meant to bolster consumer confidence (European Commission, 2013a).

[4] Inflation rate is measured the year before the joining country would join the EMU.

2.3 Cyprus and Malta membership in the eurozone 2008

Cyprus and Malta are both islands that are import dependent since their natural resources are limited, in particularly regards to energy (European Commission, 2014). They are more responsive to external shocks (e.g. changes in oil prices), but throughout the 1990s to the early 2000s both countries have experienced significant economic growth. This made their priorities shift from more growth focused to a more stabilizing focus. By joining the eurozone they could "anchor" their economy, which they did in 2008 when both countries formally started to use the euro (European Commission, 2014).

During the early 2000s both countries underwent large fiscal adjustment to meet the Maastricht convergence criteria regarding sound and sustainable public finances. For Cyprus this meant from 2003 to 2006 they focused on the budget deficit that was present in their country: it fell from 6.3 percent to 1.5 percent of their GDP. Meanwhile, Malta, suffering from a similar situation of a deficit of 10 percent, got it down to 2.6 percent during the same time frame. In doing so they showed a willingness to join and managed to meet the Maastricht convergence criteria regarding public deficit. They had yet to reach an acceptable inflation rate by 2006 but during 2007 both countries were able to lower the inflation rate which made them viable for the eurozone in 2008 (European Commission, 2014).

According to the European commission the entry into the eurozone should bolster both Cyprus' and Malta's economic stability while also bringing a great amount of trade since transaction costs and the exchange rate risk will be removed. Being import/export oriented, they should reap the full benefits of the euro market (European Commission, 2014).

Both countries introduced the euro using the big-bang scenario. In order to address consumer worries and to build consumer confidence both countries advocated that retailers show correct dual display of prices which helps show consumers if there is unfair pricing during the currency changeover (European Commission, 2014).

2.4 Slovakia’s membership in the eurozone 2009

In the year 2009 the euro was adopted as the new currency of Slovakia. According to the European Commissioner for economic and monetary affairs, this introduction of the euro brought macroeconomic stability for Slovakia. It had the added benefit of creating larger trade opportunities because of the euro's effect of bringing in foreign investors, compared to Slovakia's former national currency, the Slovak koruna (European Commission, 2013b).

The preparations preceding Slovakia’s change to the euro as national currency started six months ahead of the euro-day. This was mirrored by government institutions and its workforce. From this a signatory pledge not to exploit the changeover of the currency for profit was made public with an identity logo so to address consumer fears regarding the changeover. Same as in Slovenia, Cyprus and Malta, the big-bang scenario was used to introduce the euro to Slovakia (European Commission, 2013b).

3 Literature review

Rose (2000) found that countries that use the same currency would trade up to three times as much compared to when they used their own national currency. To obtain these findings Rose studied bilateral trade between 186 countries between the years 1970 and 1990. Rose analysed this cross-sectional data by using the gravity model of trade. Since currency unions are a rarity and the EMU had not come into existence yet, most of the observations were of countries not within a currency union. In fact, only about one percent of the observed countries were part of a currency union. Despite the low number of observed currency union members, Rose draws the conclusion that the earlier economic consensus, which is that currency unions have a very limited effect on trade, is faulty. Indeed, Rose's findings show that countries that share a common currency engage in a substantially higher degree of international trade than non-members.

The first paper that criticized Rose's findings was by Persson (2001) who focused on what he perceived as a bias in Rose's (2000) paper. Persson argued that the bias of Rose's paper was a failure to include the historical influences that countries in a common currency area shared, which differed from non-members. Rose also failed to account for the more complex relationship between trade and the determinants used in the regression as opposed to a linear one. To try and remove this bias Persson applied a statistical method that would reflect differences between groups of country pairs that are in a currency union and those that are not. This method is referred to as the matching method. After Persson applied this method to the same data that Rose (2000) used Persson concluded that Rose's findings reflects a systematic selection and hence are, to a certain degree, biased. Nevertheless, Persson did find that currency unions seem to expand trade between countries by 13 to 65 percent, which is still a sizable effect according to the author.

In 2001 the idea that national money might be a hindrance to international trade was proposed by Rose and van Wincoop with a focus on the European perspective. Rose and van Wincoop (2001) argued that through the EMU, international trade should increase by at least 50 percent. To see if this is the case Rose and Van Wincoop applied an augmented version of the gravity model on data from 1970 to 1995 and covering almost 200 countries but with a primary focus on countries within the EU. The results of this study showed that the effect of a currency union is large and statistically significant. Rose and van Wincoop argued that when a country enters a currency union, trade barriers between the country and the members of the

currency union should be lowered because of an effect called *constant elasticity of substitution* (CES). The CES means that trade between country pairs depends on their bilateral trade barrier relative to the average trade barriers with all other trade partners. Hence when the trade barrier of national currencies are removed because of the currency union, barriers to trade are lowered. Rose and Van Wincoop concluded that joining a currency union reduces trade barriers associated with national currencies. Therefore, joining a currency union should increase a country's international trade. Furthermore, the empirical work in their paper indicates that the 11 initial members of the EMU would have had an estimated increase in their trade by 59 percent if they had used a common currency during the years 1970-95 (Rose and van Wincoop, 2001).

In 2002 further criticism was brought against Rose findings from 2000 by Nitsch who proposed statistical changes to the dataset that Rose had used. These changes yielded major implications in the results, namely that trade is doubled, not trebled, when countries were in a currency union, by which Nitsch argued showed that Rose's results had been exaggerated. Two significant characteristics in the dataset were that most countries in a currency union at that time were relatively small and poor countries, and that several of these poorer countries had adopted a currency from a richer country (dollarization), which could be argued to be a pseudo-currency union. Nitsch also found that the effect varied greatly between countries. Certain countries' bilateral trade is completely unaffected (mostly countries that had adopted the U.S. dollar), while other countries' bilateral trade flow exceeded the average trade by 30,000 percent (countries that had adopted Australian dollar). This should mean, according to Nitsch, that the potential trade-enhancing effect created by currency unions (common currencies) were very unreliable.

In a broader perspective Glick and Rose (2002) observed data from 217 countries from 1948 to 1997, using the gravity model of trade. Because of the large time frame, this paper could focus on comparing the bilateral trade before and after a country's entry (or leaving) of a currency union. Similar to most other research, a significant effect is associated with currency unions: trade doubles or halves respectively as a country pair enters or leaves a currency union.

Micco, Stein and Ordoñez (2003) had a European focus and measured the bilateral trade between 22 European countries (EMU and non-EMU countries) using observations from 1992 to 2002. By applying the gravity model of trade, the authors arrived at the conclusion that for

members of the EU trade increased 4 to 10 percent, and with only EMU countries the trade increased between 8 to 16 percent. Similar to other papers, the effects on trade is smaller than those found by Rose (2000) and Rose and van Wincoop (2001) but still significant and economically important. Although, as mentioned by Micco, Stein and Ordoñez (2003), their paper only covers the first four years of the EMU, hence the effect might have changed during later years.

Berger and Nitsch (2008) measured if the EMU has a substantial effect on intra-EU trade or if there is a historical trend that could answer the euro's effect on trade.[5] They observed 22 industrial countries from 1948 to 2003 and then applied an augmented version of the gravity model equation. They found that the euro's effect is almost non-existent if historical trends are observed, but noted that only a few years of data regarding the euro was available. To counteract this small amount of data regarding the euro, a time trend was added to their model which aimed to describe the development of the intra-EMU trade.[6] Berger and Nitsch (2008, p. 1253) stated that:

> [T]he establishment of the EMU in 1999 was just another step in the long-developing movement towards increased integration and greater convergence. As a result, trade relations between EMU members intensified after 1999 as they had intensified over the previous several decades in response to earlier efforts to increase integration.

Hence the euro-effect should be viewed as a long-term trend rather than an effect on its own.

Tsangarides et al (2008) examined if currency unions affected and benefited Africa as much as the rest of the world. They applied the gravity model on 217 countries from 1948 to 2003 and focused on 49 African countries. On average they found that currency unions increase trade by a factor of 1.2 or 1.4. They also found that the longer a country has been a member of the union the greater benefits it receives from trade creation, although with some diminishing returns. In 2012, de Sousa contributed to this idea regarding diminishing returns, which he argued could stem from a financial globalization that has made currency unions less important in promotion of international trade.

[5] Read, the increase in international trade from joining the EMU.
[6] Post-World War 2.

Baldwin (2010) argued that the euro's effect on trade is not due to the OCA[7] theory idea of transaction costs because it does not answer the question of why a large number of sectors experience no euro's effect on trade. This would suggest that the idea of transaction costs is too broad to be explained by the euro's effect on trade. Baldwin also pointed out that there was no price effect, which would be affecting the transaction costs, and there was almost no trade diversion which should be occurring if there was a lowering of transaction costs within a currency union. Hereby it is argued that pro-foreign direct investments (FDI) policies have been the more important cause for the increase in intra-EU trade from joining the EMU (Baldwin, 2010).

Sadeh (2014) reasoned that the creation of the EMU primarily was a political move that brought, following classical Mundellian theory,[8] macroeconomic costs in the form of giving up the countries' own monetary and exchange rate policies. However, it also brought the microeconomic gains of elimination of barriers to trade i.e. the removal of exchange rate fluctuations and currency conversion transaction costs. Aside from these costs and gains there should also be a trade-enhancing effect for a currency union. This is mostly because of globalization, which in this context means that a small reduction in transaction cost is going to increase trade flows. This is simply because goods nowadays often cross the border between countries several times before becoming a finished product. This should then mean that the euro should bring an increase in trade between its members. Sadeh observed 145 countries between the time frame of 1991 and 2011 using a gravity model equation. The results of his study were that the euro seems to, at the very least, double the trade between its members, and that it also increases trade to third parties (Sadeh, 2014).

Figueiredo, Lima and Schaur (2015) investigated if the introduction of the euro affects countries' trade or not. From a theoretical point of view the authors argue that a currency union should remove exchange rate risk, reduce trade cost and deliver clear advantages to firms operating on the international market, which should increase trade. Using an augmented gravity equation on four groups of countries Euro-12, EU15, EEA and OECD93 these countries are observed between the years of 1993 to 2007. From their results they concluded that there was no statistically significant effect from the euro on the median of the bilateral trade flow distribution (Figueiredo, Lima and Schaur, 2015).

[7] For further clarification regarding OCA theory, see section 4.1 Optimal Currency Area.
[8] Read OCA theory, see section 4.1 Optimal Currency Area.

Glick and Rose (2016) re-examined the euro-effect by observing 200 countries from 1948 to 2013 and using an augmented version of the gravity equation. Their conclusion was that the EMU has a strong positive effect in stimulating trade between countries and a strong effect on European trade. By using an approach which includes country-pair fixed effects they pointed out that the EMU seems to have boosted bilateral trade by 50 percent.

Glick (2016) focused on how the EU and the EMU affect trade flows between old and new members (when they joined the EU). Observations from 200 countries in the years 1948 to 2013 were gathered and then an augmented version of the gravity model equation was applied. This yielded the results that older members seemed to receive a larger effect on their trade than newer members, but Glick also stated that more time is needed to fully see the effect of the EU and EMU on the newer members' international trade.

Davis (2017) studied if joining any currency union increases trade based on the theory that trade costs should decrease because of the currency union. To see if trade does increase because of a currency union, Davis observed the 26 members of the European Union[9] from 1988 to 2013 and tested them against 83 trading partners using an augmented gravity equation. From the empirical data, Davis drew the conclusion that being in the eurozone had no statistically significant impact on the total trade flows. Nevertheless, being in a currency union does seem to increase trade, but Davis could not determine whether these results came from the EMU or another currency union that was tested. The results regarding whether joining the EMU or not does increase international trade flows is inconclusive. However, the intra-euro trade does seem to increase by roughly 17 percent (Davis, 2017).

[9] Note some of the included countries are not EMU members.

4 Theory

4.1 Optimal Currency Area

The creation of the optimum currency area (OCA) theory is often credited to Mundell (1961) who explored economic underpinnings of a currency union, and the criteria which makes an area optimal for a currency union. This theory has later been expanded upon so that the optimality of a currency area could be determined. To do this, several properties are included in the OCA theory. If the OCA have several of these properties, a flexible exchange rate regime becomes more and more redundant (Krugman, Obstfeld and Melitz, 2015). The first two properties that Mundell proposes are *property of wage and price flexibility* and the *property of labour and factor mobility*. This enables labour to move from country A to country B, if, for example, a demand shock occurs concerning goods going from country A to country B. The demand shock would cause unemployment in country A, while country B would face inflationary pressure. With the mentioned properties, labour moves freely from country A to country B, thus combating unemployment in country A and the inflationary pressures in country B (Mundell, 1961).

The third property is *fiscal integration* which is the ability of relocating economic resources between member states. If a member is suffering an economic setback, a currency union with a functioning fiscal integration property can then relocate economic resources from a member with a healthy economy to the member suffering setbacks. (Krugman, Obstfeld and Melitz, 2015).

The fourth property is *product diversification/consumption*. This entails a high diversification in production and consumption lessen the impact of shock(s) specific to a sector. Hereby "diversification reduces the need for changes in the terms of trade via the nominal exchange rate and provides 'insulation' against a variety of disturbances" (Mongelli, 2005, p. 610). This makes highly diverse trade partner countries more likely to endure small cost from leaving nominal exchanges rate and joining a common currency for its benefits (Mongelli, 2005).

The fifth property is *economic openness* which reduces the need of a flexible exchange rate. This is because the cost of living in a country with a high degree of economic openness, will be affected through international prices. Hereby more open economies have more of an

incentive to join currency unions because the exchange rate may not serve as an appropriate adjustment mechanism (McKinnon, 1963).

The sixth and last property is *political integration*, which makes facilitating joint commitments, economic policies and sharing political similarities becomes all the more important (Mongelli, 2005).

One critique to this is the so-called inconsistency problem (Mongelli, 2008). Mongelli explains how compared to larger economies, smaller ones are usually less differentiated in their production. Following the *diversification* property this would make the smaller economies more likely to have a flexible exchange rate. But smaller economies are usually more open compared to larger economies' and hence should be keener on currency unions following *economic openness* property argument. This contradiction has its roots in the difficulty in the evaluation process of different OCA theory properties, which is mainly due to the properties seemingly depending on each other (Mongelli 2008).

4.2 Benefits and costs of a common currency area

Exchanging currency in order to make payments between countries always include additional costs due to the uncertainty of the value of the currency as it changes in relation to the other. Sharing a common currency removes this uncertainty and therefore the costs of exchanging one currency to another. This makes it possible for companies to view this common currency area as a single market which means that companies can benefit from economies of scale. This is true as long as long as *property of labour and factor mobility* property is in affect (Krugman, Obstfeld and Melitz, 2015).

Another benefit from viewing the area as a single market is that companies can make more use of FDI. Since most deterrents to enter another country's market disappears when joining a currency union, it enables cross border mergers to happen more easily (Baldwin, 2010).

Another gain is the transparency it offers consumers looking to make purchases in another country. The ability to compare prices of goods and services is made easier between countries when exchange rates are removed i.e. when countries share a currency (Krugman, Obstfeld and Melitz, 2015). This allows for easier trade between countries, increasing demand and making the market more attractive to companies operating on a global scale.

A common currency area should also bring a greater price stability to its members. This price stability should lessen inefficient trade, something that might happen under inflationary circumstances. Stability should increase when the currency area expands i.e. the larger the currency area is the greater the stability it has (Krugman, Obstfeld and Melitz, 2015).

Sharing a currency does, however, come with the cost of each country's loss of monetary policy independence (Krugman, Obstfeld and Melitz, 2015). A country with a different inflationary target would be at a significant disadvantage. The Maastricht convergence criteria work as a control in this regard, ensuring the goals of the currency union are the same as the single country. Note, however, that while the goals and economic situation for a country joining the EMU may be aligned with those of the EMU at that point, the circumstances may change as the economic climate changes or the country is hit with a shock. While the centrally decided interest rates may be set to counter the booming economic activity occurring in the majority of countries in the currency area, a country with decreasing economic activity will be greatly damaged by this interest rate as it causes a deflationary pressure on an already declining economy. With a shared currency, the exchange rate will not adjust itself, putting further pressure on the economy. The same will naturally occur in the reverse with low interest rates in a country with high economic activity and inflationary pressure. The exchange rate is a powerful tool, whether fixed or floating, but is dependent on either sharing economic circumstances or having monetary sovereignty to wield it.

5 Methodology and data

5.1 Gravity model of trade

To be able to observe if there is an effect on international trade from joining a currency union, there is a need to account not only for the currency union but also for several other factors that might affect trade (for example historical connections or sharing the same language). This is because when several of the other factors are considered, one may then be able to see if there is any remaining influence on international trade by a currency union. To do this, there is one economic model, among others, that enables several objects of interest to be embedded in it, called the gravity model of international trade (Baldwin and Taglioni, 2007).

The gravity model of international trade is an empirical model that explains the size of international trade between two countries. In international trade the gravity model was first used by Jan Tinbergen in 1962. Tinbergen used this model to describe the flow of international trade between two countries[10] as being relative to these countries' "mass" or, in economics, their GDP, and inversely proportional to the distance between them during a certain time period. Tinbergen's model contains variables for the trade between countries which is labelled X, GDP for the countries which is labelled Y, and the distance between the countries, labelled D. There is also the constant α which cannot be quantified in any meaningful way.[11] Lastly there are i and j which are the hypothetical countries. The equation is shown below (Krugman, Obstfeld and Melitz, 2015, p. 44):

$$X_{ij} = \alpha_0 \frac{Y_i^{\alpha_1} Y_j^{\alpha_2}}{D_{ij}^{\alpha_3}} \qquad (1)$$

The gravity model of trade used in this paper is a modified version of Glick and Rose's (2002) gravity model. The main difference between Roses and Glick's model and this model is that while Glick and Rose applied it to focus on currency unions in general and how volatility of bilateral nominal exchange rate affect trade, this essay focuses only on how the EMU affect trade. The model that Glick and Rose (2002) used is a log linear extended form of the gravity

[10] Often referred to as country *i* and country *j*.

[11] The constant comes from the physics model and was originally G for gravity.

model, and is shown in the appendix.[12] The augmented gravity model chosen for this investigation looks as following:

$$\mathrm{Log}(X_{ijt}) = \beta_0 + \beta_1 \mathrm{Log}(Y_i Y_j)_t + \beta_2 \mathrm{Log}\left(\frac{Y_i Y_j}{Pop_i Pop_j}\right)_t + \beta_3 \mathrm{Log}D_{ij} \quad (2)$$

$$+\beta_4 \mathrm{Lang}_{ij} + \beta_5 \mathrm{Cont}_{ij} + \beta_6 \mathrm{FTA}_{ijt} + \beta_7 \mathrm{Landlock}_{ij}$$

$$+\beta_8 \mathrm{Island}_{ij} + \beta_9 \ln(\mathrm{Area}_i \mathrm{Area}_j) + \gamma \mathrm{CU}_{ijt} + \varepsilon_{ijt}$$

Here i and j denotes countries, t denotes time, and the variables are defined as following:

X_{ijt} denotes the value of bilateral trade between country i and j.

Y is the real GDP.

Pop is the country's population.

D_{ij} is the distance between country i and j.

Lang_{ij} is a binary variable which is "yes" if i and j have a common official language.

Cont_{ij}denotes whether country i and j shares a border.

FTA_{ijt} is a binary variable which is "yes" if countries i and j belong to the same trade agreement at time t.

$\mathrm{Landlock}_{ij}$ is the number of landlocked countries in the country-pair that is landlocked[13]

Island_{ij} is the number of countries in the pair that are islands.

Area is the area of the country measured in square kilometres.

CU_{ijt} is a binary variable which is "yes" if i and j use the same currency at time t.

β is a vector of nuisance coefficients.

γ is the effect of a currency union on trade flows.

ε_{ijt} represents the myriad other influences on bilateral exports, assumed to be well behaved.

For this research the coefficient of major interest is the γ,which represents the effect of a currency union on the international trade. To measure this coefficient this paper uses the ordinary least square (OLS) method, which has become the norm amongst gravity models (Rose, 2000; Glick and Rose, 2002; Micco, Stein and Ordoñez, 2003; Tsangarides et al, 2006) but, similar to Glick and Rose (2002), a robust fixed effect so called "within" estimator will

[12] See in appendix Equation 4 for Glick and Rose gravity equation.

[13] Number of landlocked countries can be 0, 1 or 2. Here if zero of the countries are landlocked it is represented as 0, if one of the countries are landlocked it is 1, if both of the countries are landlocked it is denoted as 2.

be used. The fixed effect estimator will generate a set of country-pair specific intercepts into the equation. The main reason for the usage of the fixed effect estimator is according to Glick and Rose (2002, pp. 1130-1131) that:

> There are only two possible drawbacks to the estimator: the impossibility of estimating time-invariant factors, and a potential lack of efficiency.

Furthermore, this estimator also answers the question of what is the trade effect of a country joining (or leaving) a currency union is. This is because of the fixed effect estimators exploit variation over time (Glick and Rose, 2002).

5.2 Ordinary Least Square (OLS)

The OLS-method that will be used as a base for this paper is the pooled OLS-model. This model is founded on the method of pooling together the data from different individuals, in this case, country-pairs, with an indifference to individual inequalities. The general form of the pooled OLS-model equation with one explanatory variable X_1 will be written as following (Stock and Watson 2015, p. 159):

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \qquad (3)$$

This model will generate estimators that in turn chooses regression coefficients that estimates a regression line as close as possible to the observed data. Nonetheless, for the OLS-model to be consistent, unbiased and efficient three conditions should be met (Stock and Watson 2015, p. 175):

1. Error term have a mean of zero given $X_i : E(\epsilon_i|X_i)$
2. $(X_i, Y_i), i = 1, \ldots, n$, are independent and identically distributed (i.i.d.) draws from their joint distribution; and
3. Large outliers are unlikely: X_i and Y_i have nonzero finite fourth moments.

Fourth moments being finite entails that the tails of distribution are relatively short, which should make the probability of unusually large observations occurring relatively small.

If all these conditions are met and the explanatory variable X_i is non-random then the coefficient estimates on repeated observations are centred around the true parameter, even if they are a sample of the full population, which is in this essay referred to as consistent. Furthermore, no other estimators (within the class) should produce a lower variance, or more efficient, than the OLS coefficient estimates, which is referred to as efficient in this thesis.

5.3 Ordinary Least Square with country-pair fixed effects.

Cross-section OLS analysis on currency unions' effect on countries' international trade are aimed at answering if countries with a common currency will trade more than countries that do not share a currency. However, since this essay's focus is on what impact a currency union will have on the countries that adopt it, a country-pair fixed effect will be added to the regression. This will help isolate the euro's effect over time and leave out cross-sectional variation (Glick and Rose 2002). It also ensures no time-invariant variables[14] to specific country-pairs can be included in the model since they would be perfectly collinear with the fixed effects. By including these fixed effects, most of the reasons two countries in a currency union that have traded a lot, should be captured by the fixed effects, and therefore not affect the currency union variable in the regression (Herrera and Baleix, 2010).

5.4 Data

The dataset contains information on the bilateral trade from the year 1999 to 2017, between the countries that joined EMU between the years 2007-2009 which deviates a year and a half around the middle year of this essay's timeframe 1999-2017. This data contains information regarding trade flow (export), countries' GDP, free trade agreements and some historical and culture relations. All the data collected for this essay will then be used in this thesis' augmented gravity equation[15] using the statistical program R-project.

The data on exports was obtained from International Monetary Fund's Direction of Trade Statistics (IMF DOTS) dataset. This dataset contains information regarding the Free on Board (FOB) export between the observed countries, recorded in U.S. dollars. To obtain the real export from this data the same method as Baier et al (2008) was used. The trade data i scaled by the exporters' GDP deflators, which will then generate real trade flows that can be used in the analysis.

[14] i.e. distance, language, sharing a border etc.
[15] See Equation (2)

The GDP data is obtained from the World Bank's World Development Indicators for each country and for the time period. The GDP is measured in current U.S. dollars, which is then scaled by the countries' respective GDP deflators to then generate real GDP for each country. In a gravity model analysis, it is expected that a higher GDP should increase the bilateral trade flow (Krugman, Obstfeld and Melitz, 2015).

The distance variable is included as a proxy for transportation costs between the countries. This is calculated by the distance (in kilometres) between the two countries' capitals. This approach is used rather than choosing the geographical centre since the capital is more representative of the distance for trade flows. For Cyprus and Malta, the difference becomes negligible either way. This data is obtained through the dataset GeoDist which is provided by the French Institute Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Since this variable is a proxy for transportation costs, it is expected to have a negative impact on the bilateral trade between countries (Rose, 2000; Baier et al, 2008).

Furthermore, there are several binary variables being used, namely if they share a common border, colonial relationships, or have been the same country. These variables are available in the GeoDist dataset. The binary variables regarding if the countries are islands, landlocked or share official language(s) are obtained through the data source CIA World Factbook. The binary variable regarding if they are a part of the same free trade agreement is attained through WTO webpage regarding regional trade agreements. The binary variable regarding when the countries joined the currency union (EMU) is obtained through the European Central bank (ECB) homepage about the euro area.

5.5 Zero-trade data

The dataset for Slovenia, Cyprus, Malta and Slovakia and their intra-EU trade partners has some missing values regarding their exports. These are Cyprus-Luxembourg 2011, Malta-Lithuania 2005 and Malta-Estonia 2007. Missing data might result in a systematic biased sample. The International Monetary Fund - Direction of Trade Statistics (IMF DOTS) does not provide information regarding whether these values are genuinely missing or have simply been reported as zeroes, for example because of rounding of the numbers i.e. one country's trade is too small to measure for the database. However, there have been previous studies that investigated this technical problem. The researcher Gleditsch investigated this by comparing IMF DOTS to other databases such as COMTRADE. From this Gleditsch argues that 80 percent of the missing data should be regarded as zeroes (Felbermayr and Kohler, 2006). Based on the results Gleditsch found, this paper will regard all the missing values as zeros in the dataset.

6 Results and analysis

6.1 Results

To estimate how and if joining the EMU have had an effect on Slovenia, Cyprus, Malta and Slovakia's international trade, two models have been constructed using the augmented gravity model, see Equation (2). The regressions show how the independent variables affect the export value, the dependent variable, shown in percentage.

Using Equation (2) in R Project, where export is the dependent variable, the results are shown in Table 1 below. In the far-left column the definitions of the variables are shown, whereas the names of the variables can be read in column two. The results of the normal OLS regressions can be read in column three, and finally the results of the OLS with fixed effects are shown in the far-right column.

Tabell 1. Regression Results

Variables	Definition of variables	Normal OLS	OLS Fixed Effect
$Log(Y_iY_j)$	Log GDP	1.047 (0.031) ***	-0.349 (0.315)
Log(YiYj/PopiPopj)	Log GDP per capita	-0.418 (0.053) ***	1.139 (0.31) ***
$Log(D_{ij})$	Log Distance	-1.380 (0.060) ***	
$Lang_{ij}$	Language	1.675 (0.175) ***	
Cont	Share border	0.341 (0.135) *	
FTA_{ij}	Free trade agreement	0.477 (0.071) ***	0.365 (0.073) ***
$Landlock_{ij}$	Landlocked	-0.093 (0.055) .	
$Island_{ij}$	Island	-0.692 (0.079) ***	
$Log(Area_iArea_j)$	Log Area	-0.020 (0.024)	
CU_{ij}	EMU	-0.012 (0.066)	0.136 (0.053) *
Observations		2052	2052
R-Squared		0.818	0.338
Adjusted R-Squared		0.817	0.300

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. Standard error within parentheses.

All variables except the area and membership of the EMU of the countries are shown to be significant in the normal OLS regression. When applying fixed effects to the regression, only four variables remain: GDP, GDP per capita, Free trade agreement and EMU. In this case GDP show to be not statistically significant.

The normal OLS regression results do not support the theory that currency unions have a positive effect on these countries' international trade. The EMU estimate is -0.012, meaning when a country joins the EMU, this country's export should decrease by 1.2 percent. This estimate is shown to be statistically insignificant. The OLS with fixed effects in column 4 in table 1, however, shows the EMU variable to have an estimate of 0.136, which shows that exports are increasing. Hereby, when a country joins the EMU its exports should increase by 13.6 percent. This estimate is also statistically significant according to the model. Therefore this estimate supports the theory of optimal currency area and also the earlier research that

tends to show that currency unions have a positive effect on international trade, but similar to most non-Rose research these results are less than a "massive" increase i.e. not a 50 percent increase of international trade for the countries, argued by Rose (2000) and Glick and Rose (2002).

The results from the logarithmic GDP are statistically significant for the normal OLS but not for the OLS-fixed effect. According to these results, the countries' intra-EU trade should, for each percentage increase in GDP, increase their export in the normal OLS by 104.7 percent. Meanwhile, for the OLS-fixed effect there is a decrease in exports by 34.9 percent for each percentage increase in GDP, although this is not statistically significant. For the normal OLS the results are consistent with previous research by Rose (2000), Glick and Rose (2016), Davis (2017) and the gravity model theory that explains that a country that has a higher GDP will trade more. Although this numbers may look high (or more normal) this is in line with what previous research has shown. Davis (2017) saw results of real GDP increasing trade by 107.4 percent.[16]

The explanatory variable of GDP per capita are statistically significant for both models, but for the normal OLS it is shown to have a negative effect. This means that for each percentage increase in GDP per capita there is a decrease in the countries' export by 41.8 percent. This can be explained by several of the countries that have a higher GDP per capita have a larger distance between them which makes them worse trading partners than those that are closer, even though they have a smaller GDP per capita. The results from the OLS-fixed effect, however, show that there should be an increase in trade by 113.9 percent for each percentage increase in their GDP per capita. These results are aligned with the gravity theory stating that a richer country should trade more. This number also seems similar to our GDP numbers, being fairly high but not too far from numbers by previous researcher Tsangarides et al (2008), which were between 51 percent and -140 percent.

All other of the explanatory variables, except Area, follows the expectations from the gravity theory and the previous research i.e. larger distance, being landlocked or an island decreases trade, while sharing a border, same language or being part of a free trade agreement increases trade. The explanatory variable Area is expected to increase trade (Glick and Rose 2002; Glick and Rose 2016; Micco, Stein and Ordoñez 2003). However, according to these

[16] See also Micco, Stein and Ordoñez found that an increase in GDP caused an increase in trade by numbers between 79.3 to 122 percent. Tsangarides et al (2008) also found numbers between 14 and 114 percent.

estimates, a one percentage increase in area decreases trade by two percent. This could be due to the fact that several European countries with high trade, such as the Netherlands, are relatively small compared to Poland or Romania which are large area countries but smaller in trade compared to the Netherlands and Belgium. Although, this explanatory variable (Area) is not statistically significant.

The following two figures, 1 and 2, represent each country's individual exports over the observed years 1999-2017. The models have been split in two in order to show changes in more detail as the two sets of countries have widely different export levels.

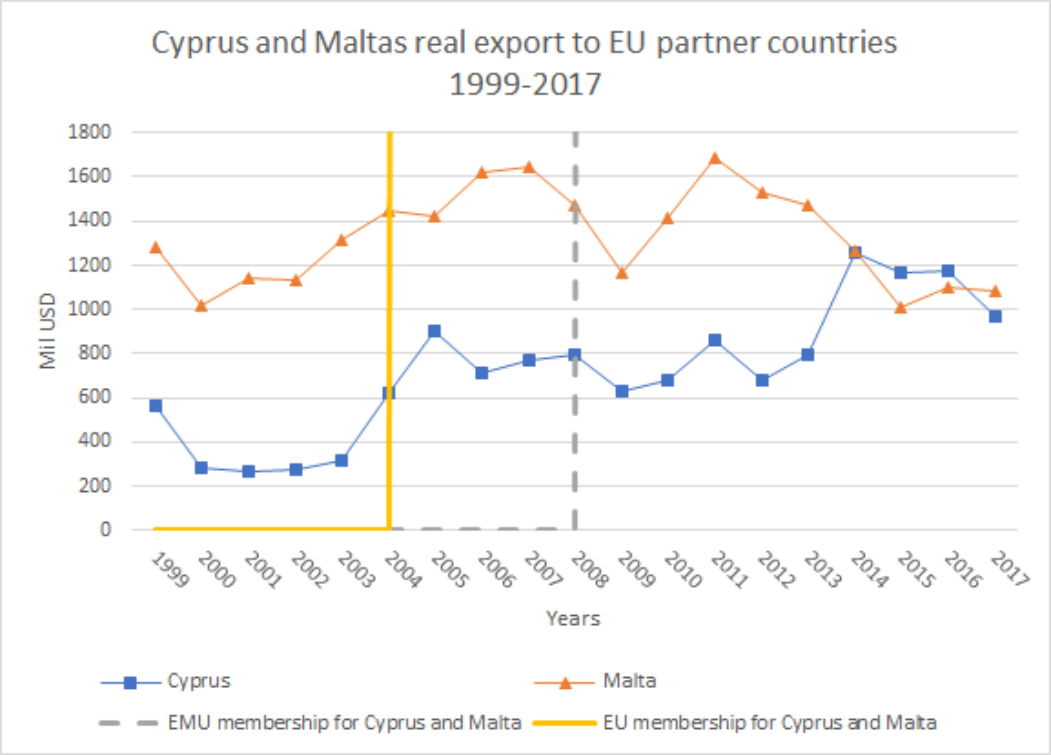

Figure 1 Shows the real export to EU partner countries for Cyprus and Malta during the years 1999 to 2017, and denotes the year they joined the EU and EMU respectively.

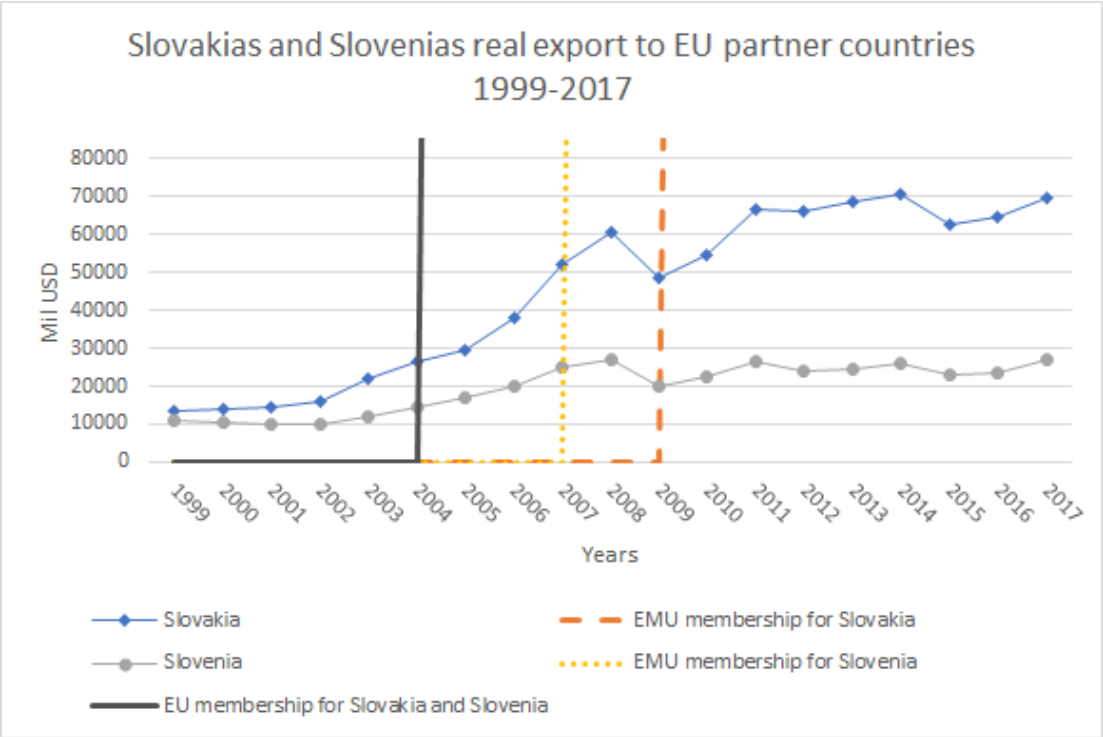

Figure 2 Shows the real export to EU partner countries for Slovenia and Slovakia during the years 1999 to 2017, and denotes the year each country joined the EU and EMU respectively.

From these tables, it seems only one country, Malta, has had a decrease in their overall export level since joining the EMU. Although, this might be due to other factors that might change with time (the country might be experiencing a slight recession) but because of the time frame is not yet showing. Cyprus, Slovenia and Slovakia do seem to have an increase in their levels of export since joining the EMU.

6.2 Analysis

Sharing a currency may have less of an effect on trade than free trade agreements. In the normal OLS regression, the joining of EMU is shown not to increase the international trade, but rather to decrease it. Being a part of a free trade agreement, however, has shown to create a positive increase in international trade. These results may stem from the fact that many positive effects of joining the EMU are already established from having a free trade agreement. This would mean that sharing a currency would have less of an effect on international trade than the agreement of trade between the countries, removing many barriers to trade without adding the joint currency.

A strong advantage to sharing a currency is the complete elimination of currency risk. By removing the currency fluctuations, the risk of international trade decrease by making it more

predictable, not least for suppliers in globally operating companies. This effect cannot be achieved completely from entering a free trade agreement which will simply remove red tape and additional obstacles from the trade such as tariffs and quotas. While this provides a great competitive advantage for the country being in the free trade agreement against other countries outside of it, it will not eliminate the risk of a fluctuating currency. The elimination of the currency risk should, on a total, decrease the costs of trade and therefore increase the international trade flows (Davis, 2017). Furthermore, as demonstrated by Sadeh (2014), sharing a currency can decrease pricing mark-ups and improve the margins for companies, meaning an even larger incentive for international trade. Hereby, even a small decrease in trading costs can increase the trade flows to a larger degree. Following this, a shared currency should have a larger impact on trade between countries than a free trade agreement Sadeh (2014).

However, it is only when the time-invariant variables are removed from the OLS regression that the effect of joining the EMU is shown to be statistically significant. A shared currency impacts international trade, but only in the OLS fixed effect regression. Meaning, arguably, that in a short-term perspective, the joining of EMU is not as important as the establishment of a free trade agreement. Considering a free trade agreement is a prerequisite for entering a currency union such as the EMU, it can be argued that the foundation of a pre-existing trade agreement is more important to decreasing barriers to trade than a shared currency. In fact, it is relevant to study further back to the circumstances leading to a free trade agreement. The data collected and analysed for this paper is from a time interval such that the chosen countries (Slovenia, Cyprus, Malta and Slovakia) joined the EU in 2004 (hence five years of data from before joining the EU), and the EMU had already been established. In table 3 to 6 in the appendix, each country's five largest trading partners in the EU are shown over the time interval 1999 to 2017. Considering all four countries joined the EU and the EMU within this time span, the changes in the top five trading partners are small. This could be argued is because each of the countries' trading partners and the trading patterns within EU had already been established before these countries joined the EMU. This supports the research of Persson (2001) where he points out that the historical context might be what decides trading partners. Given the rich and complex history of European countries it should come as no surprise that patterns and culture preceding that of modern trade agreements should impact choices in trading partners today.

This leads to what optimal currency theory denotes as simultaneity i.e. the distinction between cause and effect. Countries that had, or most likely have, an extensive trade with EMU countries are more prone to adopt the euro as a currency while countries without a significant trade with EMU countries might be less inclined to adopt the euro i.e. join the currency union. This means that well established trade patterns might be the cause of the currency union and not the effect of it. Although, looking at figure 1 (Cyprus and Malta trade export) and figure 2 (Slovenia and Slovakia trade export) where each country's total export to the EU partner countries is shown, there does seem to be an upward trend for three of the four countries in their total export towards their intra EU trade partners. With this in mind, and when taking the fixed effect OLS results into consideration, there does seem to be an increase in export for three of four countries due to joining the EMU. These results support the argument from Optimal Currency Area theory that currency unions do increase trade (Rose, 2000; Krugman, Obstfeld and Melitz, 2015). The results of the normal OLS regression does not support this, but as previously mentioned, this OLS estimate does not answer the question regarding individual countries, but rather the common currency area as a whole.

The problem with the Optimal Currency Area theory, as brought up by Baldwin (2010) is the lack of trade diversion between non-EMU members. Since the OCA theory argues that when joining a currency union trade costs decrease between its members, this should lead to more trade between the member countries and hence lead to trade diversion for the non-members. As a result of this, the intra-EU trade should increase, because some of the lowered transaction costs operate through prices which are passed on to the consumers. This, in turn, makes the intra-EU import prices fall which should, according to OCA theory, increase the trade within the EU. However, according to Baldwin, there are almost no signs of this happening.

Baldwin (2010) also argues that the euro made the euro-nations more similar to a single market. The euro brought a boost to price transparency, making third party arbitrage safer. This was also in addition to the pro-FDI effects the euro brought with it. The effect is the removal of barriers to enter different industry sectors, which had previously acted as deterrents to cross-border mergers within EU (Baldwin, 2010). This seems to indicate that this study's results are not entirely due to OCA theory of a trade-effect i.e. primarily lowering transaction costs to increase international trade, but rather due to the benefits of joining a currency union. The benefits come from the ability to view the currency union as a single market as the common currency removes uncertainty regarding future exchange (Baldwin,

2010; Krugman, Obstfeld and Melitz, 2015). Indeed, apart from encouraging an increase in trade, one possible explanation for joining a currency union might be to encourage an increase in FDI.

This study is primarily focused on whether or not there is an increase in international trade from joining the European Monetary Union for the countries Slovenia, Cyprus, Malta and Slovakia. This seems to be the case when fixed effects are taken into account. It is hard to make a definitive answer as to whether this increase is due primarily to pro-FDI incentives or OCA-theory properties, or a combination of both. This is an area that future research might want to investigate.

7 Conclusions

This thesis began examining if joining a common currency area brought an increase in international trade to its new members. This was done by focusing on the common currency area denoted as EMU and, more specifically, on four members of this currency union: Slovenia, Cyprus, Malta and Slovakia. An augmented gravity model was used on these four countries and their trading partners within the EU over the years 1999 to 2017. Following the reasoning of Glick and Rose (2002) fixed effects were added to the method to see how an individual country is affected by joining a currency union, as opposed to the "normal" OLS which explains how the area as a whole is affected. The results yielded from the fixed effect model indicates that trade does increase by 13.6 percent form joining the currency union. Meanwhile, the normal OLS showed results that indicates trade decreases from joining the currency union by 1.2 percent, but these results were statistically insignificant. Based on these results, it does seem that joining a currency union has a positive impact on individual countries' international trade. However, despite the fact that trade increases when joining the EMU for the observed countries, it is not always a rational choice for all countries that fulfil the Maastricht convergence criteria for joining the EMU to join. Motivations for joining the EMU are more complex than simply increasing trade; several aspects need to be considered, such as how inflation will be affected and whether the country is willing to abandon its monetary policy independence etc. These aspects need to be considered with the benefits of a currency union before joining the EMU.

The research question asked is if joining the EMU increases the level of trade between members countries in the EU. There does seem to be an increase in trade by sharing a common currency. This supports much of the previous research, but similar to most of the non-Rose related research, the increase is between 10-20 percent. Although, this increase in international trade has prompted some questions for further research. Based on the fact that free trade agreements have such a strong impact on trade when looking at a shorter time frame, and how a longer membership in a currency union seems to reap larger effects, we must ask whether the increase in trade estimated in this essay is really from joining a currency union or the foundation-laying lowering of barriers to trade. It must also be contemplated the deep political roots a currency union is imbedded in and the rich history of European cooperation since the Second World War. In the face of growing globalization it the aspect of FDI incentives must be taken into consideration as a major player in the trade levels.

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9 Appendix

Tabell 2. List of countries

Countries	EMU (year)	Countries	EMU (year)
Austria	1999	Italy	1999
Belgium	1999	Latvia	2014
Bulgaria	No	Lithuania	2015
Croatia	No	Luxembourg	1999
Cyprus	2008	Malta	2008
Czechia	No	Netherlands	1999
Denmark	No	Poland	No
Estonia	2011	Portugal	1999
Finland	1999	Romania	No
France	1999	Slovakia	2009
Germany	1999	Slovenia	2007
Greece	2001	Spain	1999
Hungary	No	Sweden	No
Ireland	1999	United Kingdom	No

Tabell 3. Cyprus' five largest trading partners 1999-2017

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008*
UK	UK	UK	UK	Greece	UK	France	UK	Greece	Greece
Greece	Greece	Greece	Greece	UK	Greece	UK	Greece	UK	UK
Germany	Germany	Germany	Germany	Germany	Germany	Greece	France	Germany	Germany
Bulgaria	Nether-lands	Spain	Nether-lands	Nether-lands	France	Germany	Germany	Romania	Italy
Belgium	Spain	Nether-lands	Spain	Italy	Nether-lands	Nether-lands	Italy	Italy	Spain
2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Greece	Greece	Greece	Greece	Greece	Nether-lands	Greece	UK	Greece	
Germany	Germany	UK	UK	UK	Greece	Ireland	Greece	UK	
UK	UK	Germany	Italy	Germany	UK	UK	Sweden	Germany	
Italy	Italy	Italy	Germany	Italy	Germany	Malta	Denmark	Nether-lands	
Nether-lands	Nether-lands	Nether-lands	Sweden	Sweden	Malta	Nether-lands	Malta	Belgium	

Note: * indicates the year Cyprus became a member of the EMU.

Tabell 4.Malta's five largest trading partners 1999-2017

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008*
France	Germany	France	France	France	France	France	France	Germany	Germany
Germany	France	Germany	UK	UK	UK	Germany	Germany	France	France
UK	UK	UK	Germany	Germany	Germany	UK	UK	UK	UK
Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy
Belgium	Belgium	Belgium	Belgium	Belgium	Hungary	Belgium	Portugal	Finland	Netherlands
2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	
France	France	France	France	France	France	France	France	France	
Italy	Italy	Greece	Italy	Italy	Italy	Italy	Italy	Italy	
UK	UK	Italy	UK	UK	UK	UK	UK	UK	
Cyprus	Cyprus	UK	Netherlands	Greece	Netherlands	Spain	Netherlands	Spain	

Note: * indicates the year Malta became a member of the EMU.

Tabell 5. Slovakia's five largest trading partners 1999-2017

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany
Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia
Italy	Italy	Italy	Italy	Italy	Austria	Austria	Italy	Hungary	Hungary
Austria	Austria	Austria	Austria	Austria	Italy	Italy	Poland	France	France
Poland	Poland	Poland	Hungary	Hungary	Poland	Poland	Hungary	Italy	Poland
2009*	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	
Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	Czechia	
France	Poland	Poland	Poland	Poland	Poland	Poland	Poland	Poland	
Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	Austria	France	France	
Poland	Austria	Austria	Austria	Austria	Austria	Hungary	UK	Hungary	

Note: * indicates the year Slovakia became a member of the EMU.

Tabell 6. Slovenia's five largest trading partners 1999-2017

1999	2000	2001	2002	2003	2004	2005	2006	2007*	2008
Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany	Germany
Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy	Italy
Croatia	Croatia	Croatia	Croatia	Croatia	Croatia	Croatia	Croatia	Croatia	Croatia
Austria	Austria	Austria	Austria	Austria	Austria	France	Austria	Austria	Austria
France	France	France	France	France	France	Austria	France	France	France
2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Germany	Germany	Germany	Germany	Malta	Germany	Germany	Germany	Germany	
Italy	Italy	Italy	Italy	Cyprus	Italy	Italy	Italy	Italy	
Croatia	Austria	Austria	Austria	Ireland	Austria	Austria	Austria	Austria	
France	France	Croatia	Croatia	Estonia	Croatia	Croatia	Croatia	Croatia	
Austria	Croatia	France	France	Luxembourg	France	Slovakia	Hungary	France	

Note: * indicates the year Slovenia became a member of the EMU.

Tabell 7. Correlations Matrix

EMU	Area	Border	Distance	GDP per Capita	Island	LandLock	Export	GDP	FTA	Language	
1											EMU
-0.014	1										Area
-0.069	0.09	1									Border
0.082	-0.215	-0.44	1								Distance
0.371	-0.039	-0.08	0.153	1							GDP per Capita
0.026	-0.449	-0.303	0.661	0.062	1						Island
-0.04	0.278	0.35	-0.441	-0.01	-0.419	1					LandLock
0.069	0.446	0.424	-0.377	0.026	-0.337	0.336	1				Export
0.149	0.642	0.014	-0.145	0.179	-0.213	0.119	0.676	1			GDP per Capita
0.438	0.015	-0.018	0.041	0.389	0.014	0.02	0.13	0.168	1		FTA
0.012	-0.089	-0.048	0.069	0.076	0.299	-0.128	-0.047	-0.045	0.011	1	Language

Tabell 8. Variance

	Variance Inflation Factor (VIF)	Tolerance (1/VIF)
	Log $Export_{ij}$	Log $Export_{ij}$
Log GDP_{ij}	4.535	0.221
Log $GDPperCapita_{ij}$	2.909	0.344
Log $Distance_{ij}$	2.975	0.336
Language	1.164	0.859
Border	1.770	0.565
Landlock	1.353	0.739
Island	3.046	0.328
Log $Area_{ij}$	4.695	0.213
FTA_{ij}	1.457	0.686
EMU_{ij}	1.341	0.746

An assumption should be made in order to avoid multicollinearity: the variables are not perfectly correlated. This assumption entails that variables within the estimate can be linearly predicted from each other with a degree of accuracy. Should this not be the case, there is most likely a multicollinearity problem in the estimate. In order to see if there is a problem regarding multicollinearity this essay uses the Variance Inflation Factor (VIF) which is defined as the reciprocal of tolerance: (1/VIF): $VIF = 1/(1 - R^2)$ where tolerance is $1 - R^2$. R^2 is the coefficient of determination of a regression, and the tolerance denotes the percentage of variance in the independent variable that are not explained by other variables. If the tolerance is below 0.1 it is often considered problematic hence a value above 0.1 is preferable.

The VIF indicates how much the standard errors are affect from the levels of collinearity: if the VIF value is above 10 it is considered as a sign of a problem regarding collinearity in the sample. As can be observed in table 10, the VIF values are between 4.5 and 1.3, and tolerance values are between 0.2 to 0.85, meaning there is no direct sign of a multicollinearity problem in this sample.

Equation 4. Glick and Rose's (2001) original gravity model of international trade

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(Y_i Y_j)_t + \beta_2 \ln\left(\frac{Y_i Y_j}{Pop_i Pop_j}\right)_t + \beta_3 \ln D_{ij} \quad (4)$$
$$+\beta_4 Lang_{ij} + \beta_5 Cont_{ij} + \beta_6 FTA_{ijt} + \beta_7 Landlock_{ij}$$
$$+\beta_8 Island_{ij} + \beta_9 \ln(Area_i Area_j) + \beta_{10} ComCol_{ij}$$
$$+\beta_{11} CurCol_{ijt} + \beta_{12} Colony_{ij} + \beta_{13} ComNat_{ij} + \gamma CU_{ijt} + \varepsilon_{ijt}$$

Here i and j denotes countries, t denotes time, and the variables are defined as following:

X_{ijt} denotes the value of bilateral trade between country i and j.

Y is the real GDP.

Pop is the country's population.

D_{ij} is the distance between country i and j.

$Lang_{ij}$ is a binary variable which is "yes" if i and j have a common official language.

$Cont_{ij}$ is a binary variable which is "yes"[17] if i and j share a land border.

FTA_{ijt} is a binary variable which is "yes" if i and j belong to the same trade agreement.

$Landlock_{ij}$ is the number of landlocked countries in the country-pair that is landlocked[18]

$Island_{ij}$ number of countries in the pair that are islands.

Area is the land mass of the country.

$ComCol_{ij}$ is a binary variable which is yes if country i and j were colonies after 1945 with the same colonizer.

CurCol is a binary variable which is yes if i and j where colonies at the same time.

$Colony_{ij}$ is a binary variable which is yes if i colonized j or vice versa.

$ComNat_{ij}$ is a binary variable which is yes if country i and j where apart of the same nation.

CU_{ijt} is a binary variable which is "yes" if i and j use the same currency at time t.

β is a vector of nuisance coefficients.

ε_{ijt} represents the myriad other influences on bilateral exports, assumed to be well behaved.

[17] All binary variables are coded as "0" or "1", where "0" replaces no and "1" replaces yes.
[18] Number of landlocked countries can be 0,1 or 2.