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Euro effects on intermediate and final exports*

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Abstract

This paper studies the euro effects on intermediate and final exports taking advantage of the world input-output dataset (WIOD). The originality of this empirical analysis is that it combines one of the most analyzed topics in international economics, the euro trade effects, with the theme of supply chain trade. The main findings are the following: i) the euro has positively affected Eurozone trade with a larger effect on intermediate flows relative to final exports; ii) the intra-area euro effect becomes either negative or not statistically significant when switching from a small sample of advanced economies to a larger group of emerging and developing economies. The paper provides some evidence that the heterogeneity of euro effects between the small and the large sample can be explained by a missing variable related to the increasing relevance of supply chain connections between European countries.

Keywords: euro, supply chain trade, gravity equation.

JEL Classification Codes: F1, F15, F2, F33.

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Introduction

The aim of this paper is to consider whether the euro has caused differentiated effects on intermediate and final exports[1]. The originality of this empirical analysis is that it combines one of the most analyzed topics in international economics, the euro trade effects, with the theme of supply chain trade[2]. The latter concept refers to the changes determined by the internationalization of production, also called globalization 2nd unbundling[3]: production stages that were previously performed in close proximity have been off-shored combining rich-nation high technology with low-wage labor. Trade relations have been deeply modified giving rise to supply chain trade, "*cross-border flows of goods, know-how, investment, services and people*"[4](Baldwin and Lopez-Gonzalez (2013)).

Former studies analyzing the euro trade effects are based on traditional statistics that measure the value of trade flows as they cross the border. This paper takes advantage of WIOD[5], a dataset launched in 2012 that combines international trade statistics, input-output tables and national accounts. Unlike traditional trade data, WIOD provides information that allows to analyze the consequences of production fragmentation on trade, thanks to the distinction between final and intermediate use of trade flows.

The empirical analysis in this paper makes use of the gravity model that represents the workhorse for estimating the impact of common currencies on trade (See the Appendix for a brief review). The model is estimated using the most common econometric specifications for two different samples, a group of 19 advanced economies and a larger sample of 40 countries including many emerging and developing economies connected to advanced nations through intense flows of intermediate inputs. The use

[1]Final goods are also defined consumption goods since they are sold for private and government consumption or for investments. Intermediates are used as inputs into the production process in order to produce other goods. Both can also consist of services (Baldwin and Lopez-Gonzalez (2013)).

[2]For a comprehensive analysis of supply chain trade, see Baldwin (2012) and Baldwin and Lopez-Gonzalez (2013).

[3]Baldwin (2012) divides globalization into two phases: the first one took place between the steam revolution and the late 1980s and was characterized by trade costs reduction; the main feature of the second one was the decrease in transmission costs thanks to the ICT revolution. It occurred between 1985 and 1995.

[4]Supply chain trade can also be defined trade in parts and components.

[5]World Input Output Database, http://www.wiod.org/. For a description of the dataset, see Timmer (2012).

of the gravity model in the supply chain framework assigns an additional purpose to this paper that is to test whether the traditional equation is still able to explain the common currency effects on bilateral flows when countries are deeply connected along the value chain.

The main finding of this paper is that the euro has positively affected Eurozone trade when the gravity model is estimated for a small sample of advanced economies; the trade enhancing effect has been larger for intermediate exports. However, the results become either negative or insignificant when considering a larger sample of 40 countries. As in Frankel (2010), estimates are very sensitive to the country choice. The paper provides some evidence that the heterogeneity of euro effects between the two samples could depend on the new structure of world production: an increasing number of production stages has been moved from advanced economies to low wage producers, creating deep connections between them. Intermediate inputs cross international borders many times before being assembled in a final good generating a large amount of international trade between different countries. Moreover, final goods have a high import content since they are made of inputs coming from different countries. This phenomenon is mainly regional and it is particularly relevant for Europe that has the most important value of intra-regional trade (Miroudot et al. (2009)).

The rest of the paper is organized as follows: section 1 reviews the related literature; the empirical strategy and the data are presented in sections 2; section 3 gives some stylized facts. Estimation results are presented in section 4. Section 5 presents some robustness checks and section 6 concludes. Figures and tables are in the Appendix.

1 Literature review

Andrew Rose's paper "One money, one market: estimating the effect of common currencies on trade"[6] has stimulated a big debate on the idea that currency unions enhance trade and since then many researchers have analyzed this empirical issue. The creation of the European Monetary Union (EMU) has made the euro the main

[6]Rose (1999) finds that members of currency unions trade with each other three times more than with other trading partners. This result is also known as the "Rose Effect".

focus of these studies. Empirical analysis has generally reported a statistically significant intra-euro area trade enhancing effect (De Nardis et al. (2008)): the consensus estimate is below five per cent (Fontagné et al. (2009)) and it is considered a modest result given initial expectations. Moreover, many recent papers (Silva and Tenreyro (2010)) find that the trade effect of the common currency is negligible. When considering the euro effect on trade between EMU members and extra-euro area countries, empirical analyses do not find the trade diversion effect foreseen by Mundell and his Optimal Currency Area (OCA) theory[7] (Baldwin (2009)).

This paper is based on the conceptual framework developed by Flam and Nordström (2006b) who interpret the euro as a tariff reduction that increases both trade and production sharing. They refer to the theoretical model developed by Yi (2003) to explain the growth of world trade since World War II: much this growth can be justified by vertical specialization[8] that propagates the positive effects of tariff reductions. Tariffs affect the cost of imported inputs; as the number of production stages performed in different countries increases, the positive trade effect determined by the tariff reduction becomes larger. Moreover, when tariffs fall enough, it becomes efficient to move production abroad. Through this model, Yi demonstrates that the effect of tariffs on vertical specialization is higher than on regular trade. Flam and Nordström (2006b) have extended this model to the trade cost reduction determined by the euro: it lowers the cost of making production inputs inside the Eurozone increasing intra-area trade; moreover, the euro fosters international vertical specialization and the production of some goods previously made at home is dispersed abroad. These goods become more competitive in extra euro-area markets as well and the tariff reduction determined by the common currency also increases sales from non Eurozone countries. This effect is analyzed for a sample of 20 OECD countries in the years 1989-2002. Gravity estimates show that the common currency has risen trade between EMU members by 15 per cent and trade with third countries by 8 per cent during the years 1998-2002 with respect to 1989-1997. The positive euro effect starts

[7]The theoretical framework behind the topic of the euro trade effects is the Optimal Currency Area theory (Mundell, 1961). One of the main microeconomic benefits of a currency union is the creation of trade flows among members thanks to the reduction of transaction costs. Silva and Tenreyro (2010) offer a straightforward analysis of the OCA criteria.

[8]Vertical specialization is a proxy for supply chain trade (Baldwin and Lopez-Gonzalez (2013)).

from 1998 and it is increasing over time. At sector level, the analysis suggests that the common currency has mainly affected goods characterized by processing and product differentiation[9]. In a second paper, Flam and Nordström (2006a) study the euro effects at different levels using data for the same countries but for a shorter period (1995-2005). They estimate a gravity equation with time and pair fixed effects, using one-way trade flows as dependent variable. Aggregate estimates show positive average currency union effects on both intra and extra-euro area trade during the years 2002-2005 with respect to the period 1995-1998. The effect is greater on the extensive margin, defined as products with zero exports in at least one year in the sample. The euro has lowered the cost of purchasing inputs from other euro area countries making Eurozone producers more competitive. Moreover, the common currency has reduced trade costs making profitable to incur fixed costs of exporting also for outside countries. These mechanisms work properly when considering highly processed products that require high fixed costs and consist of inputs sourced from different countries. When estimating the euro trade effects for raw materials, semi-finished and finished products, the authors find that larger average euro effects can mainly be attributed to the last two categories. Estimates for individual industries confirm this result showing that larger effects concern chemical, metal products and engineering industries, i.e. highly processed products. Similar findings are reached by Baldwin et al. (2005) that estimate the trade effects of the common currency on manufacturing sectors using bilateral import data for 18 industrialized countries. The gravity equation is estimated with country and industry fixed effects in regressions pooled by country and sectors, and with bilateral fixed effects in sectoral regressions. First, they find evidence of a convex link between exchange rate volatility and trade such that the sales per exporting firm and the number of exporting firms grow as volatility diminishes. This relation is represented in the model by the combination of the euro dummy and a volatility term measured in two different ways as the annual variance of the weekly nominal exchange rate return and as Absolute Forward Premium, a measure based on forward rates. Moreover, in addition to GDP the authors use gross value added by sectors to measure country size. The euro effect on trade with both

[9] The analysis at sector level is based on nine one-digit SITC sectors.

EMU members and third countries is positive and significant even if the magnitude of the coefficients varies according to both the model specification and the volatility term used in the regression. A possible explanation for the lack of trade diversion is that the common currency has boosted the demand of inputs used to produce exported goods fostering imports from non-euro area countries. Sectoral estimates show that the euro effect is larger for sectors characterized by imperfect competition and increasing returns to scale. Also De Nardis et al. (2008) find that the euro effects mainly concern sectors marked by increasing return to scale, imperfect competition and product differentiation. They study the euro trade effects across industries for EMU members in a heterogeneous firm model. Considering trade a dynamic process, they estimate the gravity equation with country and year dummies using the System GMM estimator of Blundell and Bond for a sample of 23 developed countries during the years 1988-2004. The use of this estimator in the gravity framework is unusual but it is justified in order to deal with a short panel and the persistence of bilateral exports. The effect of the common currency is explored also at country/sector level to underline the presence of firm-behaviour heterogeneity, i.e. the fact that in each country there are more and less productive firms that have been differently affected by the euro. Also in this case, the authors find that the effects of the common currency are concentrated on industries characterized by product differentiation. Moreover, the number of sectors positively affected by the euro is larger in small and medium-sized European economies and in Germany.

Other recent empirical papers on the euro trade effects are based on either aggregate estimates or firm level data. Silva and Tenreyro (2010) consider the main advantages and disadvantages of sharing a common currency. They empirically test one of the most important benefit of a currency union, the increase in trade flows induced by the elimination of conversion costs and the greater price transparency. The gravity equation is estimated with time-varying country dummies through a differences-in-differences technique in order to address the selection bias, i.e. the fact that currency unions are not randomly formed. Following their 2006 paper (Silva and Tenreyro (2006)), the model is estimated using the Poisson pseudo-maximum likelihood estimator (PPML) that allows to properly control for heteroskedasticity and zeros in the log-linear gravity equation. Estimates for a sample of 22 OECD countries in the years 1993-2007 show that the effect of the euro on trade is close to zero. Moreover, trade between the original euro countries was stronger than trade with non EMU members also before the adoption of the common currency. Gómez-Herrera and Baleix (2012) estimate three main specifications of the gravity equation for a heterogeneous sample of 80 countries for the period 1967-2009. They add to the baseline specification a model with the level and the volatility of the real exchange rate and dummies to capture Regional Trade Agreement (RTA) and EMU effects. These different specifications are estimated using pair, country and time fixed effects. The common currency has boosted trade in the euro area determining an additional positive effect with respect to the elimination of exchange rate volatility. Moreover, the euro effect varies across member countries. Differently from previous analyses, they find evidence of trade diversion. Some recent papers study aggregate trade effects of the common currency using panel cointegration techniques in the gravity framework. Camarero et al. (2014) estimate the euro effects for a sample of 26 OECD countries in the years 1967-2008. The gravity equation is specified as usual but in addition to time and pair fixed effects, the authors consider a country pair specific time trend to capture individual time changes with respect to other partners in the panel. The paper presents two main innovations: first, it takes into account the critique proposed by Baldwin and Taglioni (2007) in order to choose the right model specification; second, it estimates the gravity equation in a non-stationary panel framework controlling for endogeneity, cross-section dependence and structural breaks. The authors find evidence of dependence between the individuals in the panel using unit root tests based on factor models[10]. Moreover, for the first time in the related literature this paper accounts for structural breaks, i.e. changes in time of the cointegrating vector and the deterministic components. The existence of cointegration is tested through a new generation of tests allowing for both dependence and structural breaks. Therefore, since the long run relationship between trade and the gravity variables is characterized by cross-section dependence and non-stationary common factors, the model is

[10]This kind of tests assumes that the process is driven by a group of common factors between which it is possible to distinguish idiosyncratic and common components.

estimated using the continuously updated estimators (CUP) proposed by Bai, Kao and Ng (2009). The high and positive euro coefficients found by previous analyses disappear showing that the trade enhancing effect relates to the full set of European integration policies while the common currency acts as a residual factor. The same technique is used in a 2012 paper (Camarero et al. (2012)), in order to assess the long-run effects of the common currency on both EMU members and third countries. The creation of the EMU has caused a gradual but small increase in trade between European countries reinforcing the idea that the integration process should be considered as a series of policy changes. The positive effect is stronger for Austria, Belgium-Luxembourg and Italy. Moreover, there is no evidence of trade diversion.

The last part of this literature review concerns papers that study the euro trade effects using firm level data. Berthou and Fontagné (2008) use a French firm level dataset for the years 1998-2003 to assess the impact of the common currency on trade margins. Differently from product level dataset, firm level data allows to construct export margins with a variety dimension: the extensive margin is defined as the number of varieties exported in each destination country while the intensive margin measures the average value of exports by variety. Through a differences-in-differences technique the authors study the effect of the euro on French exports toward Eurozone partners with respect to French flows to extra-euro area countries. The gravity equation is estimated with industry-pair and time fixed effects to investigate both the euro adoption in 1999 and the introduction of banknotes in 2002. There is a positive euro effect on the extensive margin that goes behind the elimination of exchange rate volatility, while the effect on the intensive margin is not significant. In order to isolate the euro effects from other European integration policies, they restrict the control group to the original 15 European Union members finding that the euro has produced similar effect for Eurozone countries and the three outsiders (Uk, Sweden and Denmark). Moreover, restricting the analysis to EU15 countries means to consider economies with a similar evolution of the Multilateral Resistance index. It should be properly controlled for with time varying country fixed effects but this is impossible in a dataset with only one exporter. Vicarelli and Pappalardo (2012) study the euro effects on Italian manufacturing firms using firm level data for the period 1996-2004.

The common currency can affect both variable and fixed-entry costs and the adjustment varies according to the prevailing effect. Variable trade costs mainly influence the value of exports while fixed-entry costs affect the number of exporters. According to this distinction, they define the intensive margin as the average value of exports while the extensive one is the number of products exported by each firm in each destination country. The gravity equation is estimated with a differences-in-differences technique using fixed effects. Estimation results show that the positive aggregate euro effect is channeled by the intensive margin while the coefficient related to the extensive one is not significant.

2 Stylized facts

A look at WIOD trade data shows that intermediate exports account for 54 per cent of world sales[11]. As figure 1 in the Appendix shows, intermediate and final exports have been characterized by a similar increasing pattern, following the general rise of total trade; this growth has been particularly strong from 2003 on and it broke with the 2008 financial crisis. This evolution holds for Eurozone trade as well (Figure 2). For the original 12 Eurozone countries (EZ12; See the Appendix for a description of the acronyms used in the paper), intermediate exports explain 60 per cent of their total sales. The majority of Eurozone intermediate sales toward world partners concerns goods (75 per cent) while services have a minor role. However, the impact of intermediate exports of services on total Eurozone sales is three time higher than that of final services. Actually trade in parts and components is of main importance for Eurozone foreign exports: intermediate sales from euro area countries account for almost 20 per cent of world intermediate exports and for 10 per cent of world total trade (the share of Eurozone final sales on world total exports is 7 per cent).

Figures 3 and 4 show merchandise exports of both final and intermediate goods in Europe considering intra-euro area exports, trade between EZ12 and the three Eurozone outsiders (EU3) and trade between EZ12 and countries that joined the Union in 2004 and 2007 (EUpost2004). To isolate the physical introduction of the common

[11] In this section, I consider average shares for the period 1995-2009.

currency, 2002 is considered as the base year. First of all, intra-euro area exports have increased after 2002. Consistently with Flam and Nordström (2006b), the rise has been greater for trade in parts and components. Second, the choice to consider trade between EZ12 and EU3 nations allows to compare countries that share similar characteristics apart from the common currency; bilateral merchandise exports for both final and intermediate goods have increased from 2002 but less than intra-euro area flows. This difference seems to suggest that the higher intra-euro area trade growth can be directly ascribed to the common currency. The third interesting pattern relates to trade relations between EZ12 and European countries that became EU members after 2004. Flows from and toward EUpost2004 countries have grown more than intra-euro area trade relations. Therefore, there is no sign of trade diversion. This evolution provides an evidence of the deep and increasing integration inside Factory Europe. In line with theoretical predictions, data show that there has been a great rise in trade since 2002 that has mainly affected intermediate flows. This could be explained by the fact that the euro has increased the demand of production inputs from extra-euro area countries; moreover, the common currency has facilitated to relocate production. Eurozone countries trade many production inputs with their Central Eastern European partners (CEE) mainly because they have offshored production stages there taking advantages of lower production costs. Obviously, the dynamic of both intermediate and final merchandise exports toward and from EUpost2004 countries has also been affected by the EU enlargements to the East in 2004 and in 2007. Actually, the integration process dates back to the Europe Agreements signed between EU members and Central Eastern European countries to prepare for future membership. Trade liberalization has been one of the main step toward a closer economic and political cooperation.

Figures 5 and 6 concern services trade. The symmetric evolution of inward and outward flows by pair shown by merchandise sales disappears when considering services. Intra-euro area services exports have grown from 2002 but to a lesser extent with respect to flows with other EU countries. EZ12 imports of services have increased more than exports: there has been a large rise in final service purchases from EU3 while imports of intermediate services from both EU3 and EUpost2004 have shown a similar increasing pattern. The picture for services is less clear than it is for goods making difficult to detect a clear direction in the evolution of European flows of services from 2002; this seems to suggest that they are less regionalized than trade.

3 Data and empirical strategy

In line with the previous literature, in this paper the euro trade effects are estimated through the gravity equation. The traditional specification of the model takes the following log-linearized form:

$$\begin{aligned} lnX_{ijt} = ln\beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 lnDIST_{ij} + \beta_4 dEURO_{ijt} + \beta_5 dEU_{ijt} + \\ + \beta_6 dCL_{ij} + \beta_7 dCont_{ij} + ln\epsilon_{ijt} \end{aligned} \tag{1}$$

Bilateral trade flows (X_{ijt}) are determined[12] by the size of both the exporting and the importing countries (GDP_{it} and GDP_{jt}), the distance between them ($DIST_{ij}$) and some dummies related to the sharing of a common official language (dCL_{ij}), a common border ($dCont_{ij}$) and some integration agreements (dEU_{ijt} and $dEURO_{ijt}$). GDPs reflect expenditure in the importing country and supply in the exporting nation. Since Tinbergen's formulation, distance is interpreted as a rough measure of transportation or information costs. Other time-invariant variables, such as adjacency and common language, are introduced to augment the gravity equation with factors that could help explaining trade relations. The European Union dummy controls for the European Union membership: it is 1 when the two countries in the pair belong to the European Union. The main variable of interest is the euro dummy that is 1 when both countries in the pair share the euro in a specific year. This dummy takes the value 1 from 2002: the Eurozone was a Monetary Union during the period 1999-2001 while it became a Monetary and Currency Union in January 2002 with the introduc-

[12] Jan Tienbergen in 1962 used the gravity equation *"to determine the normal or standard pattern of international trade that would prevail in the absence of trade impediments"* finding a clear direction of causality from income and distance to trade.

tion of banknotes and coins. Moreover, since the empirical analysis goes from 1995 to 2009, the choice to consider the euro dummy from 2002 instead of 1999 gives a symmetrical sample period before and after the euro physical introduction. However, as a robustness check, the model is also estimated with a euro dummy from 1999 (See Section 5). In some specifications, also trade diversion effects are tested through two additional dummies, $dINOUT_{ijt}$ and $dOUTIN_{ijt}$: INOUT is 1 when in a specific year, the exporter is a Eurozone member and the importer is an extra-euro area country while OUTIN is the opposite. Moreover, to focus on connections between EZ12 countries and others EU economies, in some regressions two European trade diversion dummies are added to the baseline specification: $dEINOUT_{ijt}$ that is 1 when the flow is between one of the 12 original EMU members and an importer that is in the European Union but non in the Eurozone and $dEOUTIN_{ijt}$ that considers the opposite situation. European trade diversion dummies take the value 1 from 2002 for every pair of countries. ϵ_{ijt} is a normally distributed error term.

One of the feature that has made the gravity equation the workhorse of international trade is that it can be easily estimated through OLS. However, it is widely recognized that when estimating equation (1) with OLS, it faces some issues such as endogeneity (Baier and Bergstrand (2007)) and heteroskedasticity and zeros (Silva and Tenreyro (2006)). Moreover, the prevailing literature has faced the so-called gold medal mistake (Baldwin and Taglioni (2007)), i.e. the Anderson and van Wincoop Multilateral Resistance (MR) terms have been wrongly specified[13]. The MR terms are country-specific and with panel data, they also vary over time: they have to be estimated with time-varying country fixed effects[14]. Baldwin and Taglioni (2007) consider some of the most common mistakes in the literature in order to find the best gravity estimator. They observe three main problems called gold, silver and bronze medal mistakes. The gold mistake occurs when the MR terms are ignored, the silver mistake refers to the wrong average of bilateral trade in the gravity equation[15] while the bronze mis-

[13]See the Appendix for a brief review of the gravity equation.

[14]Other techniques have been used to account for the MR terms: ratio-type estimators, double-demeaning and methods to approximate the two terms such as the first-order log linear Taylor series expansion used by Baier and Bergstrand (2009). See Head and Mayer (2013) for a review.

[15]The gravity equation is a modified expenditure function and it has to be estimated using the average of the logs of uni-directional trade flows rather than the log of the average.

take is linked to the incorrect deflation of bilateral trade flows. Nowadays the gravity model is usually estimated employing theory-consistent estimation techniques that allow to properly account for the MR terms; however, one of the downside of this theory-consistent specification is that as an increasing level of country and time heterogeneity is admitted into the model, the "Rose effect" becomes either negative (Baldwin and Taglioni (2007)) or statistically insignificant (Stack (2009)). Moreover, some membership dummies cannot be estimated at all because of collinearity with fixed effects (Hornok (2011)).

In this paper the gravity equation is estimated using two different fixed effect specifications[16]: one with time and pair dummies and another based on time varying exporter and importer fixed effects together with pair dummies. The first specification takes the following form:

$$lnX_{ijt} = ln\beta_0 + \beta_1 lnGDP_{it} + \beta_2 lnGDP_{jt} + \beta_3 dEURO_{ijt} + \beta_4 dEU_{ijt} + \delta_t + \sigma_{ij} + ln\epsilon_{ijt} \tag{2}$$

It uses time dummies to capture cyclical components and pair fixed effects to control for endogeneity and selection bias. Pair dummies eliminate the cross-section correlation between the euro membership and the dependent variable reducing the bias caused by the omission of the MR terms. However, the effect of time-invariant variables such as distance cannot be estimated. This technique represents a common way to estimate the gravity equation[17] but as said before, this econometric choice faces the gold medal mistake. The specification with country-time and pair fixed effects is now considered a recommended common practice (Head and Mayer (2013)): with respect to pair dummies, time-varying country fixed effects remove also the time series correlation linked to the omission of the MR terms. The equation becomes:

$$lnX_{ijt} = ln\beta_0 + \beta_1 dEURO_{ijt} + \beta_2 dEU_{ijt} + \theta_{it} + \theta_{jt} + \sigma_{ij} + ln\epsilon_{ijt} \tag{3}$$

[16]The Hausman test suggests to use fixed rather than random effects.

[17]Micco et al. (2003) and Flam and Nordström (2006b) for instance, estimate the gravity equation with time and pair fixed effects.

The main regressions are based on seven different equations: two for intermediate exports (for both goods[18] and services) and two for final trade (based on the same distinction). Total intermediate exports, total final sales and total trade (measured as the sum of intermediate and final exports) are considered as well.

When running regressions for sectors[19], the gravity equation is exactly the same as in (1): a single equation is estimated for each one of the 34 sectors using the two fixed effect specifications. For each sector, intermediate, final and total trade flows are considered. A list of sectors is available in the Appendix.

Nominal bilateral export data for both final and intermediate flows are taken from the World Input Output Database (WIOD). This dataset fits with the aim of this paper not only because it distinguishes intermediate and final flows[20] but also because it gives a panel of 15 years (from 1995 to 2009)[21], perfectly covering the phenomenon of interest. WIOD data concern 27 European Union members and 13 other countries in the world[22]. Specifically, this paper uses World Input Output Tables (WIOT) that combine national and international flows of products for final and intermediate use. For each one of the 35 industries, WIOT show how sectoral exports from a country are used by its partners in their industries. The analysis considers unidirectional export flows such that each line in the database refers to a single flow between a pair. The database has been built according to the procedure described in the Appendix. Nominal GDP data come from UNCTAD, data on distance and other time-invariant variables are from the CEPII dataset.

[18]Goods include both commodities and manufacturing products.

[19]WIOD contains data for 35 industries based on the CPA and NACE classifications. When running sectoral estimates I exclude the last sector "Private Households with Employed Persons" because the majority of observations is zero. Therefore, sectoral estimates are based on 34 sectors, 17 goods and 17 services.

[20]Value chains can also be studied through the OCED-WTO TIVA dataset that allows to identify the sources of the value that is added in producing goods and services for export. It combines OECD input-output tables and bilateral trade data but it only has observations for some years.

[21]From November 2013, WIOD covers a larger period (1995-2011).

[22]Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia Republic, Slovenia, Spain, Sweden, United Kingdom, Canada, United States, China, India, Japan, South Korea, Australia, Brazil, Mexico, Taiwan, Turkey, Indonesia and Russia.

4 Empirical outcomes

4.1 Aggregate estimates

As a first step, the euro trade effects have been estimated for a small sample of advanced economies[23] in order to compare the results with the previous literature[24]. Aggregate estimates for 19 advanced countries for the years 1995-2009 are presented in tables 4, 5 and 6 in the Appendix. The gravity equation explains well all types of flows with a R-squared ranging from 60 to 90 per cent[25].

POLS results for intermediate, final and total exports are reported in order to check the sign and the magnitude of the standard gravity variables: all the coefficients have the expected sign and lie in the usual range; some important differences between final and intermediate flows emerge. Final exports are more sensitive to the size of both the importing and the exporting markets. On the contrary, the negative impact of distance is greater for intermediate flows; this explains why supply chain trade is a regional process in which production networks are mainly located in low wage nations that are close to headquarter economies. In this system distance is mainly linked to the *opportunity cost of time* (Baldwin (2012)) since production networks require direct interactions. The effect of contiguity is positive and significant only for final exports while common language has a positive effect on every dependent variable, with a higher magnitude for intermediate exports. The euro has a negative effect on intra-area exports: this result is far from previous analyses that find a strong positive euro trade effect in POLS regressions. However, previous studies related to the present paper do not go beyond 2006. Actually, the choice of the years has some influence on the difference between these results and the existing literature: estimating a euro dummy for each year, euro coefficients become negative in more recent years, those of the global crises[26] suggesting that the euro dummy is capturing some effects not related to the common currency; as shown later, this negative effect

[23] Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Australia, Canada, Denmark, United Kingdom, Japan, Sweden and United States.

[24] See Section 1 for a review.

[25] In specifications with time and pair fixed effects, the R-squared is lower when considering goods and services separately.

[26] The euro coefficients are negative and marginally significant in 2005 and 2006 while they become negative and highly significant from 2007 to 2009. Estimates are not reported.

disappears when adding time dummies[27]. The choice of the years can also explain the EU[28] coefficient: it is positive and significant only for final exports.

In estimations with time and pair fixed effects, the results are in line with the prevailing literature[29]. The euro dummy is positive and significant with a coefficient of 0.09 for total sales. The trade enhancing effect is larger for intermediate than for final exports: the euro increases intra-area intermediate sales by 11 per cent[30] and final exports by 7 per cent. This is consistent with both the theoretical prediction and the pattern depicted in the descriptive analysis, i.e. intra-Eurozone exports, especially trade in parts and components, have increased thanks to the euro. The results are less clear when distinguishing between services and goods. Differently from POLS, with time and pair dummies only the importer GDP has a larger effect on final exports: the size of the importing country matters since final exports have to reach a larger share of final consumers with respect to inputs that are more specialized. When the MR terms are properly considered by adding country-time and pair fixed effects, the euro coefficients are positive and the effect is again larger for intermediate goods. Moreover, the magnitude of the euro coefficients is higher with respect to the specification with time and pair fixed effects.

As a second step, I consider a larger sample of 40 countries[31] for the same period (1995-2009). As tables 7 and 8 show, including emerging and developing countries deeply changes estimation results. When the model is estimated with time and pair fixed effects, euro coefficients become negative for intermediate and final exports (both total and merchandise sales) while they are insignificant for services. The negative effect is larger for final goods. On the contrary, the EU dummy, that now takes into account the 2004 and 2007 enlargements, has positive coefficients, with a stronger effect on exports of parts and components and in particular, on intermediate merchandise sales. The size of the importing market affects more final than interme-

[27]The global crisis has deeply affected trade. In order to exclude that this change has an impact on the estimation results, the main regressions have also been run excluding the last two years (2008 and 2009). However, the results do not change.

[28]The EU dummy in the small sample considers pairs of countries that are members of the European Union without taking into account new entrances.

[29]In this sample, the EU dummy is absorbed by the fixed effects since it is time-invariant.

[30]The effect in per cent is calculated as $(e^{coefficient\ value} - 1) * 100$.

[31]The 40 countries are those in WIOD.

diate exports also in the large sample. When estimating the gravity equation for the large sample with country-time and pair fixed effects however, the euro trade effect disappears; EU dummy coefficients are insignificant as well. This seems to confirm that the specification with country-time and pair dummies has a limited ability in identifying membership effects (Hornok (2011)).

Three main reasons could explain these results: the countries, the years and the dataset. Actually, the last two causes can be excluded: as seen before, the choice of the years affects euro coefficients only in POLS regressions; moreover, the choice to use different data relative to previous analyses (all based on traditional statistics) does not play a key role: indeed, also when the model is estimated with COMTRADE data (see Section 5), the results are affected by the enlargement of the sample. Therefore, the discrepancy between the euro coefficients is mainly due to the country choice. This is consistent with Frankel (2010); he analyzes tree main causes that can explain the difference between the strong common currency effect found by Rose when considering past monetary unions and the more reasonable coefficients related to the EMU: the euro is a young phenomenon so it needs time to show its effects; the results could also depend on the size of the countries in the dataset giving bigger effects for smaller economies; moreover, endogeneity is a serious issue in this kind of analyses. The author estimates the model adding several observations (countries and years) to the baseline specification and finds that neither the years nor the country size explain Rose results. Through a natural experiment[32] also endogeneity is excluded to be one of the causes of the high currency union effect found by Rose. Rather the sample size affects the significance and the sign of the euro coefficients.

How does sample size affect the euro dummy? A possible interpretation for this empirical finding is to link it to the prediction that the euro boosts both vertical specialization and trade with third countries. Recent literature on supply chain trade (Baldwin and Lopez-Gonzalez (2013), Miroudot et al. (2009)) confirms the importance of production fragmentation within Europe and the emergence of a regional value

[32]To properly address the endogeneity bias, Frankel proposes a natural experiment in which he considers the EMU effects on trade with countries in the Communaute Financière d'Afrique (CFA) affected by the franc's conversion to the euro. The effect is positive and significant also when considering trade with these countries so self-selection is not the main cause of Rose's results.

chain. This process has led to a strong interdependence among European Union countries since they rely on each other in both the production and the purchase of intermediate inputs used to produce final goods. Trade has to be considered in this multilateral system of production and trade relations: what a Eurozone country buys from one of its partner abroad could be something that either itself or another Eurozone country is producing there. The presence of such an interconnection between countries prevents the bilateral euro dummy from capturing the common currency effects in the large sample. Some additional estimates have been run to verify whether the differences in the euro dummy coefficients between the two samples are related to a missing variable, something that is not captured because Eurozone membership correlates with it when enlarging the sample.

4.2 Additional estimates

In order to give some evidence of a missing variable in the large sample, this paper tests what happens when adding to the small sample, European countries with more than 3 million people[33], i.e. medium and big Central Eastern EU countries that act as factory economies in the European supply chain[34]. The inclusion of these countries substantially affects the results (table 9); when the gravity equation is estimated with time and pair fixed effects, the euro dummy becomes negative for total and final exports while it is insignificant for intermediate sales. In country-time and pair fixed effect regressions, the enlargement of the sample gives again insignificant coefficients. Therefore, the positive euro trade effect found for some advanced countries turns to be either negative or not significant when considering CEE countries that are deeply involved in the densification of the European production network, sharing strong links with euro area countries along the value chain. This supports the thesis that the euro dummy is capturing a missing variable related to the increasing interdependence in Factory Europe. On the contrary, the EU dummy that accounts for trade relations between Eurozone economies and countries that joined the EU in

[33]Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Romania and Slovakia are added to the advanced sample. Luxembourg is excluded.

[34]Baldwin and Lopez-Gonzalez (2013) identify two main groups of countries inside Factory Europe: headquarter economies that arrange the production chain and factory economies that provide the labor.

2004 and 2007 has positive coefficients in both fixed effect specifications confirming that the admission of some CEE countries has positively affected trade relations in the European Union.

Also sector estimates can help studying the importance of supply chain trade for Eurozone countries and how it is changing trade relations. For this purpose, I estimate the gravity equation for both the small and the large sample considering intermediate, final and total exports for 34 sectors. In regressions with time and pair dummies, the positive euro effect for the small sample mainly emerges when considering intermediate exports rather than final sales. As shown in table 11 this happens for electrical and optical equipment and transport equipment. On the contrary, for leather and footwear, a classical final good sector, the positive euro effect arises only when considering its final usage. Euro coefficients for services are difficult to interpret; for instance, negative euro coefficients concern non-traded services like construction. However, some results are easier to understand because positive euro coefficients refer to either services needed to coordinate the dispersed production or affected by a large liberalization during the last years, such as post and telecommunication, other supporting and auxiliary transport activities and financial intermediation. When using country-time and pair fixed effects, the great majority of coefficients related to goods are not statistically significant while the euro effect is still positive for some services such as financial intermediation.

Enlarging the sample affects the estimation results also at sector level (table 12). Estimates with time and pair fixed effects show that negative euro dummy coefficients mainly relate to sectors characterized by both big supply chain trade flows and a high degree of vertical specialization: textiles and related products, paper and related products, rubber and plastics, basic metals and non-metallic products, machinery, electrical and optical equipment, transport equipment and manufacturing nec. For the majority of industries, these results especially hold when considering their intermediate usage. The euro dummy for services is insignificant with few exceptions. Surprisingly, the euro effect is still positive for other supporting and auxiliary transport activities and financial intermediation showing that they are not affected by the sample enlargement. As usual, in regressions with country-time and pair fixed effects, the majority of coefficients for both goods and services loses significance apart from some interesting exceptions. The euro coefficient for transport equipment, a sector characterized by supply chain flows, is still negative while that related to leather and footwear, a typical consumption sector, is positive and significant as it is for the small sample. Sectoral estimates provide evidence for the argument that the euro is only a part of the story and that the missing part can be explained by something that relates to the dispersion of production stages: the switch from positive to negative mainly concerns sectors deeply involved in supply chain trade while the effect is less clear for services probably because they are less regionalized.

Another supporting evidence comes from the analysis of trade relations with third countries. To control for trade diversion in the large sample, the gravity equation is augmented with the dummies INOUT and OUTIN that account for trade flows between Eurozone and extra-euro area countries (table 13). In regressions with time and pair fixed effects, estimation results show that the euro has negatively affected exports from Eurozone members to third countries; on the contrary, OUTIN coefficients are not statistically significant. The euro has reduced exports from EZ12 while it has produced limited effects on EZ12 imports from the rest of the world. This effect cannot be tested with country-time dummies because trade diversion variables are collinear with the fixed effects. An attempt to test the increasing interdependence within Factory Europe is to introduce two European trade diversion dummies (EINOUT and EOUTIN)[35]. As said before, these dummies take the value 1 from 2002 so they allow to assess directly how the euro has influenced the development of supply chain trade in Europe. The EURO dummy is still negative confirming the intra area trade reduction found for the large sample. From the other side, EU coefficients are still positive and higher for intermediate flows. EINOUT has negative coefficients for every dependent variable suggesting that from 2002, Eurozone exports to other EU countries have diminished with a worse impact on final goods. On the contrary, estimations related to EOUTIN give positive and statistically significant coefficients: after 2002, exports from EU countries toward the original EMU members have in-

[35]Differently from INOUT and OUTIN, European trade diversion dummies consider only the first 12 original EMU members as IN countries.

creased by 7.6 per cent for intermediate exports and by 10 per cent for final sales. The euro has positively affected Eurozone imports from other European Union countries. This result holds also when considering Central Eastern European countries alone and the coefficients are even higher. Are these flows hiding bilateral trade between Eurozone members that have offshored production processes in nearby European countries? If this is true, the negative euro coefficient could be also justified by the fact that the traditional concepts of trade creation and trade diversion do not hold anymore. The dispersion of production might have reduced intra-area trade because plants move.

5 Robustness check

In order to check the accuracy of WIOD, the main regressions have also been run with COMTRADE data[36]. Except for one case, the results are nearly the same. In regressions with time and pair dummies, the euro trade effect is still positive for advanced countries and negative for the large sample. On the contrary, when using country-time and pair fixed effects the results are mixed: both WIOD and COMTRADE give not statistically significant effects for the large sample while the euro coefficients in the small sample switch from being positive and significant with WIOD data to be negative and insignificant with COMTRADE data. Actually, the latter finding is in line with previous studies based on traditional data: as said before for instance, Baldwin and Taglioni (2007) get a negative euro coefficient when estimating the EMU effects with country-time and pair dummies for a sample of advanced economies; also Stack (2009) finds a loss of significance of coefficients when studying the effects of European regional integration on trade using the same fixed effects specification. The explanation is that when so many dimensions of the panel are controlled for, the effect of interest tends to disappear. Moreover, it seems that the specification with country-time and pair fixed effects is sensitive to even small differences in data.

For a matter of comparison with previous studies, the model has also been estimated

[36]With COMTRADE data, estimation results concern the euro effect on total exports without distinguishing between intermediate and final trade. Moreover, Belgium and Luxembourg are considered as a unique nation (Benelux). Estimates are not reported.

with a euro dummy from 1999, i.e. considering the birth of the European Monetary Union with the accession of the first 11 countries. When using a euro dummy from 1999, the euro trade effects are analogous to those found with a euro dummy from 2002 in every specification and for both samples[37]. The unique difference concerns intermediate exports for which the euro coefficient becomes statistically insignificant in the large sample when estimating the model with time and pair fixed effects.

To control for heteroskedasticity and the presence of zeros, the model has also been estimated using a Poisson pseudo-maximum likelihood estimator (PPML) with the dependent variable in levels and by adding both time and pair and country-time and pair fixed effects (tables 14 and 15). As shown by Silva and Tenreyro (2006), if the errors are heteroskedastic, once they are log-linearized, they will be correlated with the covariates. Moreover, log-linearization is incompatible with zero values in the dependent variable[38]. However, while data are affected by heteroskedasticity[39], zeros do not represent an issue in the present analysis. For sectoral trade data for instance, log-linearization gives a percentage of missing observations lower than 3 per cent for the small sample and close to 8 per cent for the large one[40]. PPML with time and pair fixed effects confirms that the euro trade effect is positive for a sample of advanced countries; on the contrary, it gives insignificant coefficients for the large sample. With country-time and pair dummies the euro trade effect estimated with PPML disappears for intermediate and total flows and becomes negative but only marginally significant for final exports in both samples. In the present paper, similar results only concern the large sample. However, differently from the prevailing literature, also Silva and Tenreyro (2010) find that the euro trade effect is close to zero when estimating the gravity equation using the PPML with time-varying country dummies.

[37]Estimation results are not reported.

[38]Taking the logs means to drop zeros from the dataset.

[39]The modified Wald test for groupwise heteroskedasticity in fixed effects regression models rejects the null of homoskedasticity. In every regression, heteroskedasticity is controlled for with robust standard errors.

[40]The majority of zeros concerns services data.

6 Conclusions

To the best of my knowledge, this paper represents the first attempt to analyze the euro trade effects with data distinguishing between final and intermediate flows. In line with previous findings, it confirms that the euro has positive and significant effects on Eurozone trade when the gravity equation is estimated for a sample of advanced economies; it also shows that the trade enhancing effect is larger for intermediate exports than for final sales. However, when considering a larger sample of 40 countries, the results change giving either negative or insignificant coefficients. As found also by Frankel (2010), estimates are very sensitive to the country choice. The paper provides some evidence that the heterogeneity of the euro effects can be explained by a missing variable related to the increasing relevance of supply chain links between European countries. The sign and the significance of the euro dummy change when adding observations for emerging and developing economies, many of which share strong connections with advanced Eurozone economies along production chains; the inclusion of these countries prevents from clearly identifying the common currency trade effects in both the fixed effect specifications employed in the empirical analysis. This interpretation is based on several elements. For instance, the theoretical framework behind this paper suggests that the cost reduction determined by the common currency affects trade not only for the standard reasons[41], but also because it boosts vertical specialization. Also recent studies on supply chain trade (Baldwin and Lopez-Gonzalez (2013), Miroudot et al. (2009)) confirm the relevance of production fragmentation in Factory Europe; moreover WIOD data reveals that there has been a significant increase in trade between the first 12 Eurozone countries and those who joined the Union after 2004 and that it has mainly concerned intermediate inputs. The hypothesis of a missing variable related to supply chain interdependence within Factory Europe is also supported by some empirical evidences: first, positive euro coefficients become either negative or not statistically significant when Central Eastern European countries with more than three million people are added to the advanced sample; sector estimates show that the switch in the euro coefficients mainly

[41] See for instance Silva and Tenreyro (2010).

affects sectors deeply involved in supply chain flows; finally, trade diversion estimates reveal that the euro has positively affected exports from other European Union countries toward Eurozone members. The attempt of capturing multilateral interactions between countries in the gravity model through the inclusion of time-varying exporter and importer fixed effects does not give straightforward results. Therefore, the traditional specification of the gravity equation seems to have a limited ability in explaining the effect of the common currency on trade in presence of fragmentation, also when theory-consistent estimation techniques are employed. Countries are highly reliant on each other and a way to properly control for interdependence should be found.

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A Appendix

The gravity equation

The effect that the introduction of a common currency causes on bilateral trade is usually estimated through the gravity model. In its naive specification, the equation states that bilateral trade positively depends on the product of the two partners' GDP while it is negatively affected by the distance between them. This version of the gravity equation has yielded to biased estimates since it has been employed empirically for years without any theoretical foundations. On the contrary, today the gravity equation can count on a large number of theoretical derivations[42]. The theory behind the gravity model is simple: it is an expenditure function with a market-clearing condition imposed. What the importer j buys from the exporter i is a share of its total expenditures; using a CES demand function, this means that:

$$X_{ij} = \pi_{ij} X_j \tag{4}$$

where the expenditure share is assumed to depend only on relative prices, $\pi_{ij} = (\frac{p_{ij}}{P_j})^{1-\sigma}$, P_j is the CES price index and using the iceberg form, $p_{ij} = p_i \tau_{ij}$. To get total bilateral exports, the expenditure share is multiplied by the total number of varieties that the exporter sales (n_i):

$$X_{ij} = n_i (\frac{p_i \tau_{ij}}{P_j})^{1-\sigma} X_j \tag{5}$$

Assuming that markets clear, the sum of exporter's sales to all destinations (including itself) equals the value of its production: $Y_i = \sum_j X_{ij} \rightarrow Y_i = n_i p_i^{1-\sigma} \sum_j \frac{\tau_{ij}^{1-\sigma}}{P_j^{1-\sigma}} X_j$. Solving for $n_i p_i^{1-\sigma}$:

$$n_i p_i^{1-\sigma} = \frac{Y_i}{\Omega_i}; \qquad \Omega_i = \sum_k \frac{\tau_{ik}^{1-\sigma}}{P_k^{1-\sigma}} X_k = \mathit{multilateral\ resistance} \tag{6}$$

[42] For a review, see Head and Mayer (2013).

The term $\frac{\tau_{ik}^{1-\sigma}}{P_k^{1-\sigma}}$ in Ω_i measures the relative access to individual markets. A micro-founded gravity equation is obtained substituting (6) into (5):

$$X_{ij} = \tau_{ij}^{1-\sigma}\left(\frac{Y_i X_j}{\Omega_i P_j^{1-\sigma}}\right) \tag{7}$$

Bilateral trade depends on the value of both exporter's production and importer's expenditure, the two multilateral resistance terms and trade costs. MR terms identify trade costs in a multilateral dimension: trade flows between two countries are influenced not only by bilateral trade obstacles (τ_{ij}) but also by the relative weight of them with respect to all other countries (the suffix k in Ω_i). Anderson and van Wincoop (2003) derive a symmetric gravity equation: they assume that trade is balanced and that trade costs are symmetric; this means that the two MR terms are equal for all nations but this is valid only in cross-section. On the contrary, with panel data the MR terms are country-specific and have a time dimension.

The baseline model derived so far is usually augmented with other variables that help explaining bilateral trade, such as the euro membership.

The dataset

Bilateral export data in aggregate estimates are the results of the following computation:

$\sum_{z=1}^{17} x_{ij} =$ *merchandise trade* (for both final and intermediate trade flows)

$\sum_{z=18}^{35} x_{ij} =$ *trade in services* (for both final and intermediate trade flows)

where x_{ij} is export from country i to country j.

There are seven columns in the aggregate dataset; table 1 shows an example. The sectoral database has been built by summing up what country i exports to country j in each year but for each sector separately. As in the aggregate dataset, there is a distinction between intermediate and final trade flows for each one of the 34 sectors. Table

2 gives an example of the sectoral database. For both aggregate and sector estimates, total trade (i.e. the sum of intermediate and final exports) is also considered.

Table 1: Aggregate dataset, example

	Intermediate Exports			Final Exports			Total Exports
	Goods (lnxim)	Services (lnxis)	Total Intermediate (lnInterm)	Goods (lnxfm)	Services (lnxfs)	Total Final (lnFinal)	(lnTrade)
Pair 1							

Table 2: Sectoral dataset, example

		Intermediate exports	Final exports	Total exports
	Sector 1			
Pair 1	...			
	Sector 35			

Table 3: Acronyms

EZ12	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain
EU3	Sweden, United Kingdom, Denmark
EUpost2004	Cyprus, Czeck Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic, Slovenia, Bulgaria, Romania
CEE	Czeck Republic, Poland, Hungary, Romania, Slovak Republic, Slovenia and Bulgaria

Table 4: POLS regressions, small sample

VARIABLES	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.746***	0.853***	0.778***
	(0.0242)	(0.0260)	(0.0232)
ln(GDP_importer)	0.713***	0.898***	0.769***
	(0.0279)	(0.0298)	(0.0262)
ln(distance)	-0.786***	-0.537***	-0.694***
	(0.0661)	(0.0753)	(0.0647)
Contiguity	0.0291	0.353**	0.140
	(0.129)	(0.141)	(0.124)
Common Language	0.719***	0.599***	0.656***
	(0.0973)	(0.115)	(0.0971)
Euro(2002)	-0.126**	-0.340***	-0.203***
	(0.0494)	(0.0505)	(0.0461)
European Union	-0.0479	0.783***	0.231
	(0.152)	(0.163)	(0.146)
Constant	-5.776***	-12.63***	-7.323***
	(0.848)	(0.914)	(0.807)
Observations	5,130	5,130	5,130
R-squared	0.821	0.834	0.843

Robust s.e. clustered by country pair in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

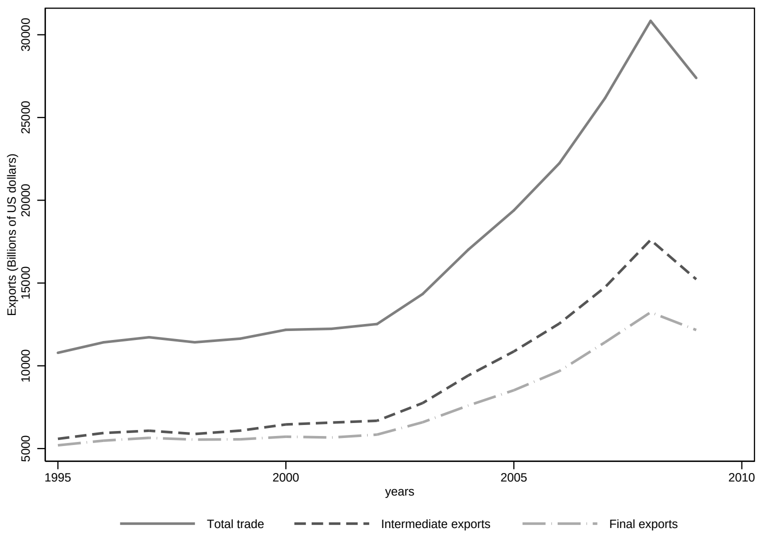

Figure 1: World Trade - Total, Intermediate and Final exports

Source: author's calculations from WIOD

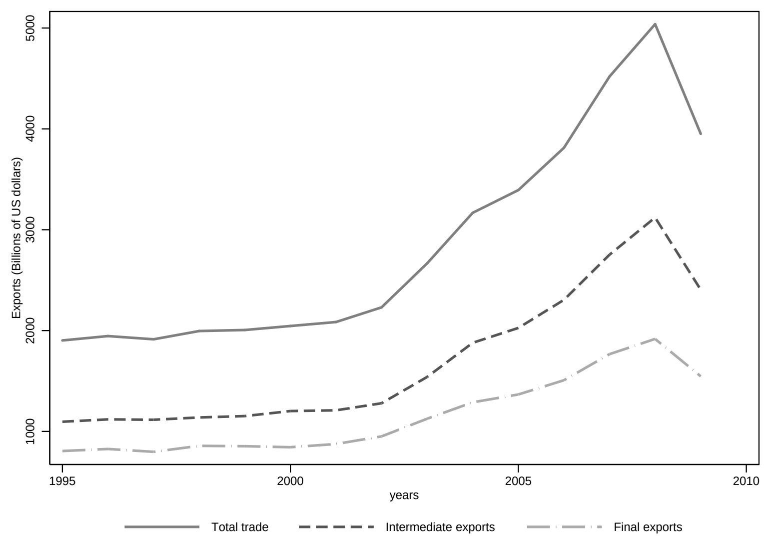

Figure 2: Eurozone Trade - Total, Intermediate and Final exports

Source: author's calculations from WIOD

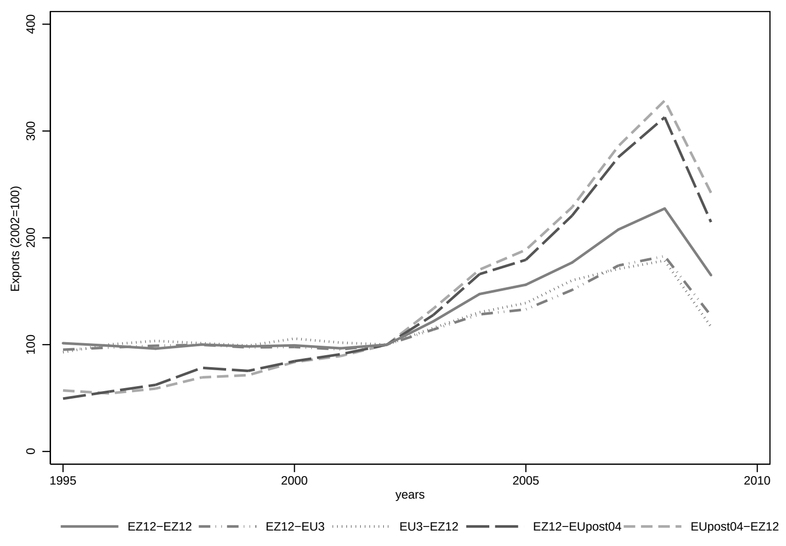

Figure 3: Intermediate manufacturing exports in Europe

Source: author's calculations from WIOD

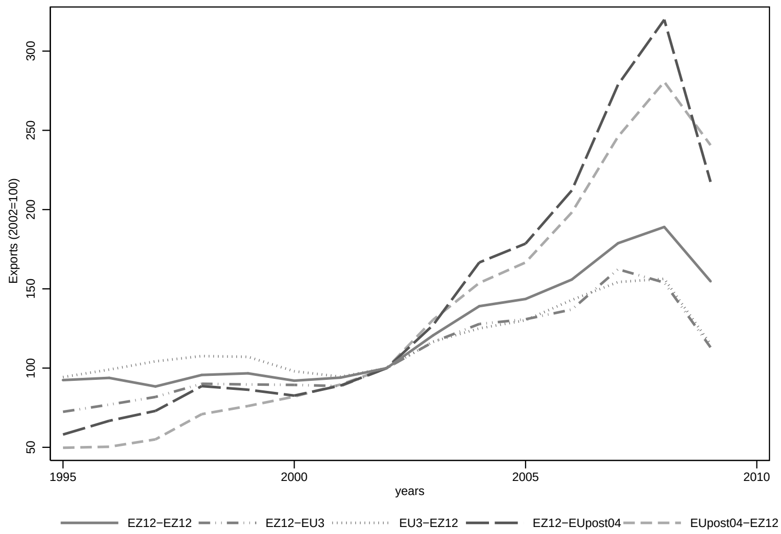

Figure 4: Final manufacturing exports in Europe

Source: author's calculations from WIOD

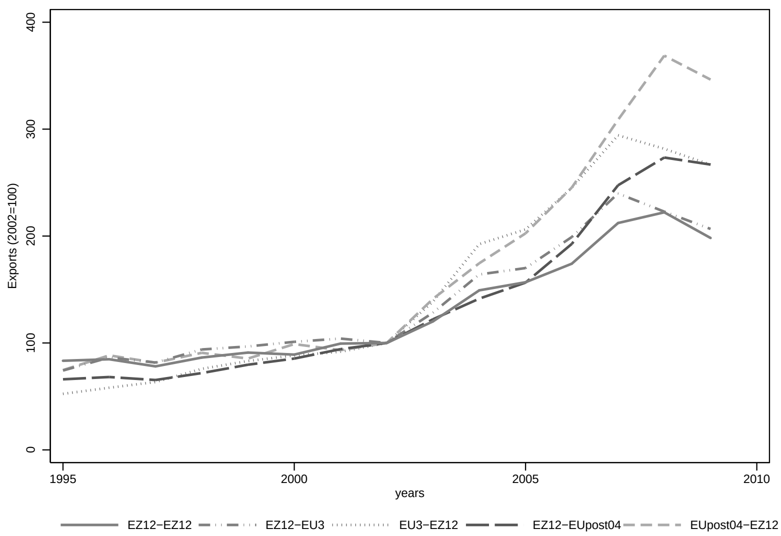

Figure 5: Intermediate services exports in Europe

Source: author's calculations from WIOD

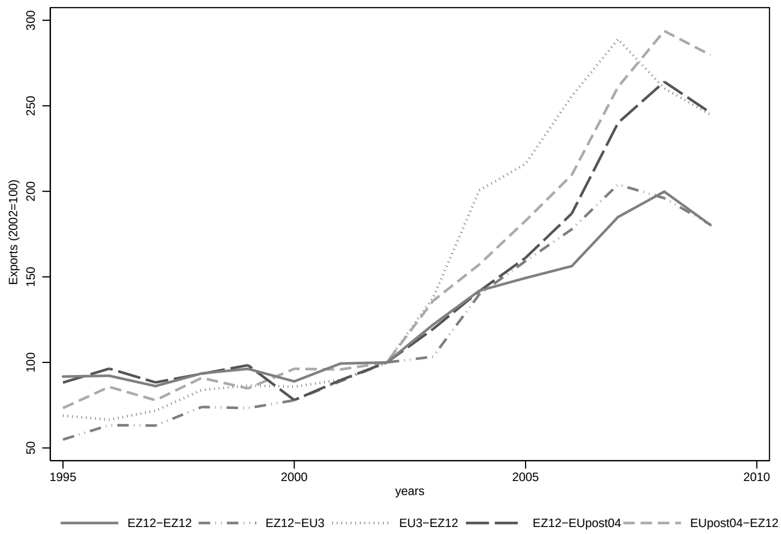

Figure 6: Final services exports in Europe

Source: author's calculations from WIOD

Table 5: Regressions with time and pair fixed effects, small sample

VARIABLES	lnxis	lnxim	lnxfs	lnxfm	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.663***	0.617***	0.757***	0.593***	0.550***	0.431***	0.490***
	(0.146)	(0.129)	(0.145)	(0.135)	(0.0913)	(0.0780)	(0.0797)
ln(GDP_importer)	0.945***	0.669***	0.943***	0.965***	0.779***	0.932***	0.891***
	(0.176)	(0.118)	(0.172)	(0.114)	(0.122)	(0.0826)	(0.105)
Euro(2002)	0.138**	0.0750	0.0851	0.0374	0.110***	0.0706**	0.0884**
	(0.0679)	(0.0467)	(0.0664)	(0.0500)	(0.0404)	(0.0325)	(0.0355)
Constant	-15.22***	-10.13***	-17.78***	-13.95***	-10.18***	-11.15***	-10.34***
	(2.880)	(2.889)	(2.983)	(2.963)	(1.795)	(1.352)	(1.543)
Observations	5,130	5,130	5,130	5,129	5,130	5,130	5,130
R-squared	0.457	0.511	0.432	0.470	0.575	0.590	0.614
Number of ID	342	342	342	342	342	342	342

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6: Regressions with country-time and pair fixed effects, small sample

VARIABLES	lnxis	lnxim	lnxfs	lnxfm	lnInterm	lnFinal	lnTrade
Euro(2002)	0.276**	0.0466	0.309***	-0.0424	0.208***	0.121**	0.170***
	(0.113)	(0.0839)	(0.120)	(0.0829)	(0.0696)	(0.0600)	(0.0631)
Observations	5,130	5,130	5,130	5,129	5,130	5,130	5,130
R-squared	0.960	0.984	0.959	0.985	0.983	0.989	0.986

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 7: Regressions with time and pair fixed effects, large sample

VARIABLES	lnxis	lnxim	lnxfs	lnxfm	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.701***	0.778***	0.840***	0.949***	0.739***	0.860***	0.766***
	(0.0596)	(0.0484)	(0.0629)	(0.0492)	(0.0436)	(0.0457)	(0.0414)
ln(GDP_importer)	0.844***	0.883***	0.862***	1.072***	0.870***	1.042***	0.939***
	(0.0610)	(0.0492)	(0.0600)	(0.0492)	(0.0444)	(0.0437)	(0.0412)
Euro(2002)	0.0169	-0.0989***	-0.0136	-0.0948***	-0.0760***	-0.0965***	-0.0867***
	(0.0468)	(0.0283)	(0.0468)	(0.0290)	(0.0283)	(0.0256)	(0.0252)
European Union	0.0935**	0.107***	0.0307	0.0744**	0.100***	0.0668**	0.0832***
	(0.0431)	(0.0324)	(0.0461)	(0.0346)	(0.0298)	(0.0308)	(0.0277)
Constant	-15.43***	-15.57***	-18.47***	-20.33***	-14.45***	-18.59***	-15.08***
	(1.021)	(0.858)	(1.033)	(0.910)	(0.778)	(0.816)	(0.744)
Observations	23,131	23,393	23,040	23,365	23,393	23,382	23,393
R-squared	0.476	0.496	0.427	0.504	0.596	0.561	0.619
Number of ID	1,551	1,560	1,543	1,560	1,560	1,560	1,560

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 8: Regressions with country-time and pair fixed effects, large sample

VARIABLES	lnxis	lnxim	lnxfs	lnxfm	lnInterm	lnFinal	lnTrade
Euro(2002)	-0.089	0.017	-0.079	0.023	-0.002	0.028	0.0004
	(0.0625)	(0.0448)	(0.0658)	(0.0452)	(0.0391)	(0.0379)	(0.0358)
European Union	0.039	0.015	-0.030	0.021	0.026	0.047	0.053
	(0.0670)	(0.0533)	(0.0733)	(0.0507)	(0.0460)	(0.0470)	(0.0434)
Observations	23,131	23,393	23,040	23,365	23,393	23,382	23,393
R-squared	0.966	0.967	0.958	0.968	0.975	0.974	0.977

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 9: Regressions for a sample of 18 advanced economies and 7 European countries

VARIABLES	lnInterm	lnFinal	lnTrade	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.823***	0.959***	0.845***			
	(0.0639)	(0.0622)	(0.0544)			
ln(GDP_importer)	0.690***	0.851***	0.754***			
	(0.0613)	(0.0581)	(0.0541)			
Euro(2002)	-0.0136	-0.0829***	-0.0392*	0.0501	-0.0556	0.0103
	(0.0270)	(0.0287)	(0.0237)	(0.0438)	(0.0440)	(0.0401)
European Union	0.228***	0.231***	0.232***	0.127*	0.123**	0.132**
	(0.0330)	(0.0363)	(0.0314)	(0.0658)	(0.0552)	(0.0552)
Observations	9,000	9,000	9,000	9,000	9,000	9,000
R-squared	0.738	0.721	0.769	0.985	0.986	0.988
Number of ID	600	600	600			
Time FE	Yes	Yes	Yes	No	No	No
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-time FE	No	No	No	Yes	Yes	Yes

Robust standard errors clustered by country pair in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 10: List of sectors

C1	Agriculture, Hunting, Forestry and Fishing
C2	Mining and Quarrying
C3	Food, Beverages and Tobacco
C4	Textiles and Textile Products
C5	Leather, Leather and Footwear
C6	Wood and Products of Wood and Cork
C7	Pulp, Paper, Paper , Printing and Publishing
C8	Coke, Refined Petroleum and Nuclear Fuel
C9	Chemicals and Chemical Products
C10	Rubber and Plastics
C11	Other Non-Metallic Mineral
C12	Basic Metals and Fabricated Metal
C13	Machinery, Nec
C14	Electrical and Optical Equipment
C15	Transport Equipment
C16	Manufacturing, Nec; Recycling
C17	Electricity, Gas and Water Supply
C18	Construction
C19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
C20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
C21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
C22	Hotels and Restaurants
C23	Inland Transport
C24	Water Transport
C25	Air Transport
C26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
C27	Post and Telecommunications
C28	Financial Intermediation
C29	Real Estate Activities
C30	Renting of M&Eq and Other Business Activities
C31	Public Admin and Defence; Compulsory Social Security
C32	Education
C33	Health and Social Work
C34	Other Community, Social and Personal Services

Table 11: Euro coefficients, small sample

	Time and pair FE			Country-time and pair FE		
Sector	Interm	Final	Total	Interm	Final	Total
C1	0.307***	0.194**	0.256***	-0.070	0.131	-0.054
C2	0.179	-0.080	0.146	0.482**	0.053	0.483**
C3	0.346***	0.206**	0.241***	0.107	0.069	0.123
C4	0.118	0.061	0.026	-0.053	0.060	-0.041
C5	0.188	0.197**	0.195**	-0.303	-0.035	-0.095
C6	0.131	-0.003	0.117	-0.230	0.126	-0.192
C7	0.064	0.075	0.057	-0.069	-0.011	-0.062
C8	-0.021	-0.126	-0.067	-0.058	-0.270	-0.134
C9	0.000	-0.063	-0.055	-0.125	-0.427***	-0.263*
C10	0.077	0.008	0.053	-0.110	-0.197	-0.124
C11	0.056	-0.061	0.051	-0.161	-0.189	-0.168
C12	0.082	0.022	0.068	-0.073	-0.067	-0.081
C13	0.078	0.027	0.048	-0.060	-0.092	-0.079
C14	0.175**	0.080	0.137	-0.085	-0.113	-0.073
C15	0.134*	0.004	0.093	-0.123	-0.222	-0.170
C16	0.035	-0.068	0.002	0.082	0.007	0.078
C17	0.617***	0.579***	0.576***	-0.046	0.061	-0.017
C18	-0.331**	-0.428***	-0.334***	0.141	0.271	0.193
C19	-0.329**	-0.266*	-0.278**	-0.052	-0.093	-0.071
C20	-0.111	-0.060	-0.165	0.301	0.421**	0.362*
C21	-0.308**	-0.205	-0.294**	-0.027	0.185	0.034
C22	-0.253	-0.254	-0.246	0.469	0.249	0.402
C23	0.055	0.038	0.062	0.039	0.064	0.077
C24	0.011	0.085	0.014	0.086	0.265	0.113
C25	0.143	0.185*	0.133	0.003	0.066	0.067
C26	0.217**	0.140	0.202*	-0.028	0.046	-0.006
C27	0.248*	0.274**	0.255**	0.145	0.119	0.128
C28	0.381***	0.474***	0.379***	0.669***	0.741***	0.660***
C29	0.105	0.094	0.054	0.410	0.394	0.417
C30	0.109	0.118	0.109	0.212	0.269	0.222
C31	0.628***	0.314*	0.488***	0.799**	0.389	0.523*
C32	0.384*	0.111	0.320	0.628**	0.541**	0.608**
C33	0.188	0.016	0.111	0.646**	0.589**	0.576**
C34	-0.294**	-0.392***	-0.330***	0.018	0.161	0.051

Table 12: Euro coefficients, large sample

	Time and pair FE			Country-time and pair FE		
Sector	Interm	Final	Total	Interm	Final	Total
C1	0.214***	0.194***	0.214***	0.058	0.138	0.124
C2	0.048	-0.291***	0.027	0.260**	-0.031	0.269**
C3	0.270***	0.173***	0.220***	0.007	0.032	0.057
C4	-0.151***	-0.196***	-0.172***	-0.175**	0.262***	-0.050
C5	-0.093	0.035	0.044	-0.095	0.249**	0.197**
C6	-0.126	-0.289***	-0.075	0.138	0.105	0.173*
C7	-0.146***	-0.146**	-0.150***	-0.050	0.018	-0.053
C8	0.027	-0.007	0.031	0.086	0.060	0.072
C9	-0.032	0.013	0.014	0.012	-0.019	0.051
C10	-0.177***	-0.158***	-0.183***	-0.017	-0.093	-0.027
C11	-0.101**	-0.002	-0.075*	0.052	0.017	0.073
C12	-0.194***	-0.067	-0.170***	0.018	0.081	0.019
C13	-0.221***	-0.211***	-0.204***	0.021	0.057	0.047
C14	-0.215***	-0.174***	-0.188***	0.021	0.014	0.032
C15	-0.111*	-0.254***	-0.179***	-0.152*	-0.147	-0.161*
C16	-0.253***	-0.364***	-0.286***	0.040	0.061	0.034
C17	0.733***	0.737***	0.733***	0.196*	0.331***	0.253**
C18	-0.267***	-0.198**	-0.231***	0.003	0.160	0.052
C19	-0.030	-0.180*	-0.007	-0.083	-0.111	-0.050
C20	-0.054	0.021	-0.049	0.105	0.161*	0.120
C21	-0.075	-0.007	-0.042	-0.091	0.042	-0.042
C22	0.072	-0.084	0.052	0.037	-0.070	0.017
C23	0.271***	0.241***	0.264***	0.008	0.015	0.037
C24	-0.050	-0.012	-0.060	0.073	0.088	0.053
C25	0.110	0.161*	0.111	-0.020	0.026	-0.013
C26	0.178**	0.097	0.161**	-0.092	-0.125	-0.090
C27	0.098	0.049	0.104	0.044	0.098	0.085
C28	0.314***	0.350***	0.316***	0.115	0.221*	0.110
C29	0.055	0.208	0.063	0.348**	0.425***	0.365**
C30	-0.105*	-0.172**	-0.125**	0.008	0.044	0.015
C31	0.200	0.238*	0.276**	0.414***	0.118	0.201
C32	0.036	-0.092	0.033	0.174	0.111	0.121
C33	0.036	-0.052	0.025	0.074	-0.015	0.040
C34	-0.440***	-0.574***	-0.481***	-0.129	-0.131	-0.133

Table 13: Euro trade diversion effects, large sample

VARIABLES	lnInterm	lnFinal	lnTrade	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.711***	0.830***	0.738***	0.717***	0.832***	0.742***
	(0.0431)	(0.0451)	(0.0409)	(0.0442)	(0.0460)	(0.0420)
ln(GDP_importer)	0.875***	1.041***	0.943***	0.890***	1.068***	0.961***
	(0.0445)	(0.0436)	(0.0413)	(0.0452)	(0.0441)	(0.0419)
Euro(2002)	-0.118***	-0.153***	-0.129***	-0.0771***	-0.0977***	-0.0876***
	(0.0325)	(0.0310)	(0.0295)	(0.0286)	(0.0260)	(0.0255)
European Union	0.113***	0.0832***	0.0955***	0.106***	0.0731**	0.0885***
	(0.0296)	(0.0301)	(0.0273)	(0.0306)	(0.0302)	(0.0279)
IN-OUT	-0.138***	-0.155***	-0.138***			
	(0.0327)	(0.0305)	(0.0303)			
OUT-IN	-0.00371	-0.0351	-0.00422			
	(0.0282)	(0.0298)	(0.0262)			
EU IN-OUT				-0.104***	-0.129***	-0.112***
				(0.0355)	(0.0366)	(0.0333)
EU OUT-IN				0.0736**	0.0976**	0.0847**
				(0.0342)	(0.0407)	(0.0332)
Constant	-14.17***	-18.22***	-14.80***	-14.43***	-18.57***	-15.06***
	(0.759)	(0.798)	(0.726)	(0.773)	(0.811)	(0.739)
Observations	23,393	23,382	23,393	23,393	23,382	23,393
R-squared	0.598	0.563	0.621	0.597	0.563	0.620
Number of ID	1,560	1,560	1,560	1,560	1,560	1,560

Robust standard errors in parentheses. Regressions with time and pair fixed effects; *** p<0.01, ** p<0.05, * p<0.1

Table 14: PPML regressions, small sample

VARIABLES	lnInterm	lnFinal	lnTrade	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.568***	0.363***	0.484***			
	(0.0747)	(0.0936)	(0.0761)			
ln(GDP_importer)	0.598***	0.818***	0.692***			
	(0.0822)	(0.0722)	(0.0695)			
Euro(2002)	0.121***	0.109***	0.114***	0.0275	-0.0678*	-0.0206
	(0.0349)	(0.0361)	(0.0317)	(0.0584)	(0.0370)	(0.0396)
Observations	5,130	5,130	5,130	5,130	5,130	5,130
Time FE	Yes	Yes	Yes	No	No	No
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-time FE	No	No	No	Yes	Yes	Yes

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 15: PPML regressions, large sample

VARIABLES	lnInterm	lnFinal	lnTrade	lnInterm	lnFinal	lnTrade
ln(GDP_exporter)	0.806***	0.996***	0.881***			
	(0.0888)	(0.0830)	(0.0842)			
ln(GDP_importer)	0.923***	0.958***	0.947***			
	(0.0839)	(0.0654)	(0.0719)			
Euro(2002)	-0.0339	-0.00870	-0.0247	0.0322	-0.0657*	-0.0103
	(0.0397)	(0.0421)	(0.0375)	(0.0400)	(0.0353)	(0.0316)
European Union	0.107**	0.123***	0.113***	0.178***	0.112*	0.155***
	(0.0433)	(0.0442)	(0.0407)	(0.0494)	(0.0657)	(0.0476)
Observations	23,400	23,400	23,400	23,400	23,400	23,400
Time FE	Yes	Yes	Yes	No	No	No
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-time FE	No	No	No	Yes	Yes	Yes

Robust standard errors clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1