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Economics

HEI Working Paper No: 11/2006

Playing Dominoes in Europe:

An Empirical Analysis of the Domino Theory for the EU, 1962-2004

Roland Rieder
Graduate Institute of International Studies

Abstract

This paper addresses the question whether the domino theory of regionalism is a reasonable explanation for the growth in EU membership over the past forty years. In essence, this theory states that the conclusion of a new regional trade agreement or the deepening of an existing one will induce non-members to join the trade bloc. The empirical analysis proceeds in two stages. First, a gravity analysis shows that the EU was more attractive than EFTA since it triggered a higher degree of trade diversion. In a second step, a discrete choice model is used to assess the importance of variables reflecting domino effects relative to other possible determinants of EU expansion. The findings provide convincing evidence in support of the domino theory.

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Keywords: Regional trade agreements, Western Europe, gravity equation, panel econometrics, qualitative choice models

JEL classification: C23, C25, F15

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*Roland Rieder, Graduate Institute of International Studies, Geneva, Switzerland, rieder0@hei.unige.ch
I thank Richard Baldwin and John Cuddy for valuable advice and guidance. Thanks are also due to Theresa Carpenter, Chantal Moser and Robin Hertz for helpful comments. I gratefully acknowledge the financial support of the Swiss National Science Foundation (SNSF) via NCCR Trade (IP 3).

1. Introduction

Nowhere in the world has the phenomenon of regionalism started earlier than in Europe and it comes to nobody's surprise that the European Union (EU) is not only the most prominent but also the most highly integrated regional trade agreement (RTA) currently existing. Its roots stretch back to the early 1950s when it had its embryonic stage as the European Coal and Steel Community followed by its birth in 1957 with the conclusion of the Treaty of Rome. Starting life as a customs union, its childhood name, European Economic Community (EEC), was soon changed to the shorter European Community (EC) reflecting the fact that its aim was not limited to economic integration.

The EC's teenage years were marked by considerable growth (several countries joined in the 1970s and 80s). With the conclusion of the Single European Act in 1987, the EC finally came of age: it completed the formation of the common market in which goods, services, capital and labour could flow freely. After another name change, it set up a framework for the creation of the Euro and the harmonisation of fiscal and social policies. In the 1990s and 2000s, the EU continued to grow (Eastern enlargement) and get more integrated (conclusion of Schengen, implementation of the common currency).

Undoubtedly a success story of regionalism, the EU[1] has never stopped deepening economic integration and expanding membership. It constitutes, therefore, a unique natural experiment to test the domino theory of regionalism (Baldwin, 1993). This theory states that the conclusion of a new RTA or the deepening of an existing one will induce non-members to join the RTA like falling dominoes. Put differently, RTAs are inherently dynamic and have a tendency to enlarge their membership. The underlying reason is that regionalism has negative economic effects on non-members, which now face discrimination in the markets covered by the RTA[2]

This paper assesses whether empirical evidence supports the domino theory by analysing the EU experience from the 1960s until today. As mentioned above, the process of deepening economic integration among EU members provides a natural experiment for the domino theory. Any natural experiment not only has a treatment group, which is thought to be affected by a particular policy change (in our case the EU member countries), but also a control group, which is not affected by this policy change. Our control group

[1] Throughout the paper, the term EU includes former designations such as EEC and EC.
[2] Section 2 examines the domino theory in more detail.

includes industrial countries outside the EU and we will have a particular look at EFTA members.

The European Free Trade Association (EFTA) came into existence in 1960, shortly after the EU, offering an alternative approach to European integration.[3] Indeed, the two European RTAs differ from each other in important aspects:

(1) Unlike the EU, which is a customs union (CU) with a common external tariff, EFTA is a free trade agreement (FTA) whose members are free to maintain or modify independently their external tariff structure. A country joining a CU may even have to increase its tariffs for some trading partners when adopting the common external tariff. As a result, CUs typically lead to higher trade diversion than FTAs.

(2) A second difference refers to the two RTAs extra-commercial and political aspirations. Our short historical excursion above has shown that the EU soon started to go beyond pure trade aspects to achieve a highly integrated economic and political union among participating states. EFTA, on the other hand, is a traditional trade agreement with the sole ambition of removing barriers to trade in industrial goods (agriculturals and fisheries are excluded).

(3) A major innovation of the EU is its supra-national character reflected in institutions such as the Commission, the Parliament and the Court of Justice. EFTA does not offer anything comparable; the only organ is the EFTA Council composed of member country representatives meeting at delegation or ministerial level.[4] Furthermore, the EFTA secretariat (staff of around 100 people) is very small compared with the EU bureaucracy in Brussels.

(4) Regarding enlargement, the picture looks completely different from that of the EU. The only country joining EFTA was Iceland in 1970.[5] By contrast, several countries left EFTA to join the EU: Denmark and the United Kingdom in 1973; Portugal in 1985; Austria, Sweden and Finland in 1995. EFTA membership decreased

[3] EFTA was founded by Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the UK. Shortly afterwards, Finland and Liechtenstein became associate members.

[4] Note that the Council may establish Committees composed of experts from member countries. These Committees are not empowered to make legally binding decisions; their main function is to advise the Council in technical matters of running EFTA.

[5] Strictly speaking, there were two other accession countries: Finland in 1986 and Liechtenstein in 1991. Both countries, however, had been linked to EFTA through an association agreement since 1961. (For Finland, full membership was no option in the 1960s due to objections from the Soviet Union).

from 10 countries[6] in the early 1970s to only 4 countries today (Iceland, Liechtenstein, Norway and Switzerland).

To cut a long story short, this paper will test the appropriateness of the domino theory for explaining the growing importance of the EU and the decline in importance of EFTA. Our analysis is carried out in two stages. Stage one examines whether the expansion and deepening of the EU had a negative impact on non-members. It is shown that the EU was more attractive due to its higher degree of trade diversion, which is a necessary, though not sufficient, condition for domino effects.[7] Stage two assesses the importance of variables reflecting domino effects relative to control variables capturing other possible determinants of EU expansion. This exercise provides sufficient evidence supporting the domino theory.

The remainder of the paper is organised as follows. Section 2 surveys the literature on the trade effects of European RTAs. Section 3 uses a gravity equation to measure the effects of the EU and EFTA on trade patterns. Section 4 estimates a discrete choice model to evaluate the importance of domino effects for EU expansion. Section 5 concludes.

[6] Including associate members Finland and Liechtenstein.

[7] Trade diversion is not a sufficient proof of domino effects for the following reason: finding a significant degree of trade diversion only demonstrates that an RTA has a negative impact on non-members. However, we also need to check whether trade diversion (and other variables related to the domino theory) is indeed an important factor in a country's accession decision.

2. Literature Review

2.1 The Domino Theory of Regionalism

The domino theory builds on Viner's (1950) observation that any RTA leads to trade creation and trade diversion. Trade creation refers to the increase in trade among members of an RTA thanks to the elimination of tariffs on intra-regional trade. Trade diversion denotes the RTA-caused shift from an efficient (lower cost) outside supplier to a less efficient (higher cost) regional one. For a long time, the debate on trade creation versus trade diversion was confined to the static level ignoring dynamic time path issues. Put differently, expansion of membership to RTAs was simply treated as exogenous (Greenaway, 2000).

Only at the beginning of the 1990s, researchers began to think about regionalism as a dynamic process. Baldwin's (1993) domino theory is the first formal model to analyse the implications of trade diversion on membership in a particular RTA. Its basic assumption is that national trade policies are endogenous: they result from a political equilibrium balancing demand and supply of protection. With respect to regional trade agreements, the policy of a particular government reflects the relative power of pro-membership forces (i.e. firms exporting to the regional bloc) compared to anti-membership forces.

The conclusion of a new RTA or the deepening of an existing one implies a loss of competitiveness and lower profits for non-member firms exporting to the regional bloc because they face entry barriers that members do not. As a consequence, these firms increase their pro-membership lobbying efforts, changing the political equilibrium in their countries. The country whose government was closest to being indifferent to membership will then join the RTA. This further enlargement of the bloc increases the costs for non-members as the number of rivals with preferential market access has grown. As this cycle continues, additional countries will join like falling dominoes.

The domino cycle only continues if the RTA in question is open and any country requesting membership is admitted. In other words, the domino theory assumes that "the supply of membership is perfectly elastic" (Baldwin, 1993, p. 29). This basic framework has been extended in several subsequent studies. Focusing on customs unions (CUs), Yi (1996) takes a closer look at the difference between CUs that are open to non-member countries and those with exclusive membership. Yi's central message is that while open CUs are stepping stones toward global free trade, exclusive CUs may become stumbling blocks against global free trade. In a recent theoretical development, Aghion,

Antràs and Helpman (2004) show that global free trade is the unique equilibrium outcome if the aggregate welfare under global free trade is higher than under any combination of bilateral and regional trade agreements.[8]

2.2 Empirical Assessments of the EU and EFTA

Gravity models have been used extensively to analyse the impact of RTAs on trade flows. Most of the studies, however, focus on the static effects of RTAs. An early example is Aitken (1973), which looks at Western European trade flows from 1951-1967. Using a gravity equation with dummies for each RTA, he examines year-by-year OLS estimates to assess the impact of the EEC and EFTA on trade flows. His results show significantly positive coefficients for both the EEC and EFTA dummies as of 1961 and 1964 respectively. These coefficients provide a measure of the factor by which intra-RTA trade has been increased as a result of the formation of the EEC and EFTA. The increase in the RTA coefficients in the years after formation of the EEC and EFTA respectively can be interpreted as evidence for trade creation among member countries. This effect was substantially larger for the EEC than EFTA.

For a long time, Aitken's (1973) article was the only one evaluating the trade effects of RTAs. At the beginning of the 1990s, the number of RTAs negotiated started to increase dramatically, which stimulated interest in the economic effects of regionalism. The most preferred tool for these analyses was the gravity model, known for its remarkable performance in empirical research. The fact that its theoretical underpinnings had been strengthened in the 1980s further enhanced its popularity.

Unsurprisingly, most research focused on Europe, where regionalism is deeper than elsewhere. Furthermore European economic integration goes back to the 1950s and since then, has seen several enlargements, offering a terrific playground for testing different hypotheses empirically. Frankel and Wei (1993), for instance, perform an Aitken-type cross-section gravity analysis for 1965-1990. They find that countries which are members to the same RTA trade more with each other than would be expected taking into account their economic size and distance. According to Frankel's and Wei's estimates, a country joining the EEC in 1980 would have experienced a 68% increase in trade with other members by 1990. As for EFTA, they do not find any significant trade creating effect.

[8] If the aggregate welfare under global free trade is lower than under a trade system with bilateral and regional trade agreements, global free trade may only occur under particular circumstances such as presence of trade diversion.

Bayoumi and Eichengreen (1995) look at European regionalism from 1956-1992 using a first-differenced gravity equation to avoid the omitted variables problem: When estimating a simple cross-section gravity framework, the coefficients on RTA dummies will pick up any time-constant country-specific characteristics that are not controlled for in the gravity equation. A first-differenced equation eliminates this problem and leads to unbiased coefficient estimates. Bayoumi and Eichengreen find that both EEC and EFTA had a significant impact on trade flows, especially in the 1960s and 1970s.

More recently, research started going beyond static issues and began to address the question whether regionalism spreads in a domino-like fashion resulting in RTAs growing and multiplying. The first attempt to test the domino theory for Western Europe is Sapir (2001). Using year-by-year OLS estimates of a standard gravity equation, he finds supporting evidence for the idea that domino effects played an important role in several rounds of EEC/EU enlargement. He pays particular attention to EFTA members and the evolution of the coefficient of the EFTA dummy variable. Until the mid-1970s, this coefficient remains insignificantly positive indicating that EFTA was rather successful in countering the EEC agreement. However, when two former EFTA members (UK and Denmark) and Ireland join the EEC in 1973, the EFTA coefficient gradually changes from positive to negative, but remains not significantly different from zero. Towards the end of the 1980s, the EFTA dummy becomes significantly negative indicating the detrimental effect trade of the EC's Single Market Programme on EFTA. According to Sapir, this prompted several EFTA members to apply for EC membership in the early 1990s. Unfortunately, his analysis stops in 1992, one year before the Single Market effectively enters into force.

Building on Sapir (2001), the subsequent parts of this paper address the question of domino effects in Western Europe. However, we will

(1) extend the sample period until 2004 to cover the years when the Single Market fully exerts its effects;

(2) increase the sample size by including non-European OECD countries to enlarge the control group;

(3) adopt a refined methodology, using panel data techniques to take into account the information given by the time structure;

(4) develop the analysis further with a discrete choice model to assess the importance of domino variables compared to other factors.

3. Measuring the Extent of Trade Diversion in Europe

3.1 Conceptual and Methodological Framework

To test the domino theory empirically, we need a tool to analyse European trade flows. For over forty years, the gravity model has been successfully applied in econometric research to model bilateral trade flows. The basic idea is borrowed from Newton's Law of Gravity in physical sciences: the gravitational attraction between two objects depends positively on their mass and negatively on the distance separating them. By analogy, bilateral trade between two countries is a function of their economic mass and the distance between them. This is intuitively plausible; bigger countries located closer to one another will most probably trade more with each other.

a) A Theoretically Founded Gravity Equation

Despite the relatively long tradition of estimating gravity models as a basis for explaining trade flows, theoretical aspects were for a long time neglected. As a result, there was no formal framework representing the role of technology, factor endowments or any other determinants of trade. It was even frequently claimed that the gravity model could not be derived from any of the dominant theoretical trade models such as Heckscher-Ohlin.

The first successful attempt to prove these critics wrong dates back to 1979 (Anderson, 1979). Subsequent research by various authors has sought to reinforce the theoretical foundations of the gravity model by deriving it from different trade models, including Ricardian (Eaton and Kortum, 2001), Heckscher-Ohlin (Deardorff, 1995) and increasing returns to scale models (Helpman and Krugman, 1985).

Under the assumption of trade in differentiated products and using a CES demand function, Baldwin (2005) derives the following microfounded gravity equation:

$$T_{od,t} = Y_{o,t} Y_{d,t} \frac{\tau_{od,t}^{1-\sigma}}{\Omega_{o,t} \Delta_{d,t}} \qquad [1]$$

Equation [1] states that at time *t*, the total value of trade from country *o* (Origin) to country *d* (Destination) equals Origin's GDP ($Y_{o,t}$) times

Destination's GDP ($Y_{d,t}$) times a *distance and remoteness term* ($\frac{\tau_{od,t}^{1-\sigma}}{\Omega_{o,t}\Delta_{d,t}}$) composed of:

- a variable capturing trade costs between Origin and Destination: $\tau_{od,t}$
- constant elasticity of substitution between varieties: σ (Note that $\sigma > 1$).
- a measure of Origin's market access: $\Omega_{o,t}$
- a measure of Destination's openness: $\Delta_{d,t}$

The *distance and remoteness term* reflects bilateral *relative* openness:

(1) The numerator can be interpreted as openness that is specific to the bilateral relationship between Origin and Destination. Since trade costs are raised to a negative power, the term gets larger as bilateral barriers to trade are lowered (in other words, when bilateral trade becomes more open).

(2) The denominator can be interpreted as general openness: it contains both Origin's general market access $\Omega_{o,t}$ (in other words, the world's openness to the exporting country's varieties) and Destination's openness to the world $\Delta_{d,t}$.

Equation [1] is the basis for the econometric analysis in this section. By applying this gravity equation to Western Europe from 1962 to 2004, we assess the impact of the EU and EFTA on bilateral trade. In line with the literature, we log-linearise equation [1].

$$\ln T_{od,t} = \ln Y_{o,t} + \ln Y_{d,t} + (1-\sigma)\ln \tau_{od,t} - \ln \Omega_{o,t} - \ln \Delta_{d,t} \qquad [2]$$

Many gravity models include both GDP and GDP per capita. Such a specification can be derived from a model combining Heckscher-Ohlin inter-industry trade and monopolistic competition intra-industry trade (Bergstrand, 1989). From an econometric point of view, including GDP per capita is equivalent to relating bilateral trade flows to GDP and population:

$$\ln T_{od,t} = \ln Y_{o,t} + \ln Y_{d,t} + \ln pop_{o,t} + \ln pop_{d,t} + (1-\sigma)\ln \tau_{od,t} - \ln \Omega_{o,t} - \ln \Delta_{d,t} \qquad [3]$$

The correct econometric specification of this gravity equation is:

$$\ln T_{od,t} = \alpha_{od} + \lambda_t + \beta_1 \ln Y_{o,t} + \beta_2 \ln Y_{d,t} + \beta_3 \ln pop_{o,t} + \beta_4 \ln pop_{d,t} + \beta_5 \ln \tau_{od,t} + \beta_6 \ln \Omega_{o,t} + \beta_7 \ln \Delta_{d,t} + \varepsilon_{od,t} \quad [4]$$

where:

$T_{od,t}$:	value of total trade from Origin to Destination at time t
$Y_{o,t}$:	Origin's GDP at time t (the same for $Y_{d,t}$ for Destination)
$pop_{o,t}$:	number of inhabitants in Origin at time t (the same for $pop_{d,t}$)
$\tau_{od,t}$:	a variable capturing trade costs between Origin and Destination
$\Omega_{o,t}$:	a measure of Origin's market access
$\Delta_{d,t}$:	a measure of Destination's openness
α_{od} :	bilateral effect (country-pair specific effect)
λ_t :	time-specific effect
$\varepsilon_{od,t}$:	white noise disturbance term

b) Problems with Simple Cross-Sectional Analysis

Typically, previous studies have adopted a cross-sectional approach: Equation [4] is estimated by OLS for each year or by pooling these cross-sections across time. Formally this implies that $\alpha_{od} = 0$ and $\lambda_t = 0$. Unfortunately, both methods are likely to provide biased estimates because they fail to account for heterogeneity in trade relations among countries. In the theoretically grounded gravity equation, this heterogeneity is captured by τ, Ω, and Δ, which reflect bilateral relative openness.

Bilateral relative openness is determined by political, cultural, historical and geographic factor which cannot be readily observed. Usually, bilateral relative openness is controlled for by including distance, a dummy variable indicating whether the trade flow takes place under an RTA and a number of other dummy variables in a gravity equation like:

$$\ln T_{od,t} = \beta_0 + \beta_1 \ln Y_{o,t} + \beta_2 \ln Y_{d,t} + \beta_3 \ln pop_{o,t} + \beta_4 \ln pop_{d,t} + \beta_5 \ln dist_{od} + \beta_6 RTA_{od,t} + \sum \gamma_k dummy_k + \varepsilon_{od,t} \quad [5]$$

A positive and significant estimate for β_6 is interpreted as indicating the extent to which a particular RTA influences international trade relations. However, β_6 and all other coefficients are biased due to omitted variables, measurement errors and simultaneity.

As mentioned, the determinants of bilateral relative openness are difficult to observe and quantify. Many variables one should control for will, therefore, not be included in the equation and are relegated into the error term. Since many of these *omitted variables* are correlated with the explanatory variables (for instance unobservable political factors are likely to influence whether an RTA between two countries exists), OLS coefficient estimates will be biased.

Measurement errors are also likely to play a major role. For example, the question how to correctly measure economic distance is a matter of great discussion.[9] The most common measure (air distance between the economic centres) may cause problems if some countries have several equally important cities that are far apart (e.g. New York, Chicago and Los Angeles for the US). In addition, some authors argue that distance should not enter in absolute but in relative terms (Greenaway and Milner, 2002). In other words, absolute distance does not account for the fact that some countries have a much lower average distance to their trading partners than others.

As for *simultaneity*, several explanatory variables are potentially endogenous to bilateral trade flows. Magee (2003) shows that RTAs are more likely among countries with high bilateral trade, which may cause an upward bias in the coefficient estimates of RTA dummies. The most obvious remedy would be instrumental variable (IV) techniques. However, several authors claim that it is highly unlikely that appropriate instruments exist and that even IV methods will provide biased estimates (Baier and Bergstrand, 2005; Baldwin, 2005).

c) Fixed versus Random Effects

An elegant way of mitigating the bias caused by omitted variables, measurement errors and simultaneity is to use panel data techniques. Previous gravity estimations differ in whether fixed effects (FE) or random effects (RE) models were adopted. Our panel estimation applies fixed effects rather than random effects because we are not estimating trade flows between a randomly drawn sample of countries but between a predetermined selection of countries.

There are also good econometric reasons for this choice: fixed effects methods provide consistent results even if the unobservable factors are correlated with one or several explanatory variables. However, the estimates may not always be most efficient. Random effects estimate more efficient coefficients than fixed, but this method rests upon the assumption of zero

[9] See, for instance, Cheng and Wall (2005)

correlation between unobservable effects and explanatory variables. As we have seen above, this is highly unlikely in the context of a gravity model.

This conclusion has been tested empirically by Egger (2000) on the basis of a Hausman test, which compares a more efficient model (in our case RE) against a less efficient but consistent model (in our case FE) to ascertain that the more efficient model (RE) also gives consistent results. In Egger's analysis, the highly significant Hausman statistic indicates that the fixed effects model is consistent, but random effects not.[10]

From a practical point of view, fixed effects have the advantage of eliminating complicated data issues, such as which measure to use for distance or how to quantify political factors. Since most of these unobservables are constant either on the time, country or country-pair dimension, they are simply absorbed by the fixed effects.

3.2 Data and Specifications

a) Data Issues

We analyse two unbalanced panels containing data on bilateral trade, GDP, population, and participation in the EU and EFTA. The difference between these two panels lies in whether bilateral trade flows are unidirectional or averaged. The *unidirectional panel* (22 957 observations) distinguishes between trade flows from country A to B and flows from B to A. The *averaged panel* (12 245 observations) does not take into account the direction of trade flows and simply calculates the average of A to B and B to A flows.

Both ways to account for bilateral trade have their advantages and drawbacks. Unidirectional trade flows allow for a more detailed analysis. In particular, we are able to estimate the degree of trade diversion caused by either EU or EFTA. A potential problem with unidirectional trade flows may arise because exchange rate movements are not considered in our gravity model even though changes in the bilateral exchange rate have an impact on countries' exports by increasing or decreasing competitiveness. Averaged bilateral trade flows impose the assumption of balanced trade and, thus, mitigate the effect of exchange rate movements on exports.[11] With averaged

[10] For more details on the econometrics of fixed and random effects models, see Wooldridge (2002), chapter 10.

[11] Some caution is required when averaging trade flows. One should first calculate the logs of each of the two flows and then take the average. Those wrongly calculating the log of the average commit the "silver medal mistake" (Baldwin, 2005).

trade flows, however, we lose information on the direction of the flows and are, in consequence, unable to assess the impact of the EU and EFTA on non-members exports to the particular trade bloc. The solution adopted in this paper is to run regressions on both panels. The unidirectional results are used to draw conclusions on the extent of trade diversion in Europe, while the results from the averaged panel regressions serve as a benchmark to make sure that exchange rate competitiveness effects do not distort the picture too much.

Both panels cover the period from 1962 to 2004 (43 years) for 26 OECD countries. These are all OECD members without the four Central European countries Poland, Hungary, Czech and Slovak Republic. The reason for excluding these nations is that for most of the period analysed, they belonged to the communist bloc with the consequence that trade data is unavailable for a large part of the period. Another reason is that even accounting for time and country-pair fixed effects, there would still be scope for omitted variables because unobservable factors influencing relations among country-pairs are changing.[12]

As suggested by the theoretically founded gravity model examined above, we use nominal (current US$) data for trade flows and GDP.[13] With respect to trade flows, import data was extracted from the UN Comtrade database using WITS (World Integrated Trade Solutions).[14] Data on GDP and population comes from the World Bank Development Indicators database. [15]

b) Fixed Effects Specifications

The first specification estimated is a gravity equation with country-specific (α_o, α_d) and year (λ_t) fixed effects. Note that there are two specific effects for each country, one as an importer and another as an exporter.

$$\ln T_{odt} = \alpha_o + \alpha_d + \lambda_t + \beta_1 \ln GDP_{ot} + \beta_2 \ln GDP_{dt} + \beta_3 \ln POP_{ot} + \beta_4 \ln POP_{dt} + \beta_5 EU \Leftrightarrow EU_{odt} + \beta_6 NonEU \Rightarrow EU_{odt} + \varepsilon_{odt} \quad [6]$$

[12] This is an issue for all countries. However, it is more important in the case of bilateral relations with countries that change from a communist to a free market regime at some point during the time period.

[13] The reason why nominal data (as opposed to real) should be used is discussed in Baldwin (2005)

[14] On the choice between import or export data, Baldwin (1994) notes that it is more common to use import data as countries presumably watch their imports more thoroughly than their exports.

[15] See Appendix A for a complete list of countries analysed as well as more information on data sources.

In equation [6], $EU\Leftrightarrow EU_{odt}$ is a binary variable indicating whether a particular trade flow occurs between two EU members. The coefficient (β_5) shows how important the particular RTA is in shaping trade patterns. A second dummy is $NonEU\Rightarrow EU_{odt}$ indicating exports from non-EU members to EU countries; its coefficient (β_6) reveals trade diversion. Using the vocabulary from medical research, this equation looks at the treatment group (EU members) in comparison to the control group (EFTA members and countries that are in neither RTA).

The second specification (equation [7]) also has country-specific and year fixed effects; however, the two EU dummies are replaced with EFTA dummies. Hence, we now look at EFTA members while the EU and other countries are in the control group.

$$\begin{aligned}\ln T_{odt} = \; & \alpha_o + \alpha_d + \lambda_t + \beta_1 \ln GDP_{ot} + \beta_2 \ln GDP_{dt} + \beta_3 \ln POP_{ot} + \beta_4 \ln POP_{dt} \\ & + \beta_5 EFTA\Leftrightarrow EFTA_{odt} + \beta_6 NonEFTA\Rightarrow EFTA_{odt} + \varepsilon_{odt} \qquad [7]\end{aligned}$$

The third specification (equation [8]) is similar to the first one but instead of country-specific fixed effects, we apply country-*pair*-specific effects (α_{od}).

$$\begin{aligned}\ln T_{odt} = \; & \alpha_{od} + \lambda_t + \beta_1 \ln GDP_{ot} + \beta_2 \ln GDP_{dt} + \beta_3 \ln POP_{ot} + \beta_4 \ln POP_{dt} \\ & + \beta_5 EU\Leftrightarrow EU_{odt} + \beta_6 NonEU\Rightarrow EU_{odt} + \varepsilon_{odt} \qquad [8]\end{aligned}$$

Like equation [7], the fourth specification (equation [9]) looks at EFTA, but with country-*pair*-specific effects.

$$\begin{aligned}\ln T_{odt} = \; & \alpha_{od} + \lambda_t + \beta_1 \ln GDP_{ot} + \beta_2 \ln GDP_{dt} + \beta_3 \ln POP_{ot} + \beta_4 \ln POP_{dt} \\ & + \beta_5 EFTA\Leftrightarrow EFTA_{odt} + \beta_6 NonEFTA\Rightarrow EFTA_{odt} + \varepsilon_{odt} \qquad [9]\end{aligned}$$

In line with the theory of gravity models depicted above, we would expect the GDP coefficients to be positive as economically larger countries will trade more. The sign of the population coefficients, however, is a little less clear cut. On the one hand, we would anticipate a negative coefficient reflecting the fact that bigger countries with a large home market and a high level of self-sufficiency will trade less than countries with a smaller population (Nilsson, 2000). On the other hand, we could expect a positive coefficient because "a large population also promotes division of labour and implies the presence of economies of scale in production and therefore also of opportunities and desire to trade with a greater variety of goods" (Nilsson, 2000, p. 812). Therefore, a positive sign would suggest that intra-industry trade is important, while a negative sign would indicate the prevalence of inter-industry (Heckscher-Ohlin) trade.

As for the sign of the *EU⇔EU* (*EFTA⇔EFTA*) coefficient, a significantly positive estimate would imply that the EU (EFTA) had a considerable effect on trade patterns among OECD countries. The *NonEU⇨EU* (*NonEFTA⇨EFTA*) coefficient shows the extent of trade diversion due to the EU (EFTA). The more negative the coefficient, the more negative the impact of the EU (EFTA) on non-members exports. A significant degree of trade diversion is a necessary condition for domino effects as exporters in non-member countries need to be in a less advantageous position than producers inside the trade bloc.

3.3 Results

Table 1 presents the results of fixed effects regressions on equations [6] to [9] using the unidirectional panel. Since there is clear evidence of heteroskedasticity, White-corrected (robust) standard errors are reported.[16]

In common with other empirical literature using gravity equations, the explanatory power of all models is good (high R^2); the included variables explain between 85 and 95 percent of the variation of OECD trade flows. The GDP coefficients have the expected signs (significantly positive); an increase in a country's GDP causes a slightly more-than-proportional increase in its imports and exports. The estimates for the population coefficients are mostly positive and significant confirming the intra-industry hypothesis, which states that larger nations trade more because they benefit from higher economies of scale and thus have opportunities to exchange a greater variety of goods. This seems reasonable for our sample, which only includes only OECD countries, which have a reputation of trading mainly at intra-industry level.

In addition to the *unidirectional* panel, regressions were run on the *averaged* panel to get an idea of the impact of exchange rate movements. These results are presented in Appendix C. A comparison of the coefficient estimates of the regressions on both panels suggests that it does not make a huge difference whether the averaged or the unidirectional panel is used.[17] This suggests that, on average over the whole period, exchange rate movements may have exerted a less important impact on trade among OECD countries than is usually thought.

With regards to the dummy coefficients, the results conform largely to expectations. Significantly positive coefficient estimates for the *EU⇔EU* and

[16] Appendix B offers a more detailed treatment of the issue of heteroskedasticity in our model.
[17] Frankel (2005) comes to the same conclusion: it does not make much difference whether one analyses unidirectional or averaged trade flows.

Table 1: Gravity Regressions of Unidirectional Trade Flows

Dependent Variable ln T_{odt}	**Country-specific and year effects**		**Pair-specific and year effects**	
Independent Variables	**[6]**	**[7]**	**[8]**	**[9]**
ln GDP_{ot}	1.440 (0.042) [0.000]	1.427 (0.042) [0.000]	1.431 (0.028) [0.000]	1.427 (0.028) [0.000]
ln GDP_{dt}	1.068 (0.046) [0.000]	1.054 (0.046) [0.000]	1.065 (0.029) [0.000]	1.061 (0.029) [0.000]
ln POP_{ot}	1.182 (0.150) [0.000]	-0.139 (0.146) [0.341]	0.734 (0.082) [0.000]	0.303 (0.080) [0.000]
ln POP_{dt}	1.725 (0.137) [0.000]	0.985 (0.138) [0.000]	1.460 (0.088) [0.000]	1.139 (0.088) [0.000]
$EU \Leftrightarrow EU_{odt}$	0.647 (0.028) [0.000]		0.309 (0.016) [0.000]	
$EFTA \Leftrightarrow EFTA_{odt}$		0.682 (0.040) [0.000]		0.083 (0.023) [0.001]
$Non\text{-}EU \Rightarrow EU_{odt}$	-0.332 (0.027) [0.000]		-0.133 (0.018) [0.000]	
$Non\text{-}EFTA \Rightarrow EFTA_{odt}$		-0.206 (0.033) [0.000]		0.032 (0.020) [0.130]
Number of observations	22 957	22 957	22 957	22 957
R^2	0.8564	0.8527	0.9596	0.9587
Adjusted R^2	0.8558	0.8521	0.9585	0.9575
Root MSE	1.0026	1.0155	0.5378	0.5441

Heteroskedasticity-robust standard errors in parentheses. P-values in brackets.

EFTA⇔EFTA dummies indicate that both EU and EFTA play a role in shaping trade patterns. This is true for the regression with *country-specific* fixed effects as well as for the regression with *pair-specific* fixed effects. However, the impact of the EU and EFTA turns out to be larger in the models using *country-specific* effects and the effect of EU and EFTA appears to be similar in magnitude. On average over the period, intra-EU and intra-EFTA trade is

estimated to be around 2 times larger than non-preferential trade.[18] Using *pair-specific* fixed effects, estimates are generally smaller and there is a clear difference in the extent to which the EU influences trade patterns compared to EFTA. Intra-EU trade is on average around 35% larger than non-preferential trade, whereas intra-EFTA trade out-performs non-preferential trade only by around 10%.[19] Whether country-specific or pair-specific effects are preferred is discussed further below.

The results in Table 1 are useful to determine the degree of trade diversion that can be ascribed to EU and EFTA. The *NonEU⇨EU* and *NonEFTA⇨EFTA* coefficient show how exports from non-members to EU or EFTA countries differ from exports to countries outside the EU or EFTA. More precisely, a significantly negative dummy coefficient hints at non-negligible trade diversion due to the EU or EFTA. Looking at the estimates for the models with *country-specific* effects (equations [6] and [7]), we detect considerable trade diversion caused by the EU and EFTA. On average over the period, exports from non-EU countries to EU members were around 30% smaller than exports to countries that are not in the EU. For EFTA, trade diversion is reflected by a 20% decrease in exports from non-members to the EFTA.[20] In the models with *pair-specific* effects (equations [8] and [9]), the estimates are smaller, but the *NonEU⇨EU* coefficient is still significantly negative indicating that the EU caused trade diversion of over 10%.[21] At the same time, EFTA did not create significant trade diversion; the *NonEFTA⇨EFTA* coefficient is positive but insignificant at the 10% level. In sum, Table 1 confirms the hypothesis that the EU caused more trade diversion than EFTA.

a) Country-Specific versus Pair-Specific Fixed Effects

It is still an open question, whether the coefficients from the country or pair-specific regression are more appropriate. With pair-specific effects, we obtain estimates that are smaller and more reasonable than with country-specific effects. The literature is divided on the issue; some advocate using country-specific effects (Mátyás, 1997; Anderson and van Wincoop, 2001), others prefer country-pair-specific effects (Cheng and Wall, 2005; Holmes, 2005). From a conceptual point of view, the pair-specific model is preferred

[18] In model [6], for EU: exp(0.647) = 1.910; in model [7], for EFTA: exp(0.682) = 1.978.
[19] In model [8], for EU: exp(0.309) = 1.362; in model [9] for EFTA: exp(0.083) = 1.087
[20] In model [6], for the *nonEU⇨EU* estimate: exp(-0.332) = 0.717;
in model [7], for the *nonEFTA⇨EFTA* estimate: exp(-0.206) = 0.814
[21] In model [8], for the *nonEU⇨EU* estimate: exp(-0.133) = 0.875

because its fixed effects manage to capture the elements of a special relationship among two countries. For example, it can be argued that German-Dutch trade relations are different from trade relations that either country maintains with any other nation. Pair-specific effects will control for this special relationship while country-specific effects fail to do so.

The model using country-specific effects can be considered as "a special case of the [pair-specific effects] model in that it has a unique value for each trading pair's intercept, with the restrictions that a country's fixed effect as an exporter is the same for all its trading partners" (Cheng and Wall, 2005, p. 51). In other words, the country-specific model is a restricted model of pair-specific effects. We can easily find out whether the restricted country-specific model differs significantly from the unrestricted pair-specific model with a likelihood ratio test. The calculated likelihood ratio strongly rejects the null hypothesis, which is that the restrictions do not have a statistically significant effect on the estimation;[22] we conclude that pair-specific are preferred to country specific fixed effects.

This conclusion also explains the higher magnitude of the country-specific coefficient estimates compared to the pair-specific ones. When country-specific effects are used, we omit explanatory variables that are most probably correlated with other explanatory variables present in our regression. As a result, the estimates are biased and the effect of the EU and EFTA may be overestimated because their coefficients also capture unobserved factors that are specific to country pairs.

In light of the previous analysis, our preferred models are equations [8] and [9], both of which take account of pair-specific effects. As seen above, the estimates of these models provide evidence for our hypothesis that the EU caused considerably higher trade diversion than EFTA. While the *NonEU⇨EU* coefficient is negative and significant, the *NonEFTA⇨EFTA* coefficient is not significantly different from zero. One should note that this conclusion is only valid on average over the whole period from 1962 to 2004. However, the degree of trade diversion was probably far from constant and may have evolved. Indeed, for domino effects to take place, trade diversion does not have to be present over the entire time period. In the EU context, it would be sufficient if trade diversion were particularly strong and/or increasing in the years before one or several countries join the EU. Therefore, we change our specification slightly to estimate how the four EU and EFTA dummies evolved over time.

[22] Likelihood ratio test for model [6] nested in model [8]:
$LR = -2\left(\ln \hat{L}_{restricted} - \ln \hat{L}_{unrestricted}\right) = 29111.7$ and $\Pr\left(29111.7 > \chi^2(506)\right) = 0.000$ → reject H_0

b) Evolution over Time

This can easily be implemented by interacting the EU and EFTA variables with year dummies to get 43 *EU⇔EU* dummies (one for each year between 1962 and 2004), 43 *EFTA⇔EFTA* dummies, 43 *NonEU⇨EU* dummies, and 43 *NonEFTA⇨EFTA* dummies. To get a better idea of the results of this regression, the estimates of β_5 and β_6 in equations [8] and [9] are shown graphically in Figures 1 to 4.[23]

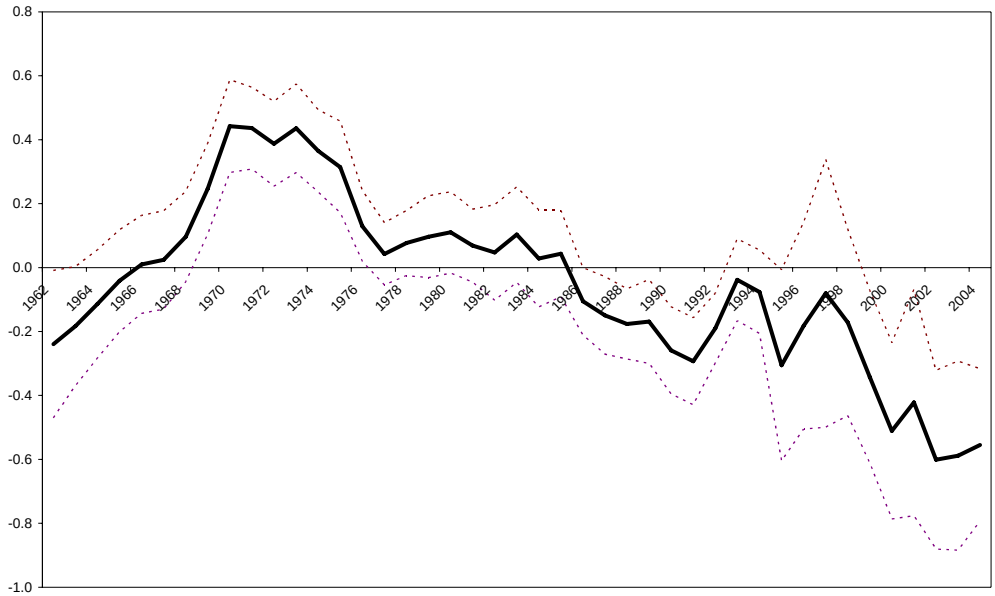
As expected, the *EU⇔EU* coefficient estimate is significantly positive for most of the period from 1962 to 2004 (Figure 1). There are some years where it experiences sudden drops, most of which can be explained by expansion of membership. The 1973 drop, for instance, is due to the accession of the UK, Ireland and Denmark. The accession treaty of these three countries provided for a 4-year phase-in period to adopt the customs union (Mongelli, Dorrucci and Agur, 2005). Similar explanations can be given for the drops in 1986 (Spain and Portugal join) and in 1995 (Austria, Sweden and Finland join).

The evolution of the *EFTA⇔EFTA* coefficient is quite different (Figure 2). It is significantly positive between 1969 and 1977 and significantly negative as of 1999. It is consistently lower than the *EU⇔EU* coefficient, most of the time significantly so (with the exception of the 1970s). Its trend is rising

Figure 1: EU⇔EU Coefficient 1962-2004 (95% Confidence Interval)

[23] For the underlying regression results, see Appendix D.

Figure 2: EFTA⇔EFTA Coefficient 1962-2004 (95% Confidence Interval)



until 1970 remaining at a relatively high level until 1973 when two EFTAns (the UK and Denmark) leave to join the EU. From 1974 to 2004 the trend is decreasing and for much of this period the EFTA has no significant impact on OECD trade flows.

For our assessment of the domino theory, the most interesting variable is the *NonEU⇨EU* dummy (Figure 3). The evolution of its coefficient tells an interesting story. In most years, it is significantly negative indicating considerable trade diversion. In 1980, it starts declining and this trend persists until the end of the 1990s. Moreover, trade diversion seems to become a bigger issue in 1986 when the Single Market Act is signed and the coefficient is even more negative and highly significant as of 1993 when the Maastricht treaty comes into effect. Hence, starting toward the end of the 1980s, the EU created significant trade diversion for non-members. This may have been a major motivation leading EFTA members to either apply for full membership in the EU (Austria, Sweden and Finland) or to negotiate a separate trade agreement to mitigate the effects of trade diversion (Norway, Switzerland, Liechtenstein and Iceland). Trade diversion was also increasing and significant from 1967 to 1972 in the run-up to the accession of the UK, Ireland and Denmark (1973). Prior to Spain's and Portugal's joining (1986), on the other hand, trade diversion was not significant.

In sum, trade diversion seems to have been present during the two most important EU expansions in the early 1970s and 1990s.

Figure 3: NonEU⇨EU Coefficient 1962-2004 (95% Confidence Interval)

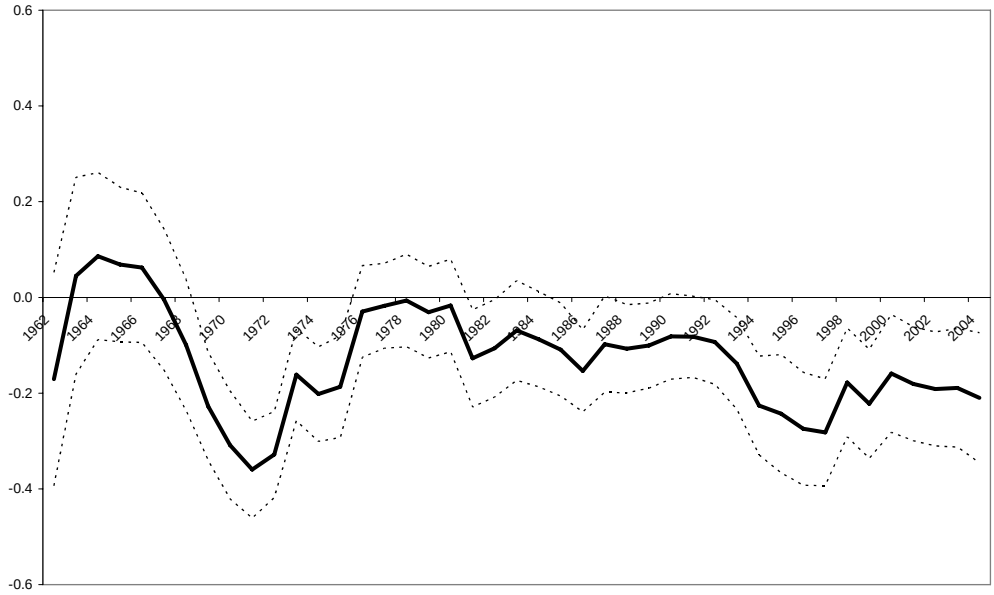
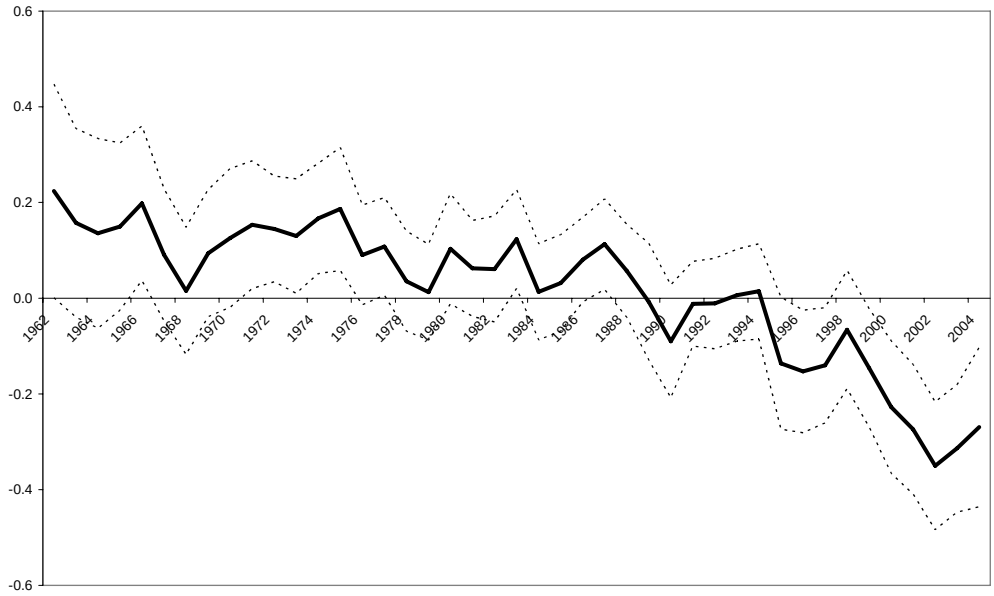


Figure 4: NonEFTA⇨EFTA Coefficient 1962-2004 (95% Confidence Interval)



With regards to Figure 4, EFTA did not create any trade diversion as indicated by a *NonEFTA⇨EFTA* coefficient that is insignificant throughout almost the entire period. The estimates detect some significant trade diversion as of 2001. One possible explanation is that, by then, EFTA is a small group of small countries that are linked to the EU by various agreements such as the European Economic Area (Norway, Iceland and Liechtenstein) or a series of

bilateral agreements (Switzerland). As a consequence, EFTA members are economically more integrated into the EU bloc than other non-EU countries, which may have the effect that EFTA also creates some trade diversion.

How do our fixed effects results compare to Sapir (2001), who runs separate OLS regressions for each year? Using the original six EU members as a control group, Sapir's EFTA coefficient is not significantly different from zero until 1988. As of 1973, this coefficient steadily declines until 1992 when his sample period ends. Our findings are roughly similar with the decline of the *EFTA⇔EFTA* coefficient continuing until 2004. Sapir also includes an EC-EFTA dummy variable, which differs from our trade diversion dummies (*NonEU⇨EU* and *NonEFTA⇨EFTA*). The EC-EFTA dummy does not differentiate whether trade flows are from the EFTA to the EC or the reverse and, therefore, nothing can be said about trade diversion. Sapir takes the fact that both the EFTA and EC-EFTA coefficient become significantly negative at the end of the 1980s as supporting evidence for domino effects.

Our results point in the same direction: As of 1973, EFTA's ability to influence OECD trade flows decreases steadily while, at the same time, trade diversion caused by the EU bloc increases. These results clearly indicate that there was a great potential for domino effects in the early 1970s and especially as of the late 1980s. However, we cannot yet conclude that trade diversion (and thus domino effects) have played a major role, without controlling for other factors that may have had an impact on countries' decision whether or not to join the EU. This issue will be analysed in the following section.

4. The Importance of Domino Effects in Europe

Our gravity analysis has revealed that the expansion and deepening of the EU had a negative impact on non-members by causing trade diversion. This is a necessary condition for domino effects, but it is not sufficient. Remember, the domino theory essentially states that the conclusion of a new RTA or the deepening of an existing one will induce non-members to join. Therefore, to make our empirical analysis complete, we need to assess the impact of domino variables on the probability that a particular country applies for EU membership. The most obvious way to do this is with a discrete choice model.

4.1 Conceptual and Methodological Framework

a) The Determinants of RTAs

Until recently, research interest in regionalism focused on the economic effects of RTAs on trade flows and the RTA dummy was treated as exogenous. Perhaps as a consequence of the post Cold War upsurge in RTAs, the question of which factors actually cause regionalism has made its appearance on the research agenda. The domino theory (Baldwin, 1993) was one of the first to suggest an explanation for why countries choose to join an RTA. Baldwin gives a political reason with economic roots: pro-membership lobbying efforts increase because domestic companies lose competitiveness in comparison to members of an RTA.

In the past three years, a few empirical studies were done on the determinants of RTAs. However, none of these takes a closer look at domino effects. The first attempt that systematically looks at factors influencing the probability of two countries forming an RTA is Baier and Bergstrand (2003). They find that the likelihood of an RTA between a country pair is higher the smaller the distance between them and the farther away they are from the rest of the world. In addition, higher potential gains due to different capital-labour ratios (Heckscher-Ohlin trade) have a positive impact on RTA formation.

Mansfield and Reinhardt (2003) offer a more political explanation for RTA formation, arguing that one of the main determinants of regional trade agreements are developments at the multilateral level. In their view, difficulties in GATT/WTO negotiations prompt countries to engage in regionalism. In another study, Wu (2004) shows that democracy and economic freedom have a significant impact and she also finds a positive relationship between trade

uncertainty and RTA formation. She argues that globalisation has engendered greater trade uncertainty, which leads countries to conclude RTAs in an attempt to alleviate potential risks in a highly integrated global economy.

After determining which of the 158 RTAs are effectively implemented, Holmes (2005) analyses a variety of potential factors influencing RTA formation. Convincing evidence is found that mercantile interests in assuring export market access are a key explanation. This is in line with the idea that RTAs are more likely between countries trading already to a considerable extent with each other.

Our analysis examines the impact of domino variables on the decision of joining or not joining the EU. In other words we try to establish that the size of the EU bloc and its degree of integration have a significant effect on the likelihood of accession. We control for a variety of other potentially significant determinants that were briefly presented above.

b) Unconditional vs. Conditional Fixed Effects Logit

In essence, we want to determine which factors are important in a country's decision regarding EU membership. Therefore, our dependent variable is binary. The models most readily used in such contexts are probit and logit. The difference between probit and logit models is in the assumption about the functional form of the cumulative probability distribution function (cdf). Probit assumes a normal cdf, while logit assumes a logistic cdf. There is no clear theoretical guidance on which functional form to opt for and in most cases, the choice between the two does not make much difference (Greene, 2003, chap. 21). We select the logit model for a practical reason: in a panel data context, logit offers ways to alleviate the incidental parameters problem (described below).

We use the following fixed effects logit model:

$$\Pr(y_{it} = 1 \mid x_{it}) = \frac{\exp(\alpha_i + x'_{it}\beta)}{1 + \exp(\alpha_i + x'_{it}\beta)} = \Lambda(\alpha_i + x'_{it}\beta) \qquad [10]$$

In our domino context, y_{it} denotes the observation on EU membership (1 = member; 0 = not member) for country i at time t; $x'_{it}\beta$ represents the explanatory variables and the corresponding coefficients; α_i are the country-specific fixed effects (also called incidental parameters).

When this fixed-effects model is estimated by maximising the unconditional likelihood function, the estimator of the country-specific effects

α_i is consistent as $T \longrightarrow \infty$ for fixed N, but inconsistent as $N \longrightarrow \infty$ for fixed T. This is the incidental parameters problem, which, according to Katz (2001), arises because the number of country-specific parameters increases with N, while the amount of information about each of these country-specific (or incidental) parameters is fixed. This problem has potentially far-reaching repercussions because the estimator of β is a function of the α-estimators, which means that all other coefficient estimates are not consistent either. Also, when T is small, estimators will be biased. Yet, there is no consensus among econometricians as to the size of this bias.[24]

In contrast to the unconditional likelihood function, the conditional likelihood function does not include the incidental parameters α_i. As a consequence, using the conditional logit estimation method provides coefficient estimates that are consistent even in a panel data context. We thus prefer conditional to unconditional fixed effects logit estimates.

4.2 Data and Specifications

a) Data Issues

Like in the previous sections, our analysis covers the period from 1962 to 2004 for the same 25 OECD countries. Our dependent variable is a binary variable indicating whether a particular country i was an EU member at time t ($\Pr(EU_{it}= 1)$). This dummy is regressed on a number of explanatory variables using the following logit model.

$$\begin{aligned}\Pr(EU_{it} = 1) = \Lambda\,(\alpha_i &+ \beta_1 \textit{Size of EU bloc}_{it} \\ &+ \beta_2 \textit{Degree of EU integration}_t \\ &+ \beta_3 \textit{Trade uncertainty}_{it} \\ &+ \beta_4 \textit{Multilateral backlash}_t + \varepsilon_{it})\end{aligned} \qquad [11]$$

The above specification contains two variables that find their raison d'être in the domino theory. The *Size of EU bloc* coefficient captures the effect of changes in the economic size of the EU. The bigger the EU, the higher the loss in competitiveness for outsiders and, thus, the higher the probability that a country will join the EU. The impact of *Size of EU bloc* is different for each country as indicated by the *it* subscript. It depends on the importance the EU

[24] Katz (2001) finds only a negligible amount of bias for $T \geq 16$. Greene (2003), on the other hand, cites older studies that estimate the bias to be more substantive.

has for a particular country. This is measured by the percentage of exports that country *i* sends to EU members at time *t*, which is calculated using annual export data from the UN Comtrade database. Including the variable *Percentage of exports to EU members* may bring about a simultaneity problem. We already alluded to this issue in the gravity part of this paper and it is perennial topic of discussion among economists analysing RTAs. One would reasonably expect that the level of a particular country's exports to the EU not only has an impact on the probability of accession, but also the reverse: the fact that a country joins the EU bloc should usually boost the share of exports that are sent to other EU members.[25] Instrumental variable techniques are a possible solution. However, it is not obvious which instrument might be a valid candidate to address the simultaneity problem. In addition, applying instrumental variable techniques in a (conditional) fixed effects logit context seems rather complicated and I doubt that any econometric computer programme would provide an easy solution.[26]

The domino theory also states that the probability of EU accession may increase as institutional integration is deepened. The rationale behind this assertion is that higher integration will most likely increase the degree of trade diversion. This effect is reflected in the *Degree of EU integration* variable, the coefficient of which is expected to be positive. Mongelli, Dorrucci, and Agur (2005) have developed an index for each EU member showing how well it participated in different EU institutions at a certain point in time. In our analysis, an aggregate of these indices is calculated to measure the degree of EU integration.

Trade uncertainty is used as a control variable. Its roots are in Wu (2004), which finds significant positive effects on the likelihood that a particular country concludes RTAs. Like in her study, we will use trade openness as a proxy for trade uncertainty. Our measure for trade openness comes from the World Development Indicators (WDI) database, which takes tariffs measured by import duties as a percentage of total imports. We expect that the more open country *i* is at time *t*, the higher the probability of joining the EU.

A second control variable (*Multilateral backlash*) comes from Mansfield and Reinhardt (2003). They argue that when multilateral relations in the WTO become more complicated and less manageable, countries have an incentive to liberalise in a regional or bilateral manner. In other words, the probability of RTAs increases in proportion to difficulties in WTO negotiations, which of course are difficult to quantify. We will proxy multilateral backlash by the number of WTO members, reflecting the fact that it is frequently claimed that

[25] This is what we tested with the gravity model in section 3.
[26] STATA, for instance, does not offer such a possibility for its clogit command.

as the number of WTO countries increases, multilateral trade negotiations become harder. Since trade talks at the WTO usually take place during rounds, the number of WTO members is interacted with a dummy variable, which equals one if, in a particular year, a trade round is underway.[27]

b) Logit Specifications

In light of the previous sub-section, equation [11] is adapted as follows.

$$\begin{aligned}\Pr(EU_{it}=1) = \Lambda\,(\alpha_i &+ \beta_1 \textit{Percentage of exports to EU members}_{it} \\ &+ \beta_2 \textit{Index of EU integration}_t \\ &+ \beta_3 \textit{Trade openness}_{it} \\ &+ \beta_4 \textit{WTO membership} \cdot \textit{trade round yes}_t + \varepsilon_{it}) \quad [12]\end{aligned}$$

Equation [12] is estimated using different logit panel data techniques: pooled logit, unconditional logit with country-specific fixed effects and conditional logit with country-specific fixed effects. Each of these techniques is applied for two distinct specifications which differ in whether or not the control variables (*Trade openness* and *WTO membership · trade round yes*) are included. This allows for testing the joint significance of the controls.

The first two models are simple pooled logits, neglecting cross-country heterogeneity. Model I includes the control variables, model II does not. The estimates of these two models are expected to be biased due to the omitted variables problem. We think that there are (partly unobservable) country characteristics, such as historical, cultural and political factors, that have an impact on the probability of joining the EU. In addition, some of the unobservable country characteristics are likely to be correlated with the included explanatory variables.

To mitigate the heterogeneity bias, we adopt the same strategy as in our gravity estimations: we use panel data techniques and specifically fixed effects.[28] Models III and IV apply unconditional logit controlling for country-specific fixed effects. As a result, we lose all observations for those countries which were either in the EU during the entire period or non-EU members until 2004. Since the country-specific fixed effects absorb all time-constant country characteristics, only those countries which had a change in EU membership will remain in the sample. In the same intent, models V and VI estimate a

[27] For more information on data, as well as line charts describing it, see Appendix E.
[28] A random-effects model is, again, not a valid solution because it provides biased estimates. The reasons for this are essentially the same as those presented in section 3.2(c).

conditional fixed effects logit to prevent, at the same time, the incidental parameters problem discussed in section 4.1(b). A positive side effect of country-specific fixed effects is that they also control for time-constant factors explicitly included in previous studies such as Baier and Bergstrand (2003), Wu (2004) and Holmes (2005).

4.3 Results

The results of the six models are shown in Table 2. As for pooled logit estimates (models I and II), the domino variables coefficients have the expected signs. However, only the coefficient of the variable reflecting the size of the EU bloc (*Percentage of exports to EU members*) is significant. The coefficients of the control variables are insignificant at any reasonable confidence level. In contrast to standard OLS, the magnitude of the coefficients is not that easy to interpret because of the non-linear nature of the logistic function.[29] For our purposes, it suffices to know the sign of the coefficients and whether they are significant. As a note of caution, we have to keep in mind that the pooled estimates (I and II) are probably gravely biased, a hypothesis which will be tested further below.

The results of the unconditional fixed effects logit seem much more reasonable. Model III provides estimates, which are positively significant for our first domino variable (*Percentage of exports to EU members*) and for Wu's (2004) trade uncertainty proxy (*Trade openness*). The regression without control variables (model IV) shows that both domino factors have a significant impact on the probability of EU accession. Unsurprisingly, thanks to the country-specific fixed effects, the goodness of fit has increased. Although the unconditional fixed effects take care of the heterogeneity bias, we should treat these results with some caution because of the incidental parameters problem.

Columns V and VI of Table 2 display the results of the conditional fixed effects logit model. A comparison of model V with III shows that the *Trade openness* coefficient loses its significance once the incidental parameters problem is under control. The only significantly positive coefficient in model V is *Percentage of exports to EU members* (at 5%-level). If the control variables are dropped (model VI), both domino variables are significantly positive. With respect to goodness of fit, it is basically as good as before. The reader may wonder why the percentage of correctly predicted outcomes is not reported. The reason is that, since the country-specific effects are not actually estimated

[29] A rule of thumb is to divide the logit estimates by 4 to make them comparable to a linear model (Wooldridge, 2002, chap. 15)

Table 2: Logit Regressions of EU Membership
(Criterion: Date of Entry into Force of Accession Treaty)

Dependent Variable $\Pr(EU_{it} = 1)$	**Pooled Logit**		**Unconditional Logit** (country-specific fixed effects)		**Conditional Logit** (country-specific fixed effects)	
Independent Variables	**I**	**II**	**III**	**IV**	**V**	**VI**
Constant	-5.0716 (0.3850) [0.000]	-5.1232 (0.3813) [0.000]	-93.0488 (38.2902) [0.015]	-95.8042 (28.5179) [0.015]		
Percentage of exports to EU members$_{it}$	0.0991 (0.0079) [0.000]	0.0981 (0.0069) [0.000]	0.8253 (0.3317) [0.013]	0.7826 (0.2126) [0.000]	0.5777 (0.2873) [0.044]	0.5771 (0.1782) [0.001]
Index of EU integration$_{t}$	0.0021 (0.0060) [0.733]	0.0018 (0.0060) [0.769]	0.5837 (0.3869) [0.131]	0.7923 (0.2756) [0.004]	0.4088 (0.3367) [0.225]	0.5881 (0.2322) [0.011]
Trade openness$_{it}$	-0.0003 (0.0040) [0.938]		0.3745 (0.2233) [0.094]		0.2805 (0.1858) [0.131]	
WTO membership · trade round yes$_{t}$	-0.0018 (0.0018) [0.315]		-0.0024 (0.0432) [0.954]		-0.0036 (0.0392) [0.927]	
Number of observations	1010	1010	413	413	373	373
McFadden's Pseudo R^2	0.3853	0.3845	0.9770	0.9660	0.9799	0.9671
% correctly predicted	78.6 %	78.9 %	99.3 %	99.3 %	n/a	n/a
Log-likelihood value	-410.182	-410.687	-6.489	-9.585	-4.080	-6.680
Akaike Criterion (AIC)	830.363	827.375	36.979	39.169	16.160	17.360
Schwarz Criterion (BIC)	854.952	842.128	85.260	79.404	31.846	25.203

Standard errors in parentheses. P-values in brackets.

in the conditional logit model, it is not possible to compute probabilities with these coefficient estimates (Greene, 2003).

Regarding the coefficients of our control variables, they are hardly ever significant in any of the models (an exception is the *Trade openness* coefficient in model III). In addition, these control variables do not seem to make a big difference when considering the specification without the controls as a restricted case of the general model. The similar log-likelihood values for the restricted and unrestricted model in all three cases hint at such a conclusion. We formally check this with a likelihood ratio test. Using a 5% significance

level, we do not reject the null hypothesis that the restrictions do not have a statistically significant effect on the estimation for the pooled model and for the conditional fixed effects model. In other words, it does not make a significant difference whether the control variables are included in the pooled and conditional logit specification. As for the unconditional logit, the likelihood ratio indicates that the controls are jointly significant.[30]

The incidental parameters problem was brought up on several occasions in the previous paragraphs with a warning that both pooled logit and unobserved fixed effects logit models are inconsistent if there is unobserved heterogeneity among countries. Should this be the case, we can estimate a conditional fixed effects logit model. However, in the absence of cross-country heterogeneity, there is no inconsistency problem, but we would prefer the pooled logit estimates because of their higher efficiency. Since the pooled logit likelihood ratios are not comparable with the conditional fixed effects logit ones, the most natural way to test for consistency of the pooled model is to perform a Hausman test (Greene, 2003). Under the null hypothesis both estimators are consistent, but the conditional logit estimator is inefficient. Under the alternative hypothesis, the pooled logit estimator is inconsistent, while the conditional logit estimator is consistent. The Hausman statistic rejects the null at a 5%-level and we deduce that only estimation using conditional fixed effect logit is consistent.[31] Hence, our preferred models are models V and VI.

In all models estimated so far, our dependent variable is a binary variable indicating whether country *i* was an EU member at time *t*. This dummy changes from 0 to 1 in the year when the accession treaty enters into force. One may argue that the decision to join the EU takes place well before the entry into force of the accession treaty. As a result, the EU dummy should switch from 0 to 1 in the year when a particular country applies for EU membership. This dependent variable, however, poses some problems because some countries applied for EU membership but failed to join for various reasons.[32] An alternative criterion to determine the EU dummy is the year when the accession treaty is signed.[33] We followed this approach to construct a second

[30] Pooled logit (I vs. II): $LR = 1.01$ and $\Pr(1.01 > \chi^2[2]) = 0.603$ → do not reject H_0
Unconditional logit (III vs. IV): $LR = 6.19$ and $\Pr(6.19 > \chi^2[2]) = 0.045$ → reject H_0
Conditional logit (V vs. VI): $LR = 5.20$ and $\Pr(5.20 > \chi^2[2]) = 0.074$ → do not reject H_0

[31] Model VI (consistent under H_0 & H_1) vs. model II (inconsistent under H_1, efficient under H_0)
Hausman = 7.88 and $\Pr(7.88 > \chi^2[2]) = 0.019$ → reject H_0

[32] The most prominent example is Switzerland, which formally applied for EU membership in the early 1990s. Several negative referenda demonstrated the lack of popular support and today, Switzerland is still not in the EU.

[33] For a list of countries and the dates when the respective accession treaties were signed, see Appendix E.

Table 3: Conditional Logit Regressions (country-specific fixed effects)

Dependent Variable Pr(EU_{it} = 1)	**Criterion: Date of Entry into Force**		**Criterion: Date of Signature**	
Independent Variables	**V**	**VI**	**VII**	**VIII**
Percentage of exports to EU members$_{it}$	0.5777 (0.2873) [0.044]	0.5771 (0.1782) [0.001]	0.3916 (0.1268) [0.002]	0.5096 (0.1499) [0.001]
Index of EU integration$_{t}$	0.4088 (0.3367) [0.225]	0.5881 (0.2322) [0.011]	0.5508 (0.1218) [0.000]	0.6391 (0.1967) [0.001]
Trade openness$_{it}$	0.2805 (0.1858) [0.131]		0.1754 (0.0855) [0.040]	
WTO membership · trade round yes$_{t}$	-0.0036 (0.0392) [0.927]		0.0110 (0.0206) [0.592]	
Number of observations	373	373	373	373
McFadden's Pseudo R^2	0.9799	0.9671	0.9565	0.9671
% correctly predicted	n/a	n/a	n/a	n/a
Log-likelihood value	-4.080	-6.680	-8.863	-12.189
Akaike Criterion (AIC)	16.160	17.360	25.726	28.379
Schwarz Criterion (BIC)	31.846	25.203	41.412	36.222

Standard errors in parentheses. P-values in brackets.

data set. The results of logit regressions using this data set are presented in Table 3. Our analysis in the previous paragraphs has shown that the conditional logit models are preferred (models V and VI). The results of these are reproduced in the first two columns of Table 3 for convenience. The last two columns present the results of the conditional logit regressions using the data set based on the date when the accession treaty was signed (models VII and VIII).

Similar to the results using the Entry into Force criterion, the estimates in models VII and VIII have the expected sign. Both domino variables (*Percentage of exports to EU* and *Index of EU integration*) are now highly significant as indicated by p-values close to zero. The *Trade openness* coefficient estimate is significant at the 5% level but the variable capturing difficulties in multilateral trade negotiations remains insignificant at any reasonable confidence level. All four models have a high explanatory power. A

likelihood ratio test reveals that when using the data set based on the Signature criterion, the model including the control variables (model VII) is better.[34]

Which of the two criteria is preferred? In my opinion, one can find arguments for both. Independent of whether one uses the Entry into Force or the Signature criterion, variables related to the domino theory seem to play an important role in a country's accession decision. The coefficient estimate of *Percentage of exports to EU* is significantly positive in all models. The other domino variable, *Index of EU integration*, is significant when using the data set based on the date when the accession treaty was signed. The reason for this ambiguity is that the degree of institutional integration may affect the probability of joining the EU both positively and negatively. Positively because of the domino theory, negatively because deep integration means that a future EU country will have to delegate many political and economic responsibilities to Brussels. Most countries dislike any loss of sovereignty.

Among the two explicitly included control variables, only the variable capturing the uncertainty in international trade relations (*Trade openness*) is marginally significant in some specifications. Difficulties in the WTO do not appear to have any impact on whether or not a country joins the EU, which contradicts the findings in Mansfield and Reinhardt (2001).

[34] Model VII vs. model VIII: $LR = 6.65$ and $\Pr(6.65 > \chi^2[2]) = 0.036 \rightarrow$ reject H_0

5. Conclusions

The primary purpose of this paper was to address the question whether domino effects constitute a reasonable explanation for the expansion in EU membership over the past forty years. While previous studies have sought empirical evidence on the topic, this paper is the first to use sophisticated econometric tools to subject Baldwin's (1993) domino theory to thorough scrutiny. Moreover, it is not limited to a simple estimation of the degree of trade diversion but also investigates the extent to which variables from the domino theory affect the likelihood that a country applies for EU membership.

In a first stage, bilateral trade flows between OECD countries were examined using a gravity model. Our results suggest that throughout the sample period (1962-2004), the EU exerted a strong impact on trade patterns among industrial countries, both through trade creation and trade diversion. Intra-EU trade flows were, on average throughout the period, over 35% higher than non-preferential flows. With regards to trade diversion, exports from non-EU countries to EU members were over 10% smaller than exports to countries that are not in the EU. We also looked at the evolution over time and detected an increasing degree of trade diversion from 1967-1972 and from 1980 until today. This exercise showed that during most of the sample period, trade diversion caused by the EU was significant, possibly constituting an important impetus for domino effects.

As the first part of the paper had established that the economic effects of the EU on non-members were considerable, the analysis went on to determine the factors that increase the probability of EU accession. We found that the relative importance of the EU bloc for a particular country has a significant impact on the accession decision. This supports the domino theory in that it confirms that as the size of an RTA increases, non-members are more likely to join. The effect of the degree of institutional integration in the EU is more ambiguous, which arguably reflects political anxieties. Two control variables, namely trade uncertainty and difficulties in multilateral trade negotiations at the WTO are unlikely to be important in a country's accession decision.

In essence, this paper has shown that the domino theory performs well in an empirical exercise. While we managed to control for a variety of omitted variables that caused trouble in some previous studies, a few issues still remain unresolved, most notably the reverse causality (or simultaneity) problem. The only feasible way to eliminate the resulting bias is an instrumental variables approach. Unfortunately, finding a proper instrument for the EU dummy is far

from easy, and it comes to nobody's surprise that the notorious "needle in the haystack" has not yet been found. In the meantime, one should exercise caution when interpreting our results and keep in mind the possible simultaneity bias.

In the future, this study could serve as a model for empirical analyses of domino effects in other parts of the world, such as America and Asia. Once its specifications have been refined further, economists may not only *explain* why countries joined a particular RTA, they could conceivably also *predict* which nation will be the next falling domino.

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7. Appendix

A. Data (analysed in section 3)

a) List of Countries and Membership in EU/EFTA

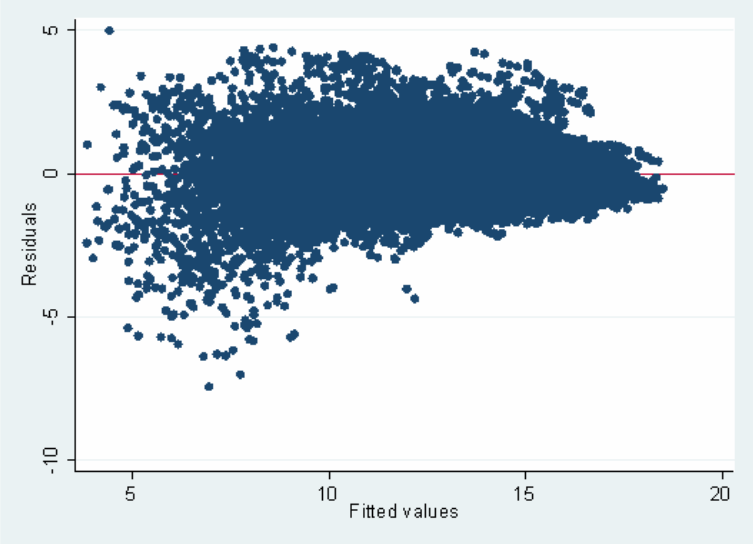
Country	EU	EFTA	none
Australia			1962-2004
Austria	1995-2004	1962-1994	
Belgium	1962-2004		
Canada			1962-2004
Germany	1962-2004		
Denmark	1973-2004	1962-1972	
Spain	1986-2004		1962-1985
Finland	1995-2004	1962-1994	
France	1962-2004		
Greece	1981-2004		1962-1980
Ireland	1973-2004		1962-1972
Iceland		1970-2004	1962-1969
Italy	1962-2004		
Japan			1962-2004
Korea			1962-2004
Luxembourg	1962-2004		
Mexico			1962-2004
Netherlands	1962-2004		
Norway		1962-2004	
New Zealand			1962-2004
Portugal	1986-2004	1962-1985	
Sweden	1995-2004	1962-1994	
Switzerland		1962-2004	
Turkey			1962-2004
United Kingdom	1973-2004	1962-1972	
United States			1962-2004

b) Data Sources

Bilateral imports (nominal)	UN Comtrade database extracted through WITS (World Integrated Trade Solution, wits.wordbank.org)
Nominal GDP (current US$)	World Bank Development Indicators (WDI) database (devdata.worldbank.org/dataonline/)
Total population	WDI (see above)
Date range	1962-2004

B. Heteroskedasticity

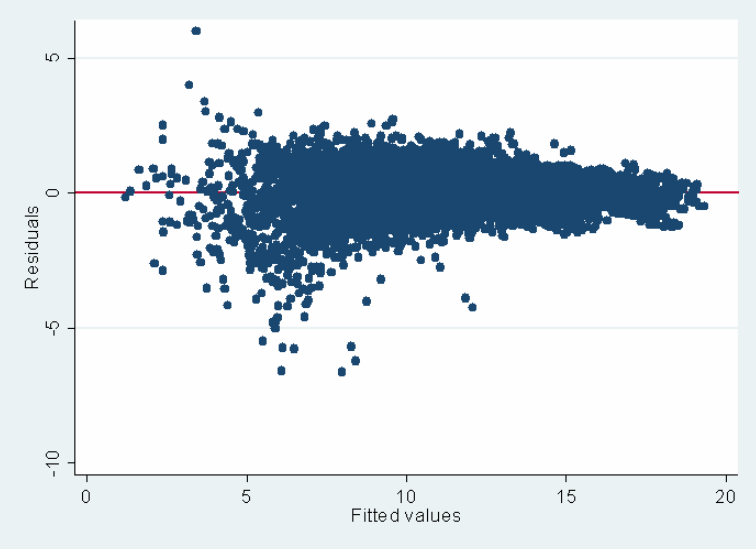
a) Residuals vs. Fitted Values for Model [6] (Country-Specific)



Breusch-Pagan test for heteroskedasticity (H_0: homoskedasticity):

BP = 3540.28 and Pr(3540.28 > χ^2[1]) = 0.000 → reject H_0

b) Residuals vs. Fitted Values for Model [8] (Pair-Specific)



Breusch-Pagan test for heteroskedasticity (H_0: homoskedasticity):

BP = 11825.07 and Pr(11825.07 > χ^2[1]) = 0.000 → reject H_0

C. Gravity Estimation of Averaged Trade Flows

Dependent Variable ln T_{odt}	**Country-specific and year effects**	**Pair-specific and year effects**
Independent Variables	**[6]**	**[8]**
Constant	-94.895 (4.594) [0.000]	-96.640 (2.765) [0.000]
ln GDP_oGDP_d	1.182 (0.041) [0.000]	1.176 (0.023) [0.000]
ln POP_oPOP_d	1.676 (0.131) [0.000]	1.775 (0.078) [0.000]
$EU \Leftrightarrow EU$	0.785 (0.027) [0.000]	0.414 (0.015) [0.000]
$EFTA \Leftrightarrow EFTA$	0.768 (0.040) [0.000]	0.051 (0.024) [0.032]
Number of observations	12 245	12 245
R^2	0.8795	0.9726
Adjusted R^2	0.8788	0.9718
Root MSE	0.8994	0.4341

Heteroskedasticity-robust standard errors in parentheses. P-values in brackets.

Note that when using averaged trade flows, it is completely arbitrary which country is the origin and which the destination. For this reason, we take the log of the product of both GDPs (or population) to get only one estimate for the GDP (population) coefficient.

D. Results of Regressions with Time-Interacted RTA Dummies

a) Equation [8] with Time-Interacted EU Dummies

```
Linear regression, absorbing indicators                     Number of obs =   22957
                                                            F(132, 22272) = 1247.30
                                                            Prob > F      =  0.0000
                                                            R-squared     =  0.9600
                                                            Adj R-squared =  0.9587
                                                            Root MSE      =  .53646

------------------------------------------------------------------------------
             |               Robust
    limports |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lgdp_o |   1.436149   .0283284    50.70   0.000     1.380623    1.491675
      lgdp_d |   1.074097   .0293805    36.56   0.000     1.016509    1.131685
      lpop_o |   .8284262   .0882303     9.39   0.000     .6554885    1.001364
      lpop_d |   1.413624   .1042743    13.56   0.000      1.20924    1.618009
        eu62 |  -.0260311   .1138669    -0.23   0.819    -.2492183    .1971561
        eu63 |   .2709173    .158336     1.71   0.087    -.0394325    .5812671
        eu64 |   .2766397   .1632753     1.69   0.090    -.0433914    .5966709
        eu65 |   .2786709   .1733693     1.61   0.108    -.0611452    .6184869
        eu66 |   .3224449   .1622854     1.99   0.047      .004354    .6405357
        eu67 |   .3173409   .1500167     2.12   0.034     .0232976    .6113841
        eu68 |   .3001333   .1442514     2.08   0.037     .0173904    .5828763
        eu69 |   .2286197   .0667879     3.42   0.001     .0977107    .3595286
        eu70 |   .1736313   .0603326     2.88   0.004     .0553751    .2918875
        eu71 |   .2175317   .0445594     4.88   0.000      .130192    .3048713
        eu72 |    .234959    .041995     5.59   0.000     .1526458    .3172723
        eu73 |   .0052671   .0493354     0.11   0.915    -.0914338    .1019679
        eu74 |   .0657565   .0525508     1.25   0.211    -.0372468    .1687597
        eu75 |   .1190043   .0462811     2.57   0.010     .0282901    .2097184
        eu76 |   .3360351   .0428081     7.85   0.000     .2521282    .4199419
        eu77 |   .3182354   .0467937     6.80   0.000     .2265165    .4099543
        eu78 |   .3108765   .0500234     6.21   0.000     .2128272    .4089259
        eu79 |   .2301807   .0433895     5.30   0.000     .1451342    .3152272
        eu80 |   .1996012   .0395665     5.04   0.000      .122048    .2771544
        eu81 |   .3102162   .0363445     8.54   0.000     .2389784    .3814541
        eu82 |   .3597291   .0354954    10.13   0.000     .2901556    .4293027
        eu83 |   .4119852   .0383386    10.75   0.000     .3368388    .4871316
        eu84 |    .449558   .0374322    12.01   0.000     .3761882    .5229278
        eu85 |   .4475553    .038105    11.75   0.000     .3728669    .5222438
        eu86 |   .2688983   .0346062     7.77   0.000     .2010677    .3367289
        eu87 |   .2921704   .0372716     7.84   0.000     .2191155    .3652254
        eu88 |   .3633401   .0374118     9.71   0.000     .2900103    .4366698
        eu89 |     .45779   .0394014    11.62   0.000     .3805605    .5350195
        eu90 |   .3809318   .0389146     9.79   0.000     .3046564    .4572071
        eu91 |   .3892403   .0361679    10.76   0.000     .3183486    .4601319
        eu92 |   .3253779   .0394033     8.26   0.000     .2481447    .4026111
        eu93 |   .3140728   .0403582     7.78   0.000     .2349678    .3931778
        eu94 |   .3088928   .0428237     7.21   0.000     .2249553    .3928304
        eu95 |   .1870361   .0468753     3.99   0.000     .0951571     .278915
        eu96 |   .2045656    .044962     4.55   0.000     .1164369    .2926942
        eu97 |   .2597774   .0439004     5.92   0.000     .1737295    .3458253
        eu98 |   .2080543   .0448215     4.64   0.000     .1202009    .2959077
        eu99 |   .2833621   .0455002     6.23   0.000     .1941785    .3725458
        eu00 |   .4119493   .0484016     8.51   0.000     .3170787    .5068199
        eu01 |   .3801404    .048277     7.87   0.000      .285514    .4747668
        eu02 |   .3845748   .0504474     7.62   0.000     .2856944    .4834552
        eu03 |   .3059692   .0498596     6.14   0.000     .2082409    .4036975
        eu04 |   .2782422   .0532735     5.22   0.000     .1738223    .3826621
   eu_noeu62 |  -.1706811   .1136403    -1.50   0.133    -.3934241    .0520618
   eu_noeu63 |   .0449825    .105077     0.43   0.669    -.1609758    .2509408
   eu_noeu64 |   .0863126   .0889574     0.97   0.332    -.0880501    .2606753
   eu_noeu65 |   .0686346   .0824768     0.83   0.405    -.0930256    .2302949
   eu_noeu66 |   .0623399   .0796549     0.78   0.434    -.0937893    .2184691
   eu_noeu67 |  -.0044169   .0751366    -0.06   0.953     -.15169    .1428562
   eu_noeu68 |  -.0993577   .0698232    -1.42   0.155    -.236216    .0375007
   eu_noeu69 |  -.2274075   .0576468    -3.94   0.000    -.3403994   -.1144156
   eu_noeu70 |    -.30861   .0575252    -5.36   0.000    -.4213634   -.1958566
   eu_noeu71 |  -.3596935   .0515638    -6.98   0.000    -.4607621   -.2586249
   eu_noeu72 |  -.3281896   .0458044    -7.17   0.000    -.4179695   -.2384098
   eu_noeu73 |  -.1613648   .0490224    -3.29   0.001    -.2574522   -.0652774
   eu_noeu74 |  -.2018928   .0503831    -4.01   0.000    -.3006473   -.1031384
   eu_noeu75 |  -.1866833   .0540994    -3.45   0.001    -.2927218   -.0806447
```

```
   eu_noeu76 |  -.0293863   .0488918    -0.60   0.548    -.1252178    .0664451
   eu_noeu77 |  -.0175684    .045292    -0.39   0.698    -.1063438    .0712071
   eu_noeu78 |  -.0064988    .049192    -0.13   0.895    -.1029186    .0899211
   eu_noeu79 |  -.0308692   .0488005    -0.63   0.527    -.1265217    .0647832
   eu_noeu80 |   -.016879   .0493594    -0.34   0.732     -.113627     .079869
   eu_noeu81 |  -.1272876    .051747    -2.46   0.014    -.2287154   -.0258598
   eu_noeu82 |  -.1062894   .0518958    -2.05   0.041    -.2080087    -.00457
   eu_noeu83 |  -.0691354   .0531022    -1.30   0.193    -.1732194    .0349487
   eu_noeu84 |   -.087274   .0507903    -1.72   0.086    -.1868264    .0122785
   eu_noeu85 |  -.1088395   .0496609    -2.19   0.028    -.2061784   -.0115007
   eu_noeu86 |   -.153331   .0437717    -3.50   0.000    -.2391266   -.0675354
   eu_noeu87 |  -.0976566   .0511896    -1.91   0.056    -.1979918    .0026787
   eu_noeu88 |  -.1073067   .0470502    -2.28   0.023    -.1995284    -.015085
   eu_noeu89 |  -.1007434   .0452676    -2.23   0.026     -.189471   -.0120158
   eu_noeu90 |  -.0812493   .0455599    -1.78   0.075      -.17055    .0080513
   eu_noeu91 |  -.0821759   .0432407    -1.90   0.057    -.1669307    .0025789
   eu_noeu92 |  -.0932432    .045077    -2.07   0.039    -.1815973   -.0048891
   eu_noeu93 |  -.1383098   .0489117    -2.83   0.005    -.2341801   -.0424395
   eu_noeu94 |  -.2256639   .0527616    -4.28   0.000    -.3290803   -.1222475
   eu_noeu95 |  -.2429198   .0629202    -3.86   0.000    -.3662478   -.1195918
   eu_noeu96 |  -.2742695   .0601409    -4.56   0.000    -.3921498   -.1563891
   eu_noeu97 |  -.2818376   .0568911    -4.95   0.000    -.3933481    -.170327
   eu_noeu98 |  -.1775892    .057901    -3.07   0.002    -.2910793   -.0640991
   eu_noeu99 |  -.2221789   .0581453    -3.82   0.000    -.3361478    -.10821
   eu_noeu00 |   -.158887   .0627706    -2.53   0.011    -.2819218   -.0358521
   eu_noeu01 |  -.1803484   .0607209    -2.97   0.003    -.2993658   -.0613311
   eu_noeu02 |  -.1912912   .0606722    -3.15   0.002     -.310213   -.0723694
   eu_noeu03 |  -.1888115   .0632246    -2.99   0.003    -.3127363   -.0648868
   eu_noeu04 |  -.2094143    .069258    -3.02   0.003    -.3451649   -.0736637
          y2 |   -.190166   .0757438    -2.51   0.012    -.3386292   -.0417027
          y3 |  -.3615975    .075449    -4.79   0.000    -.5094829   -.2137122
          y4 |  -.4965297   .0741428    -6.70   0.000    -.6418548   -.3512047
          y5 |  -.6256006   .0751579    -8.32   0.000    -.7729154   -.4782859
          y6 |  -.7540166   .0718653   -10.49   0.000    -.8948777   -.6131556
          y7 |   -.810719   .0688087   -11.78   0.000     -.945589    -.675849
          y8 |  -.9414405   .0730897   -12.88   0.000    -1.084701   -.7981796
          y9 |  -1.004682   .0755202   -13.30   0.000    -1.152707    -.856657
         y10 |  -1.234332   .0750427   -16.45   0.000    -1.381421   -1.087243
         y11 |  -1.499215   .0766504   -19.56   0.000    -1.649455   -1.348975
         y12 |  -1.756501   .0828735   -21.19   0.000    -1.918939   -1.594063
         y13 |  -1.849914   .0886396   -20.87   0.000    -2.023654   -1.676174
         y14 |  -2.227568   .0914191   -24.37   0.000    -2.406756    -2.04838
         y15 |  -2.394353    .092233   -25.96   0.000    -2.575136    -2.21357
         y16 |  -2.552907   .0947354   -26.95   0.000    -2.738595   -2.367219
         y17 |  -2.900013   .1020496   -28.42   0.000    -3.100037   -2.699988
         y18 |  -3.034557   .1072109   -28.30   0.000    -3.244698   -2.824416
         y19 |  -3.218844   .1120683   -28.72   0.000    -3.438506   -2.999183
         y20 |  -3.151992   .1105303   -28.52   0.000    -3.368639   -2.935344
         y21 |  -3.147316   .1097028   -28.69   0.000    -3.362341   -2.932291
         y22 |  -3.129395   .1102384   -28.39   0.000     -3.34547    -2.91332
         y23 |  -3.039123   .1100758   -27.61   0.000    -3.254879   -2.823366
         y24 |  -3.048694   .1114249   -27.36   0.000    -3.267095   -2.830293
         y25 |  -3.451258   .1190156   -29.00   0.000    -3.684537   -3.217979
         y26 |  -3.749184   .1269657   -29.53   0.000    -3.998046   -3.500322
         y27 |  -3.971384    .132523   -29.97   0.000    -4.231139    -3.71163
         y28 |   -4.03379   .1346896   -29.95   0.000    -4.297791   -3.769788
         y29 |  -4.310701   .1399608   -30.80   0.000    -4.585034   -4.036367
         y30 |  -4.433046    .140904   -31.46   0.000    -4.709227   -4.156864
         y31 |  -4.549106   .1427364   -31.87   0.000    -4.828879   -4.269332
         y32 |  -4.517845   .1417383   -31.87   0.000    -4.795662   -4.240027
         y33 |  -4.558043   .1449401   -31.45   0.000    -4.842136    -4.27395
         y34 |  -4.693054   .1518677   -30.90   0.000    -4.990726   -4.395383
         y35 |  -4.749362   .1531442   -31.01   0.000    -5.049535   -4.449188
         y36 |  -4.670643   .1521981   -30.69   0.000    -4.968962   -4.372324
         y37 |  -4.662748   .1511024   -30.86   0.000    -4.958919   -4.366577
         y38 |   -4.75214   .1536684   -30.92   0.000    -5.053341   -4.450939
         y39 |  -4.714739   .1545646   -30.50   0.000    -5.017696   -4.411781
         y40 |  -4.727479   .1542552   -30.65   0.000    -5.029831   -4.425128
         y41 |  -4.923385   .1579708   -31.17   0.000    -5.233019   -4.613751
         y42 |  -5.186881   .1641889   -31.59   0.000    -5.508702   -4.865059
         y43 |  -5.384064   .1701362   -31.65   0.000    -5.717543   -5.050585
       _cons |  -85.60301   2.519391   -33.98   0.000    -90.54119   -80.66482
-------------+----------------------------------------------------------------
        pair |   absorbed                                     (553 categories)
```

b) Equation [9] with Time-Interacted EFTA Dummies

```
Linear regression, absorbing indicators                     Number of obs =   22957
                                                            F(132, 22272) = 1106.56
                                                            Prob > F      =  0.0000
                                                            R-squared     =  0.9594
                                                            Adj R-squared =  0.9582
                                                            Root MSE      =  .54013

------------------------------------------------------------------------------
             |               Robust
    limports |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lgdp_o |   1.432962   .0284716    50.33   0.000     1.377156    1.488768
      lgdp_d |   1.055201   .0294496    35.83   0.000     .9974776    1.112924
      lpop_o |   .3523922   .0804551     4.38   0.000     .1946945    .5100899
      lpop_d |   1.056209   .0895204    11.80   0.000     .8807426    1.231675
      efta62 |  -.2395771   .1178043    -2.03   0.042    -.4704819   -.0086723
      efta63 |  -.1832159   .0950057    -1.93   0.054    -.3694339     .003002
      efta64 |  -.1138008   .0863731    -1.32   0.188    -.2830982    .0554965
      efta65 |   -.041634   .0814595    -0.51   0.609    -.2013003    .1180324
      efta66 |   .0099142   .0781882     0.13   0.899    -.1433403    .1631686
      efta67 |   .0240979   .0784974     0.31   0.759    -.1297624    .1779583
      efta68 |   .0965637   .0719367     1.34   0.179    -.0444373    .2375647
      efta69 |   .2465614   .0725889     3.40   0.001     .1042819    .3888408
      efta70 |   .4426822   .0739803     5.98   0.000     .2976756    .5876889
      efta71 |    .436054    .065142     6.69   0.000      .308371    .5637369
      efta72 |   .3872727   .0676773     5.72   0.000     .2546204     .519925
      efta73 |   .4355996   .0706651     6.16   0.000     .2970911    .5741081
      efta74 |   .3647525   .0657026     5.55   0.000     .2359707    .4935342
      efta75 |   .3145065   .0731754     4.30   0.000     .1710776    .4579354
      efta76 |   .1297491   .0563772     2.30   0.021     .0192459    .2402524
      efta77 |   .0426834   .0497537     0.86   0.391    -.0548374    .1402041
      efta78 |   .0767242   .0519202     1.48   0.139    -.0250431    .1784915
      efta79 |   .0964285   .0653383     1.48   0.140    -.0316391    .2244961
      efta80 |   .1101497   .0649093     1.70   0.090    -.0170771    .2373766
      efta81 |   .0685459   .0583549     1.17   0.240    -.0458339    .1829257
      efta82 |   .0471566   .0762916     0.62   0.537    -.1023804    .1966935
      efta83 |   .1031825   .0762645     1.35   0.176    -.0463013    .2526663
      efta84 |   .0286009   .0773999     0.37   0.712    -.1231084    .1803102
      efta85 |   .0434678   .0687695     0.63   0.527    -.0913253     .178261
      efta86 |   -.105627   .0536888    -1.97   0.049    -.2108608   -.0003932
      efta87 |  -.1496227   .0618185    -2.42   0.016    -.2707913   -.0284541
      efta88 |  -.1762267    .055971    -3.15   0.002    -.2859337   -.0665197
      efta89 |  -.1688814   .0668405    -2.53   0.012    -.2998936   -.0378693
      efta90 |  -.2594001   .0696935    -3.72   0.000    -.3960042   -.1227959
      efta91 |  -.2930982   .0695765    -4.21   0.000    -.4294731   -.1567234
      efta92 |  -.1901031   .0557518    -3.41   0.001    -.2993805   -.0808256
      efta93 |  -.0381711   .0654014    -0.58   0.559    -.1663625    .0900204
      efta94 |  -.0759002   .0665915    -1.14   0.254    -.2064243    .0546239
      efta95 |  -.3056477   .1524598    -2.00   0.045    -.6044795   -.0068158
      efta96 |  -.1819294   .1647834    -1.10   0.270    -.5049165    .1410577
      efta97 |  -.0804467   .2135651    -0.38   0.706    -.4990494     .338156
      efta98 |  -.1720366   .1487178    -1.16   0.247    -.4635339    .1194607
      efta99 |  -.3422524   .1376568    -2.49   0.013    -.6120694   -.0724353
      efta00 |  -.5108373   .1406222    -3.63   0.000    -.7864666   -.2352079
      efta01 |  -.4221561   .1806099    -2.34   0.019    -.7761643   -.0681479
      efta02 |  -.6009564   .1425418    -4.22   0.000    -.8803485   -.3215644
      efta03 |  -.5883034   .1509159    -3.90   0.000    -.8841092   -.2924976
      efta04 |   -.554964   .1215635    -4.57   0.000     -.793237   -.3166909
efta_noeft62 |   .2239863   .1138002     1.97   0.049     .0009299    .4470427
efta_noeft63 |   .1574246   .1005356     1.57   0.117    -.0396323    .3544814
efta_noeft64 |    .135487    .101154     1.34   0.180    -.0627821    .3337561
efta_noeft65 |   .1498069   .0891194     1.68   0.093    -.0248734    .3244873
efta_noeft66 |   .1984348    .082447     2.41   0.016     .0368328    .3600369
efta_noeft67 |   .0907614   .0704714     1.29   0.198    -.0473676    .2288903
efta_noeft68 |   .0153509   .0678507     0.23   0.821    -.1176412    .1483429
efta_noeft69 |   .0940412   .0677731     1.39   0.165    -.0387989    .2268813
efta_noeft70 |   .1258724   .0739566     1.70   0.089    -.0190877    .2708325
efta_noeft71 |   .1536642   .0680014     2.26   0.024     .0203766    .2869517
efta_noeft72 |   .1448802   .0563214     2.57   0.010     .0344864    .2552741
efta_noeft73 |   .1299309   .0610429     2.13   0.033     .0102826    .2495792
efta_noeft74 |   .1667583   .0587668     2.84   0.005     .0515713    .2819453
efta_noeft75 |   .1863768   .0655574     2.84   0.004     .0578796     .314874
efta_noeft76 |   .0903439   .0530991     1.70   0.089    -.0137342     .194422
efta_noeft77 |   .1081027   .0521825     2.07   0.038     .0058213    .2103841
efta_noeft78 |   .0354991    .053365     0.67   0.506      -.0691    .1400982
efta_noeft79 |   .0124665   .0510963     0.24   0.807    -.0876858    .1126188
efta_noeft80 |   .1033183   .0587591     1.76   0.079    -.0118536    .2184902
```

```
efta_noeft81 |   .0624266   .0511193     1.22   0.222    -.0377708    .1626239
efta_noeft82 |   .0611456   .0564819     1.08   0.279    -.0495629    .1718541
efta_noeft83 |    .123478   .0526769     2.34   0.019     .0202276    .2267284
efta_noeft84 |   .0132447   .0513634     0.26   0.797    -.0874311    .1139205
efta_noeft85 |   .0320598   .0514677     0.62   0.533    -.0688206    .1329401
efta_noeft86 |   .0804657   .0451946     1.78   0.075    -.0081189    .1690504
efta_noeft87 |   .1129471   .0482405     2.34   0.019     .0183923     .207502
efta_noeft88 |   .0574236   .0495028     1.16   0.246    -.0396053    .1544525
efta_noeft89 |  -.0075183    .062232    -0.12   0.904    -.1294975    .1144608
efta_noeft90 |  -.0901653   .0600401    -1.50   0.133    -.2078481    .0275175
efta_noeft91 |  -.0114362   .0451892    -0.25   0.800    -.1000102    .0771378
efta_noeft92 |  -.0110227   .0482145    -0.23   0.819    -.1055264    .0834811
efta_noeft93 |   .0061782   .0490133     0.13   0.900    -.0898912    .1022477
efta_noeft94 |   .0146065    .050634     0.29   0.773    -.0846396    .1138526
efta_noeft95 |  -.1358321   .0703048    -1.93   0.053    -.2736346    .0019703
efta_noeft96 |  -.1529722   .0654182    -2.34   0.019    -.2811964    -.024748
efta_noeft97 |  -.1400763   .0614762    -2.28   0.023    -.2605739   -.0195787
efta_noeft98 |  -.0657979   .0630185    -1.04   0.296    -.1893186    .0577229
efta_noeft99 |  -.1456813   .0629309    -2.31   0.021    -.2690303   -.0223324
efta_noeft00 |   -.227286   .0706237    -3.22   0.001    -.3657135   -.0888585
efta_noeft01 |   -.273825   .0690684    -3.96   0.000    -.4092039    -.138446
efta_noeft02 |  -.3500982   .0681626    -5.14   0.000    -.4837017   -.2164947
efta_noeft03 |  -.3134187   .0680785    -4.60   0.000    -.4468574   -.1799801
efta_noeft04 |  -.2691474    .084883    -3.17   0.002     -.435524   -.1027708
          y2 |  -.1155945   .0887953    -1.30   0.193    -.2896396    .0584506
          y3 |  -.2744622   .0863273    -3.18   0.001    -.4436698   -.1052546
          y4 |  -.4175732   .0857592    -4.87   0.000    -.5856672   -.2494791
          y5 |   -.555407   .0881174    -6.30   0.000    -.7281233   -.3826906
          y6 |  -.6584813     .08381    -7.86   0.000    -.8227547   -.4942078
          y7 |  -.7114109   .0784795    -9.06   0.000    -.8652363   -.5575855
          y8 |  -.8950086   .0840509   -10.65   0.000    -1.059754    -.730263
          y9 |  -1.013887   .0867204   -11.69   0.000    -1.183865   -.8439094
         y10 |  -1.245169   .0829848   -15.00   0.000    -1.407825   -1.082513
         y11 |  -1.483166   .0845906   -17.53   0.000    -1.648969   -1.317363
         y12 |  -1.676339   .0876079   -19.13   0.000    -1.848057   -1.504621
         y13 |  -1.762946    .093087   -18.94   0.000    -1.945403   -1.580489
         y14 |  -2.121256   .0959391   -22.11   0.000    -2.309304   -1.933209
         y15 |  -2.186187   .0972093   -22.49   0.000    -2.376724   -1.995649
         y16 |   -2.33253   .0996688   -23.40   0.000    -2.527888   -2.137172
         y17 |  -2.654709   .1069482   -24.82   0.000    -2.864335   -2.445083
         y18 |  -2.789628   .1122338   -24.86   0.000    -3.009614   -2.569642
         y19 |  -2.986024   .1164422   -25.64   0.000    -3.214259   -2.757789
         y20 |  -2.909637   .1145821   -25.39   0.000    -3.134226   -2.685048
         y21 |  -2.886004   .1133861   -25.45   0.000    -3.108249   -2.663759
         y22 |  -2.865279   .1140062   -25.13   0.000     -3.08874   -2.641819
         y23 |  -2.740918   .1134606   -24.16   0.000    -2.963308   -2.518527
         y24 |  -2.756683   .1146786   -24.04   0.000    -2.981462   -2.531905
         y25 |  -3.165714    .121772   -26.00   0.000    -3.404396   -2.927033
         y26 |  -3.439063   .1294553   -26.57   0.000    -3.692804   -3.185321
         y27 |  -3.632121   .1342035   -27.06   0.000     -3.89517   -3.369073
         y28 |  -3.655045   .1354295   -26.99   0.000    -3.920496   -3.389593
         y29 |  -3.912187   .1416229   -27.62   0.000    -4.189778   -3.634596
         y30 |  -4.037698   .1433965   -28.16   0.000    -4.318765   -3.756631
         y31 |   -4.16662   .1459849   -28.54   0.000     -4.45276   -3.880479
         y32 |  -4.157309   .1447549   -28.72   0.000    -4.441039    -3.87358
         y33 |  -4.213838    .147832   -28.50   0.000    -4.503599   -3.924077
         y34 |  -4.326836   .1524242   -28.39   0.000    -4.625598   -4.028074
         y35 |   -4.37831   .1536728   -28.49   0.000    -4.679519     -4.0771
         y36 |  -4.281747   .1522707   -28.12   0.000    -4.580208   -3.983285
         y37 |  -4.267562   .1522841   -28.02   0.000    -4.566049   -3.969074
         y38 |  -4.326383   .1539257   -28.11   0.000    -4.628088   -4.024678
         y39 |  -4.214991   .1529229   -27.56   0.000    -4.514731   -3.915252
         y40 |  -4.235233   .1531349   -27.66   0.000    -4.535388   -3.935077
         y41 |  -4.414334   .1564592   -28.21   0.000    -4.721005   -4.107663
         y42 |  -4.697964   .1636664   -28.70   0.000    -5.018762   -4.377166
         y43 |   -4.90741   .1691147   -29.02   0.000    -5.238887   -4.575933
       _cons |  -71.52346   2.283555   -31.32   0.000    -75.99939   -67.04753
-------------+----------------------------------------------------------------
        pair |   absorbed                                     (553 categories)
```

E. Data (analysed in section 4)

a) Dependent Variable $\Pr(EU_{it} = 1)$

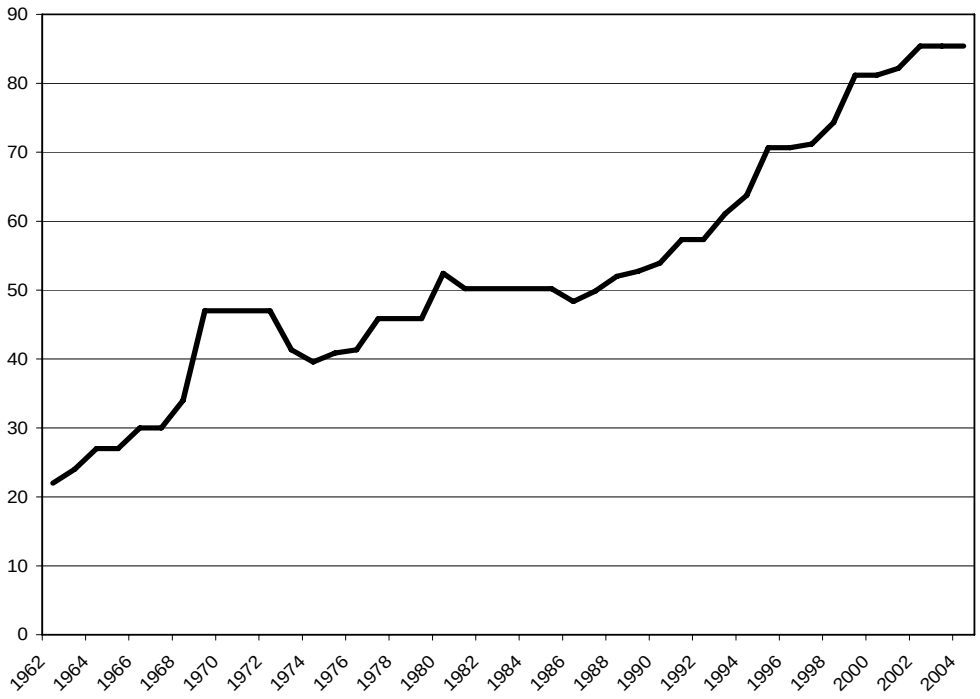
Accession Treaty	**Date Signed**	**Date Entering Force**
UK, Denmark and Ireland	22 January 1972	1 January 1973
Greece	28 May 1979	1 January 1981
Spain and Portugal	12 June 1985	1 January 1986
Austria, Finland and Sweden	24 June 1994	1 January 1995

Source: British Management Data Foundation (www.eurotreaties.com)

b) Data Sources

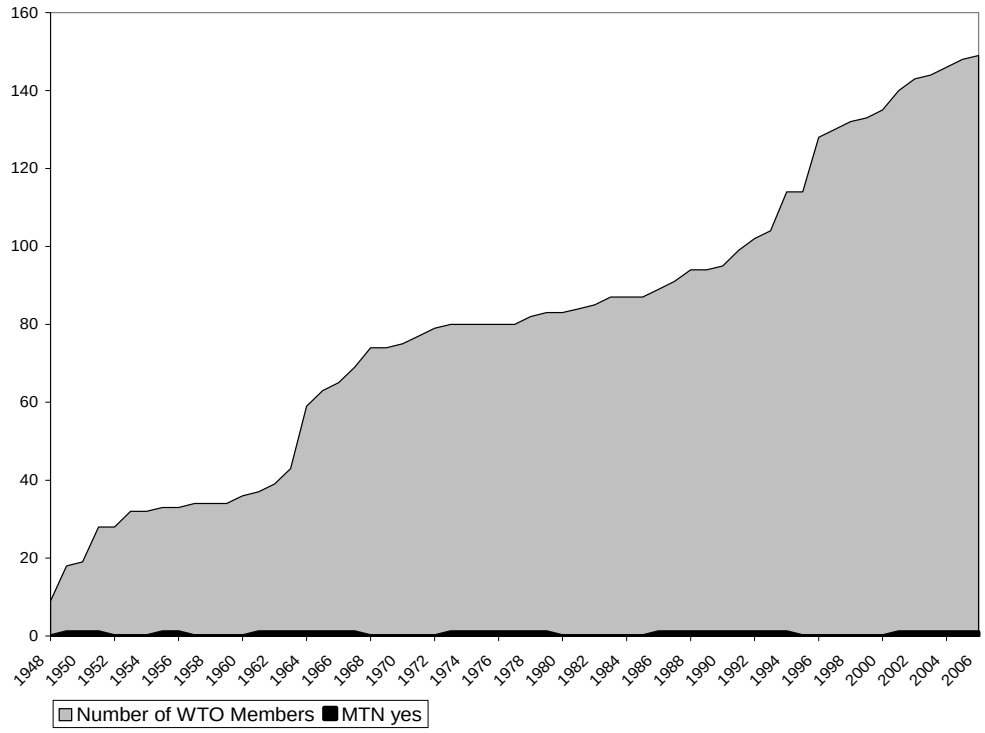
Nominal exports	UN Comtrade database extracted through WITS (World Integrated Trade Solution, wits.wordbank.org)
Index of EU integration	Constructed by author using data from Mongelli, Dorrucci and Agur (2005)
Trade openness	World Bank Development Indicators (WDI) database (devdata.worldbank.org/dataonline/)
WTO membership Multilateral trade rounds	www.wto.org
Date range	1962-2004

c) Index of EU institutional integration, 1962-2004



Source: author's calculations; Mongelli, Dorrucci and Agur (2005)

d) Evolution of WTO/GATT Membership



Source: WTO