ON THE TRADE BALANCE EFFECTS
OF FREE TRADE AGREEMENTS
BETWEEN THE EU-15 AND THE CEEC-4 COUNTRIES

Guglielmo Maria Caporale[1*]
Christophe Rault[2]
Ana Maria Sova[3]
Robert Sova[4]

[1] Centre for Empirical Finance, Brunel University, London
[2] LEO, University of Orleans, IZA and WDI
[3] CES, Sorbonne University, and E.B.R.C
[4] CES, Sorbonne University, A.S.E and E.B.R.C

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Abstract

The expansion of regionalism has spawned an extensive theoretical literature analysing the effects of Free Trade Agreements (FTAs) on trade flows. In this paper we focus on FTAs (also called European agreements) between the European Union (EU-15) and the Central and Eastern European countries (CEEC-4, i.e. Bulgaria, Hungary, Poland and Romania) and model their effects on trade flows by treating the agreement variable as endogenous. Our theoretical framework is the gravity model, and the econometric method used to isolate and eliminate the potential endogeneity bias of the agreement variable is the fixed effect vector decomposition (FEVD) technique. Our estimation results indicate a positive and significant impact of FTAs on trade flows. However, exports and imports are affected differently, leading to some disparity in trade flow performance between countries. Therefore, there is an asymmetric impact on the trade balance, the agreement variable resulting in a trade balance deficit in the CEEC.

Corresponding author: Professor Guglielmo Maria Caporale, Centre for Empirical Finance, Brunel University, Uxbridge, Middlesex UB8 3PH, UK. Tel.: +44 (0)1895 266713. Fax: +44 (0)1895 269770. *Email:* Guglielmo-Maria.Caporale@brunel.ac.uk

1. Introduction

Following the new wave of regionalisation in the eighties, regional integration has again been extensively investigated both in the theoretical and empirical literature. Recent analyses are based on Viner's (1950) framework but also include theoretical ideas from the new trade theory and economic geography, being concerned with the impact of integration on global welfare. The innovation compared to the first wave studies consists in taking into account the dynamic effects of geographical size, non-economic gains, industrial localisation, and economies of scale.

The enlargement of the European Union (EU) to 27 countries which was proposed during the nineties was unprecedented in terms of the number of countries and the changes which were implied, hence representing a challenge for both EU member countries and Central and Eastern European countries (CEEC). It was a very important development for the future of the European continent. From a political point of view, it ensured stability after the troubled years of the Cold War. From an economic point of view, because of the size and the population of the countries involved and the development gap relative to the EU, the transition towards a market economy has not been without difficulties for the CEEC.

There exists already an extensive literature analyzing the effects of regional free trade agreements (FTAs) on trade flows and stressing the role of regionalisation. However, the evidence is mixed. Most studies assume that the FTA formation (i.e. the choice of partner countries) is exogenous, but some papers highlight the potential endogeneity bias in estimating the effects of FTAs on trade volumes (Magee, 2003; Baier and Bergstrand, 2004). Regional agreements require the assent of two governments. According to Grossman and Helpman (1995) a FTA assumes a relative balance in the potential trade between the partner countries.

In this paper we focus on association agreements between four Central and Eastern European countries (CEEC-4, i.e. Bulgaria, Hungary, Poland and Romania) and

European Union member states (EU-15, i.e. Austria, Belgium-Luxemburg, Denmark, England, Finland, France, Germany, Greece, Holland, Ireland, Italy, Portugal, Spain, Sweden) in the context of EU enlargement towards the East. Our econometric analysis is based on the gravity model and tries to determine the effects of association agreements on trade flows treating FTAs as endogenous. We are particularly interested in whether such European agreements have increased trade flows between their members and, if so, by how much and how; in particular, we investigate whether their impact is symmetric or not. To address these issues, we examine the links between exports and imports volume introducing a dummy variable which represents the association agreement. Further, we use panel data techniques to isolate and eliminate the potential endogeneity bias of the agreement variable.

The remainder of the paper is organised as follows. In Section 3 we discuss briefly European agreements and the issue of endogeneity in regional agreements. In Section 3 we outline the theoretical framework, i.e. the gravity model. In sections 4 we discuss alternative econometric methods to estimate gravity models, whilst the empirical analysis is presented in Section 5. Section 6 summarises the main findings and offers some concluding remarks.

2. European Agreements and the Endogeneity Issue

EU enlargement is not a new phenomenon, as the EU has already been enlarged several times since its creation: the year 1973 marked the accession of Denmark, the United Kingdom and Ireland; 1981, of Greece; 1986, of Spain and Portugal; 1995, of Austria, Sweden and Finland. However, EU enlargement towards the East is different both politically and economically, as it is the first time that countries belonging to the old communist bloc have applied for EU membership, and on this occasion integration has increased by as much as a third the EU population and territory (and to a lesser extent its wealth).

The EU proposed two basic strategic objectives for enlargement. Firstly, the creation of a Europe which guarantees peace, stability, democracy and respect of the human rights of minorities. Secondly, the creation of an open and competitive market able to improve the standard of living in the CEEC, gradually achieving real convergence. As a first step, in the early nineties all candidate countries signed bilateral "European Agreements" or "Association Agreements" with the EU creating preferential trade relationships.[1] These included a time schedule for trade liberalisation between the signatories, with the EU agreeing to reduce barriers more quickly than the CEEC. However, initially tariff and non-tariff barriers were not dismantled for sensitive sectors such as agriculture and textiles.

The expansion of regionalism has spawned an extensive literature on the effects of FTAs on trade flows and the choice of countries to form a preferential trade agreement. This literature provides some motivations based on welfare-enhancing and political arguments to explain association agreements. Since Viner (1950) most studies have analysed the welfare gains or losses from FTAs for member countries. FTAs have a positive impact on welfare if trade creation exceeds trade diversion. Factors accounting for the probability that two countries sign a regional agreement can be divided in three groups: (i) geography factors, (ii) intra-industry trade determinants, (iii) inter-industry trade determinants. In brief, two countries are more likely to sign an agreement if they are closer geographically, similar in size and differ in terms of factor endowment ratios:

i) The net welfare gain is higher the closer the two countries are, because of trade creation. Several studies (see Frankel, Stein and Wei, 1996; Frankel and Wei, 1998) include geographical proximity in their analysis of a FTA formation. The rationale is the existence of transport costs (Helpman and Krugman, 1985), leading to the concept of "natural trade partners" based on geographical distance. Krugman (1991b) shows that in the case of agreements between geographically close countries trade creation is sizable (see also Wonnacot and Lutz, 1989), but the concept of "natural" partners has attracted

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[1] Hungary (1991), Poland (1991), Romania (1993), Czech Republic (1993), Slovakia (1993), Bulgaria (1993), Latvia (1995), Estonia (1995), Lithuania (1995), Slovenia (1995).

criticism, on the grounds that geographical proximity and initially high trade volumes do not necessarily ensure trade creation (see Bhagwati and Panagaryia, 1996).

(ii) The larger and more similar in economic size the two countries signing a trade agreement are, the higher the welfare gains from trade creation, which are achieved by exploiting economies of scale in the presence of differentiated products.

(iii)   The greater the difference in endowment ratios between two countries, the higher the potential welfare gains from trade creation reflecting traditional comparative advantages.

Consequently, countries which sign a regional agreement tend to have similar economic characteristics, which leads to trade creation and welfare gains.

Non-economic objectives can also be behind regional agreements (Johnson 1965b, Cooper and Massell (1965), Wonnacott and Lutz, 1989, Magee, 2003, Baier and Bergstrand, 2004). In particular, better political decision-making, a guarantee of policy irreversibility, and bigger negotiating power with third parties could also explain such agreements (especially when the agreement takes the form of a customs union with a common exterior tariff – see Schiff and Winters, 1998). Also, democratic countries are more interested in consumers' welfare and more likely to sign agreements with other democratic partners. Further, De Melo *et al.* (1993) showed that regional agreements make the implementation of policies more effective owing to a dilution effect of preferences: the lobby capacity of interest groups is lower in a regional as opposed ot national framework. Finally, such agreements make domestic policy reforms irreversible (Fernandez et Portes, 1998).

The first empirical studies analysing the trade effects of a FTA included a FTA dummy variable in a gravity model. Most of them treated FTA formation (choice of partner countries) as exogenous. The evidence was mixed. For instance, some studies found a significant impact of EC (European Community) agreements on trade flows between members (Aitken, 1973), whilst others concluded that this effect was insignificant (Bergstrand, 1985) or even negative (Frankel, 1997). This highlighted the potential

endogeneity bias affecting the preferential agreement variable, and subsequently a few studies tried to address the endogeneity issue by considering the role of economic factors, democratic freedom, and transport costs in the decision to conclude a regional agreement. Baier and Bergstrand (2004) found that pairs of countries that sign an agreement tend to share common economic characteristics, which results in net trade creation and welfare growth. Magee (2003) measured the effects of preferential agreements on trade volumes treating FTAs as endogenous, estimating a system of simultaneous equations with 2SLS. He found that it is likely that two countries will sign an agreement if they are closer geographically, are similar in size and are both democracies.

Ghosh and Yamarik (2004) tried to test the robustness of the regional agreement effect by using cross-section data. They concluded that its effect may be over- or underestimated owing to the potential endogeneity of this variable. These findings were confirmed by Baier and Bergstrand (2007), who pointed out that the regional agreement variable is not exogenous and the estimation of a gravity model using cross-section data for investigating the quantitative effect of this variable on trade flows can be biased because of unobservable heterogeneity or/and omitted variables. The bias resulting from not considering this variable as endogenous is an important issue; it can be the consequence of omitted variables that can be correlated with the regional agreement variable. Panel data (fixed effects) methods were shown to be suitable to take endogeneity into account.

3. Trade Flow Effects of FTAs: The Gravity Model

Our theoretical framework to examine the trade flows effects of FTAs (treating association agreements as endogenous) is the gravity model [2], in which trade flows from country i to country j are a function of the supply of the exporter country and of the demand of the importer country and trade barriers. In other words, national incomes of two countries, transport costs (transaction costs) and regional agreements are the basic determinants of trade.

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[2] The popularity of the gravity model is highlighted by Eichengreen and Irwin (1995) who consider it "the workhorse for empirical studies of regional integration".

Initially inspired by Newton's gravity law, gravity models have become essential tools in the analysis of the effects of regional agreements on trade flows. The first applications were rather intuitive, without great theoretical claims. These included the contributions of Tinbergen (1962) and Pöyhönen (1963). But these studies were criticised for their lack of robust theoretical foundations. Subsequently, new international trade theory provided theoretical justifications for these models in terms of increasing returns of scale, imperfect competition and geography (transport costs).

Linnemann (1966) proposed a gravity model derived from a Walrasian, general equilibrium model. He explained exports of country i to country j in terms of the interaction of three factors: potential supply of exports of country i, potential demand of imports from the country j and a factor representing trade barriers. Potential export supply is a positive function of the exporting country's income level and can also be interpreted as a proxy for product variety. Potential import demand is a positive function of the importing country's income level. Barriers to trade are a negative function of trade costs, transport costs, tariffs. The model takes the following form:

$$X_{ij} = e^{\beta_0} Y_i^{\beta_1} N_i^{-\beta_2} Y_j^{\beta_3} N_j^{-\beta_4} D_{ij}^{-\beta_5} e^{\sum_k \gamma^k P_{kij}} \qquad (1)$$

where **Y** represents country income, **N** represents the population, **D** is the geographical distance and P_k includes dummy variables. Anderson (1979), Bergstrand (1985) and Helpman and Krugman (1985) provided further theoretical justifications for this model.

This equation was extended by Bergstrand (1989) by including per capita income, which is an indicator of demand sophistication (demand for luxury versus necessity goods):

$$X_{ij} = e^{\beta_0} Y_i^{\beta_1} \left(\frac{Y_i}{N_i}\right)^{-\beta_2} Y_j^{\beta_3} \left(\frac{Y_j}{N_j}\right)^{-\beta_4} D_{ij}^{-\beta_5} e^{\sum_k \gamma^k P_{kij}}$$

where X_{ij} represents exports of country i to country j, β_0 is the intercept, Y_i and Y_j are the GDP of country i and j respectively, (Y_i/N_i) and (Y_j/N_j) stand for GDP per capita of country i and j respectively, D_{ij} represents the geographical distance between the

economic centers of two partners, P_{kij} stands for other variables such as common language and historical bonds.

4. Econometric Issues

The regionalism issue was most frequently examined using a gravity model including a dummy variable for regional agreements[3]. Most studies estimating a gravity model applied the ordinary least square (OLS) method to cross-section data. Recently several papers have argued that standard cross-section methods lead to biased results because they do not account for heterogeneity. For instance, the impact of historical, cultural and linguistic links on trade flows is difficult to quantify. On the other hand, the potential sources of endogeneity bias in gravity model estimations fall under three categories: omitted variables, simultaneity, and measurement error (see Wooldrige, 2002).

Matyas (1997) points out that the cross-section approach is affected by misspecification and suggests that the gravity model should be specified as a "three – way model" with exporter, importer and time effects (random or fixed ones). Egger (2000) argues that panel data methods are the most appropriate for disentangling time-invariant and country-specific effects. Egger and Pfaffermayr (2003) underline that the omission of specific effects for country pairs can bias the estimated coefficients. An alternative solution is to use an estimator to control bilateral specific effects as in a fixed effect model (FEM) or in a random effect model (REM). The advantage of the former is that it allows for unobserved or misspecified factors that simultaneously explain the trade volume between two countries and lead to unbiased and efficient results[4]. The choice of the method (FEM or REM) is determined by economic and econometric considerations. From an economic point of view, there are unobservable time-invariant random variables, difficult to be quantified, which may simultaneously influence some explanatory variables and trade volume. From an econometric point of view, the inclusion of fixed effects is preferable to random effects because the rejection of the null assumption of no correlation between the

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[3] Baldwin (1994), Frankel (1997), Soloaga et Winters (2001), Glick et Rose (2002), Carrere (2006).
[4] Egger (2000), Egger (2002)

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unobservable characteristics and explanatory variables is less plausible (see Baier and Bergstrand 2007).

Another method which has gained considerable acceptance among economists (see Egger and Pfaffermayr, 2004) is the Hausman-Taylor's panel one incorporating time-invariant variables correlated with bilateral specific effects (see, for instance, Hausman-Taylor, 1981; Wooldrige, 2002; Hsiao, 2003). Plümper and Troeger (2004) have proposed a more efficient method called "the fixed effect vector decomposition (FEVD)" to accommodate time-invariant variables. Using Monte Carlo simulations they compared the performance of the FEVD method to some other existing techniques, such as the fixed effects, or random effects, or Hausman-Taylor method. Their results indicate that the most reliable technique for small samples is FEVD if time-invariant variables and the other variables are correlated with specific effects, which is likely to be the case in our study. Consequently, we use this technique for the empirical analysis.

Next we provide more details of the alternative methods mentioned above, i.e. random effect estimator (REM), fixed effect estimator (FEM) and fixed effect vector decomposition (FEVD).

4.1   Within Estimator and Random Estimator (FEM and REM)

In the presence of correlation of the unobserved characteristics with some of the explanatory variables the random effect estimator leads to biased and inconsistent estimates of the parameters. To eliminate this correlation it is possible to use a traditional method called "within estimator or fixed effect estimator" which consists in transforming the data into deviations from individual means. In this case, even if there is correlation between unobserved characteristics and some explanatory variables, the within estimator provides unbiased and consistent results.

The fixed effect model can be written as

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$$y_{it} = \sum_{k=1}^{K} \beta_k x_{itk} + \alpha_i + u_{it} \text{ , } t = 1, 2, \ldots, T, \quad k=1, 2,,K \text{ regressors, } i=1, 2,,N \text{ individuals} \qquad (2)$$

where α_i denotes individual effects fixed over time and u_{it} is the disturbance term.

$$y_{it} - \bar{y}_i = \sum_{k=1}^{K} \beta_k (x_{itk} - \bar{x}_{ik}) + (u_{it} - \bar{u}_i) \qquad (3)$$

In the fixed effect transformation, the unobserved effect, α_i, disappears, which yields unbiased and consistent results.

The random model has the same form as before,

$$Y_{it} = â_0 + â_1 x_{it1} + â_2 x_{it2} \ldots\ldots\ldots\ldots.. + â_k x_{itk} + á_i + u_{it} \qquad (4)$$

where an intercept is included so that the unobserved effect, $á_i$, has a zero mean. Equation (4) becomes a random effect model when we assume that the unobserved effect $á_i$ is uncorrelated with each explanatory variable:

$$Cov(x_{itk}, á_i) = 0, \ t = 1,2,\ldots, T; \ j =1,2,\ldots, k. \qquad (5)$$

The Hausman χ^2 test consists in testing the null hypothesis of no correlation between unobserved characteristics and some explanatory variables and allows us to make a choice between random estimator and within estimator. The *within* estimator has however two important limits:

 - it may not estimate the time-invariant variables that are eliminated by data transformation;

 - the fixed effect estimator ignores variations across individuals. The individual's specificities can be correlated or not with the explanatory variable. In traditional methods these correlated variables are replaced with instrumental variables uncorrelated to unobservable characteristics.

4.2.   Fixed Effect Vector Decomposition (FEVD)

Plümper and Troeger (2004) suggest an alternative to the estimation of time-invariant variables in the presence of unit effects. The alternative is the model discussed in Hsiao (2003). It is known that unit fixed effects are a vector of the mean effect of omitted variables, including the effect of time-invariant variables. It is therefore possible to regress the unit effects on the time-invariant variables to obtain approximate estimates for invariant variables. Plümper and Troeger (2004) propose a three-stage estimator, where the second stage only aims at the identification of the unobserved parts of the unit effects, and then uses the unexplained part to obtain unbiased pooled OLS (POLS) estimates of the time-varying and time-invariant variables only in the third stage. The unit effect vector is decomposed into two parts: a part explained by time-invariant variables and an unexplainable part (the error term). The model proposed by Plümper and Troeger (2004) yields unbiased and consistent estimates of the effect of time-varying variable and unbiased for time-invariant variables if the unexplained part of unit effects is uncorrelated with time-invariant variables.

This model has the robustness of fixed effect model and allows for the correlation between the time-variant explanatory variables and the unobserved individual effects. In brief, the fixed effect vector decomposition (FEVD) proposed by Plümper and Troeger (2004) involves the three following steps:

> ➢ estimation of the unit fixed effects by the FEM excluding the time-invariant explanatory variables;

> ➢ regression of the fixed effect vector on the time-invariant variables of the original model (by OLS);

> ➢ re-estimation of the original model by POLS, including all time-variant explanatory variables, time-invariant variables and the unexplained part of the fixed effect vector. The third stage is required to control for multicollinearity and to adjust the degrees of freedom[5].

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[5] The program STATA proposed (ado-file) by the authors executes all three steps and adjusts the variance-covariance matrix. Options like AR (1) error-correction and robust variance-covariance matrix are allowed.

A general form of regression equation can be written as :

$$y_{it} = \alpha + \beta X_{it} + \gamma Z_i + \varepsilon_{it} \quad (8)$$

where :

βX_{it} = time-variant variable vector;

γZ_i = time-invariant variable vector;

ε_{it} = normal distributed error component;

In the presence of unobserved time-invariant variables the equation (8) can be written as

$$y_{it} = \alpha + \beta X_{it} + \gamma Z_i + u_i + \varepsilon_{it} \quad (9)$$

where u_i = unobserved time-invariant variable whose unobserved effects are a random variable rather than an estimated parameter.

The FEVD approach is implemented as follows.

First step

Recall the data generating process of equation (8). The *within* estimator quasi de-means the data and removes the individual effects u_i:

$$y_{it} - \bar{y}_i = \beta_k \sum_{k=1}^{K}(x_{kit} - \bar{x}_{ki}) + \varepsilon_{it} - \bar{\varepsilon}_i \equiv \tilde{y}_{it} = \beta_k \sum_{k=1}^{K}\tilde{x}_{ki} + \tilde{\varepsilon}_{it} \quad (10)$$

The variance not used by the fixed effect estimator is most important.

The unit effects are explained by:

$$\hat{u}_i = \bar{y}_i - \hat{\beta}_k^{FEM} \sum_{k=1}^{K}\bar{x}_{kit} = \hat{\alpha} + \gamma_j \sum_{j=1}^{J}z_{ji} + \eta_i + \bar{\tilde{\varepsilon}}_i \quad (11)$$

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where :

η_i is the unexplained part of the unit effects and $\bar{\varepsilon}_i$ are the average unit means of the FEM estimation (indicating panel heteroskedasticity if $\bar{\varepsilon}_i \neq 0$)

Second step

Given equation (11), it is simple to regress the $\hat{u}_i$ on the z-variables.

$$\hat{u}_i = \omega + \gamma_j \sum_{j=1}^{J} z_{ji} + \eta_i \text{ and } \hat{\eta}_i = \hat{u}_i - \varpi - \gamma_j \sum_{j=1}^{J} z_{ji} \quad (12)$$

where ω is the intercept of the stage 2 equation and η_i is the unexplained part of the unit effects as in equation (11). Equations (11) and (12) show that the exclusion of variables that are simultaneously correlated with the unit-effects $\hat{u}_i$ and the time-invariant variables z_i lead to biased estimates. In other words, the estimates are unbiased only if $\eta_i \cong 0$ for all i or if $E(z_i \mid \eta_i) = E(z_i) = 0$.

Third step

The full model is rerun without the unit effects but including the decomposed unit fixed effect vectors comprising $\hat{\eta}_i$ obtained in step 2. The third step is estimated by pooled OLS (or Prais-Winston in the presence of serial correlation).

$$y_{it} = \alpha + \beta_k \sum_{k=1}^{K} x_{kit} + \gamma_j \sum_{j=1}^{J} z_{ji} + \hat{\eta}_i + \varepsilon_{it} \quad (13)$$

By construction, $\hat{\eta}_i$ is no longer correlated with the vector of the z's.

By including the error term of step 2 it is possible to account for individual specific effects that cannot be observed. The coefficient of $\hat{\eta}_i$ is either equal to 1.0 or at least close to 1.0 (by accounting for serial correlation or panel heteroskedasticity) in step 3. Estimating stage 3 by pooled OLS further requires that heteroskedasticity and serial correlation must be eliminated beforehand.

At least in theory this method has three obvious advantages (see Plümper and Troeger, 2004):

a) the fixed effect vector decomposition does not require prior knowledge of the correlation between time-variant explanatory variables and unit specific effects,

b) the estimator relies on the robustness of the within-transformation and does not need to meet the orthogonality assumptions (for time-variant variables) of random effects,

c) *FEVD* estimator maintains the efficiency of POLS.

Essentially FEVD produces unbiased estimates of time-varying variables, regardless of whether they are correlated with unit effects or not, and unbiased estimates of time-invariant variables that are not correlated. The estimated coefficients of the time-invariable variables correlated with unit effects, however, suffer from omitted variable bias. To summarise, FEVD produces less biased and more efficient coefficients. The main advantages of FEVD come from its lack of bias in estimating the coefficients of time-variant variables that are correlated with unit-effects.

5. Empirical Analysis

5.1 The Econometric Model

The econometric model we adopt in order to identify and to quantify the impact of the association agreement on trade flows between the EU-15 and CEEC-4 countries was chosen taking into account our sample data, the potential endogeneity of variable, the existence of unobservable bilateral characteristics which might or might not be correlated with the explanatory variables, and multicollinearity.

Our econometric specification is the following:

$$\log(Y_{ijt}) = \alpha_0 + \alpha_1 \log(GDP_{it}) + \alpha_2 \log(GDP_{jt}) + \alpha_3 \log(DGDPC_{ijt}) + \alpha_4 \log(Dist_{ij}) + \\ \alpha_5 \log(Tchr_{ijt}) + \alpha_6 Acc_{ijt} + u_{ij} + \theta_t + \varepsilon_{ijt} \, (i = 1,......N; t = 1,......T) \tag{1}$$

In this specification, the bilateral trade (Y_{ijt}) is the dependent variable. The explanatory variables used are the gross domestic product of the two partners (GDP_{it}), (GDP_{jt}),

geographic distance ($Dist_{ij}$), the difference in development level ($DGDPC_{ijt}$), the real exchange rate ($Tchr_{ijt}$), the dichotomous variable association agreement (Acc_{ijt}).

The notation is the following:

- Y_{ijt} denotes the bilateral trade between countries *i* and *j* at time *t* with $i \neq j$ (millions of dollars);

- α_o is the intercept;

- GDP_{it}, GDP_{jt} represents the Gross Domestic Product of country *i* and country *j* (millions of dollars);

- $DGDPC_{ijt}$ is the difference in GDP per capita between partners and is a proxy of economic distance or of comparative advantage intensity,

$$DGDPC_{ijt} = \left| \frac{GDP_{it}}{N_{it}} - \frac{GDP_{jt}}{N_{jt}} \right|$$

  where $N_{i(j)}$ is the population ;

- $Dist_{ij}$ represents the distance between country *i* and country *j* (kilometers);

- $Tchr_{ijt}$ is the real exchange rate which indicates price competitiveness;

$$Tchr_{ijt} = Tcn_{ijt} \, x \, \frac{P_{it}}{P_{jt}}$$

  where : Tcn_{ijt} is the nominal exchange rate;

  $P_{i\,(j)}$ is the consumer price index;

- Acc_{ijt} is a dummy variable that is equal to 1 if country *i* and country *j* have signed a regional agreement, and zero otherwise;

- u_{ij} is a bilateral specific effect ($i = 1,2,\ldots,N$, $j = 1,2,\ldots,M$) ;

- θ_t is a time specific effect ($t = 1,\ldots..T$);

- ε_{ijt} is the disturbance term, which is assumed to be normally distributed with a zero mean and a constant variance for all observations and to be uncorrelated.

The source of data is the CHELEM – French CEPII data base for GDP, GDP/capita, nominal exchange rate and population; the CEPII data base for geographic distance; and the World Bank – World Tables for the consumer index price. The estimation period goes

from 1987 to 2005, i.e. 19 years for a sample of EU-15[6] and 4 CEEC countries[7]. We construct a panel with two dimensions: country pairs, and years.

5.2 Estimation Results

This section summarises the results from the estimation of the gravity model. We used panel data techniques for eliminating the endogeneity bias, and applied different panel data econometric methods such Fixed Effect Model (FEM), Random Effect Model (REM) and Fixed Effects Vector Decomposition (FEVD) in order to check the robustness of our estimates (see Table 1, 2, 3).

Table 1 shows the impact of FTAs on trade flows. To establish whether the effect on the trade balance is symmetric or asymmetric, we estimate separately the effects on exports (Table 2) and imports (Table 3). The aggregate estimation indicates a positive effect of the association agreement variable on trade flows, in accordance with previous studies[8]. The coefficients are statistically significant and have the expected signs consistently with the gravity model: a positive effect on trade flows of country size and association agreement, and a negative impact of geographical distance and of real exchange rate. Moreover, the positive effect of the association agreement is found to be stronger after eliminating the endogeneity bias, the estimated coefficient being now close to 0.33 (see column 3, Table 1). The coefficient of the European agreement variable decreases from 0.37 (random effects model) to 0.33 in the fixed effects and FEVD model. Thus, there is clear evidence that the agreement has increased trade volume between EU-15 and CEEC-4 countries.

The association agreement appears to have had a positive but different impact on the CEEC-4 exports and imports towards the EU-15 countries. The coefficients are higher for imports (0.36) than for exports (0.21), indicating asymmetry. Concerning the trade

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[6] EU-15: Austria, Belgium-Luxemburg, Denmark, England, Finland, France, Germany, Greece, Holland, Ireland, Italy, Portugal, Spain, Sweden.
[7] Bulgaria, Hungary, Poland, Romania.
[8] See for instance, Soloaga and Winters (2001), Carrère (2006), Cheng and Wall (2004), Rault and Sova (2007).

balance, we note that association leads to a trade deficit for the CEEC-4 with respect to the EU-15. Moreover, movements of the trade balance over time reveal that imports increase more quickly than exports (see Graph 1). Some potential explanations are: (i) the lack of product competitiveness in the European market, (ii) the increasing vertical FDI, importing intermediate goods necessary for their production process; (iii) a greater preference of consumers for products from the EU.

Concerning robustness, the estimated coefficients are similar for FEM and FEVD; however, the latter not only enables us to isolate the endogeneity of the association agreement variable and to obtain unbiased coefficients, but also captures the effects of time-invariant variables on trade flows.

The Fisher test suggests the introduction of effects (fixed or random) to improve the estimation results. The estimated coefficients of the FEM are different from those obtained with the REM (for instance, association agreement) which can be explained by the existence of a correlation between some explanatory variables and the bilateral specific effect. Moreover, the Hausman test rejects the null assumption of no correlation between the individual effects and some explanatory variables for all estimations. This implies endogeneity bias, and therefore the fixed effects model is preferred. The Davidson-MacKinnon test of exogeneity (F=160.26, P-value = 0.00), confirm the endogeneity of the FTA. We also calculate the variance inflation factor (VIF) to ensure that multicollinearity does not affect the quality of estimates. In our all estimates, VIF did not exceed the threshold of 10, indicating that there is no multicollinearity[9].

Overall, the agreement variable coefficient indicates a positive and significant impact on trade flows but an asymmetric effect on exports and imports.

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[9] A variance inflation factor value higher than 10 reveals the presence of multicollinearity requiring specific corrections (see Gujarati, 1995).

6. Conclusions

This paper has analysed the impact of association agreements on trade flows between the EU-15 and CEEC-4 countries treating the agreement variable as endogenous and using appropriate panel methods to estimate a gravity equation. The most relevant estimates are those provided by the FEVD estimation method which is the most appropriate for our purposes. This method permits to obtain unbiased coefficients and to capture the effects of time-invariant variables. As theory suggests, association agreements were found to have a positive and significant impact on trade flows between the participant countries. However, such effects appear to be asymmetric, the estimated coefficient being higher for imports (0.36) than for exports (0.21), which suggests trade asymmetry. In particular, the agreements resulted in increased trade deficits for the CEEC-4 countries (net importers), which is not desirable for economies still trying to catch up with the other EU states[10]. Convergent or divergent dynamics of imports and exports are the main cause of trade balance changes. The evolution of exports, imports as well as of trade balance over the estimation period for all CEEC-4 highlights the persistence and the deepening of the trade deficit (see Graphs 1 and 2).

The lower impact of the agreement on CEEC-4 exports can be interpreted in terms of low EU demand for CEEC products reflecting their lack of attractiveness for European consumers, despite their price competitiveness based on comparative advantages due to lower labour costs. Trade liberalisation did not lead to a restructuring of exports and to a development of the most innovative sectors of the economy. Instead, CEEC-4 exports are still represented mainly by labour-intensive products with lower added value.[11]

Higher trade openness and the progressive liberalisation of the capital flows resulting from the trade agreement have strongly influenced the behaviour of multinationals firms. Vertical FDI in the CEEC-4 countries has instead increased. This type of investment consists in the fragmentation of the various operations of the production process to

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[10] The trade balance is a component of GDP: a surplus increases GDP and a deficit reduces it.
[11] See Rault et al. (2007)

implement them in countries offering lower costs. The production location which results from it inevitably entails a rise of intermediate and equipments good imports of these countries from the investor's countries. Thus, in the case of the CEEC-4 countries vertical FDI has induced a significant increase of intermediate and equipments good (and hence of total imports): these now represent more than half of the CEEC-4 countries total imports from the EU (see Graph 3). In order to reduce their trade deficit and to have a sustainable trade balance, the CEEC-4 countries would need instead more intra-branch trade with high added value products so as to increase their export competitiveness towards the EU and to attract horizontal FDI, thereby achieving real convergence.

In conclusion, our estimation results indicate a positive and significant impact of FTAs on trade flows. However, exports and imports are affected differently, leading to some disparity in trade flow performance between countries. Therefore, there is an asymmetric impact on the trade balance, the agreement variable resulting in a trade balance deficit in the CEEC-4.

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APPENDIX

Table 1 – The impact of the association agreement on trade flows

| VARIABLE	FEM	REM	FEVD
	x_{ij}	x_{ij}	x_{ij}
	(1)	(2)	(3)
GDP_{it}	2.021	1.450	2.021
	(25.33)***	(28.56)***	(25.32)***
GDP_{jt}	1.476	1.222	1.476
	(18.50)***	(24.06)***	(18.50)***
$Dist_{ij}$	0.000	-1.340	-1.192
	(.)	(10.56)***	(26.84)***
$DGDPC_{ijt}$	0.347	0.380	0.347
	(7.81)***	(8.67)***	(94.18)***
$Tchr_{ijt}$	-0.042	-0.036	-0.042
	(11.49)***	(10.19)***	(3.47)***
Acc_{ijt}	0.327	0.374	0.327
	(26.88)***	(31.56)***	(15.28)***
Residuals	-	-	1.000
			(117.06)***
Constant	-17.820	-9.417	-14.073
	(33.26)***	(15.76)***	(208.56)***
No. of observations	2128	2128	2128
Number of groups	112	112	-
R-squared	0.73	0.79	0.94
Fischer test (F)	35.60	-	-
Prob > F	(0.00)		
Hausman test (chi2)	-	225.39	-
Prob>chi2		(0.00)	
Absolute value of t-statistic in parentheses			
* significant at 10%; ** significant at 5%; *** significant at 1%			

Table 2 - The impact of the association agreement on exports

VARIABLE	FEM	REM	FEVD
	x_{ij}	x_{ij}	x_{ij}
	(1)	(2)	(3)
GDP_{it}	1.264	1.430	1.264
	(10.45)***	(16.41)***	(10.44)***
GDP_{jt}	2.867	1.409	2.867
	(15.97)***	(18.31)***	(15.96)***
$Dist_{ij}$	0.000	-1.200	-1.003
	(.)	(6.73)***	(12.78)***
$DGDPC_{ijt}$	-0.020	0.321	-0.020
	(2.26)**	(4.93)***	(4.05)***
$Tchr_{ijt}$	-0.019	-0.020	-0.019
	(3.79)***	(3.90)***	(2.02)**
Acc_{ijt}	0.211	0.314	0.211
	(11.23)***	(18.96)***	(7.23)***
Residuals	-	-	1.000
			(137.14)***
Constant	-19.940	-10.496	-16.788
	(26.24)***	(12.28)***	(182.58)***
No. of observations	1064	1064	1064
Number of groups	56	56	-
R-squared	0.72	0.81	0.94
Fischer test (F)	33.62	-	-
Prob > F	(0.00)		
Hausman test (chi2)	-	148.79	-
Prob>chi2		(0.00)	
Absolute value of t-statistic in parentheses			
* significant at 10%; ** significant at 5%; *** significant at 1%			

Table 3 - The impact of the association agreement on imports

| VARIABLE	FEM	REM	FEVD
	x_{ij}	x_{ij}	x_{ij}
	(1)	(2)	(3)
GDP_{it}	2.515	1.265	2.515
	(13.93)***	(17.71)***	(13.92)***
GDP_{jt}	1.004	1.098	1.004
	(8.25)***	(12.97)***	(8.25)***
$Dist_{ij}$	0.000	-1.637	-1.505
	(.)	(10.05)***	(19.07)***
$DGDPC_{ijt}$	0.100	0.377	0.100
	(2.27)**	(5.75)***	(19.64)***
$Tchr_{ijt}$	-0.068	-0.054	-0.068
	(13.47)***	(10.69)***	(3.62)***
Acc_{ijt}	0.358	0.450	0.358
	(18.95)***	(26.72)***	(12.20)***
Residuals	-	-	1.000
			(123.19)***
Constant	-17.204	-6.885	-12.472
	(22.51)***	(8.46)***	(134.87)***
No. of observations	1064	1064	1064
Number of groups	56	56	-
R-squared	0.77	0.76	0.94
Fischer test (F)	34.64	-	-
Prob > F	(0.00)		
Hausman test (chi2)	-	510.25	-
Prob>chi2		(0.00)	

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

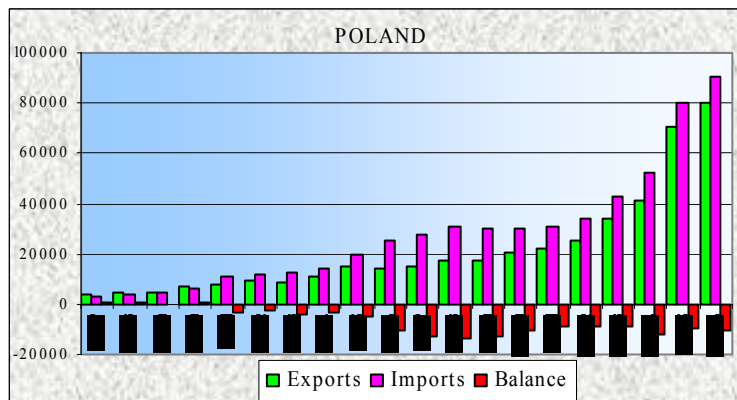Graph.1.Evolution of trade balance for CEEC-4 with EU -15.
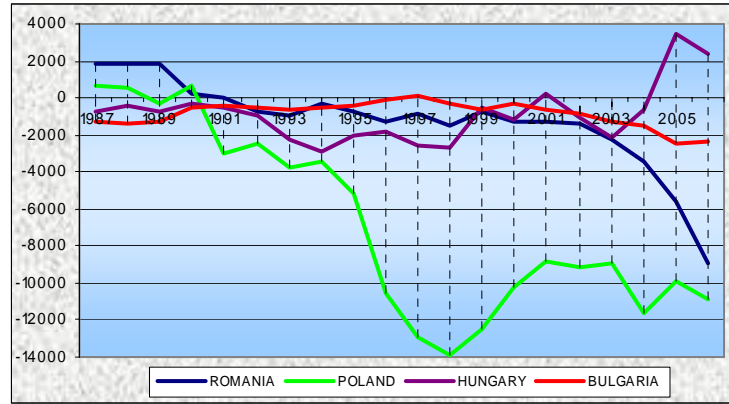
Data source : CHELEM – French CEPII data base. Calculations by the authors.

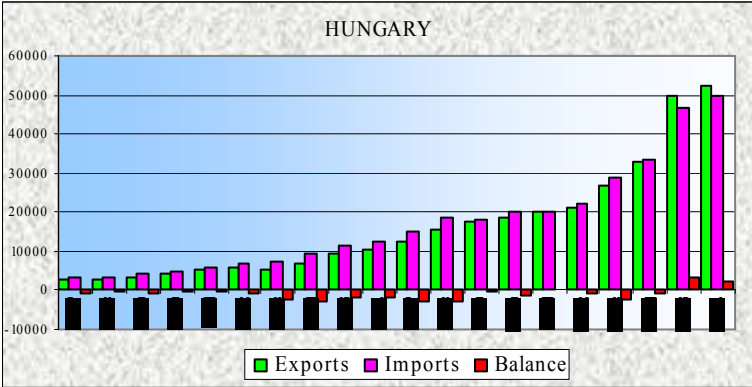Graph. 2.a - Evolution of exports, imports and trade balance of Romania with EU-15
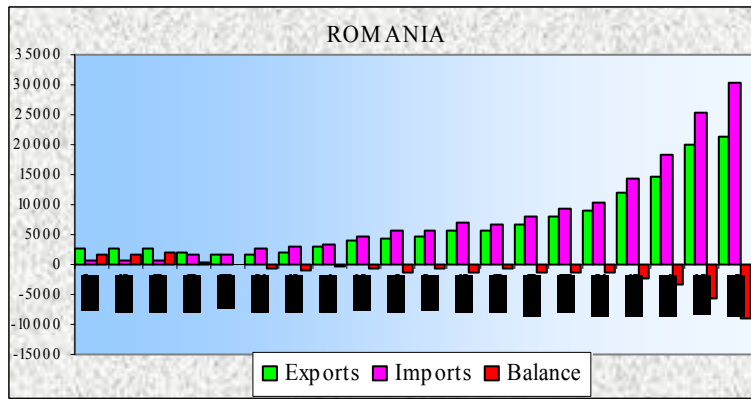
Data source : CHELEM – French CEPII data base. Calculations by the authors.

Graph.2.b. Evolution of exports, imports and trade balance of Poland with EU-15
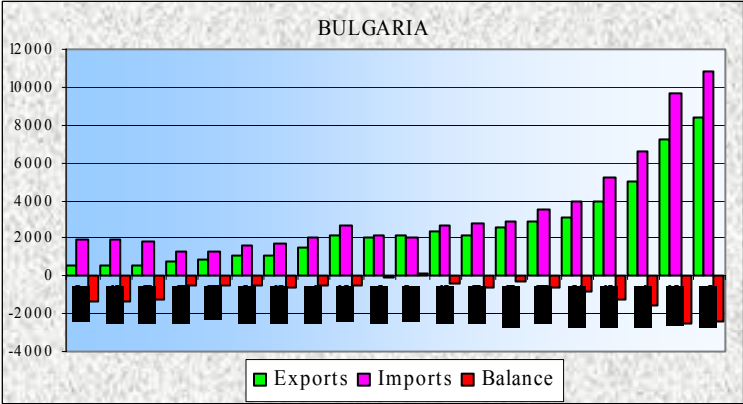

Data source : CHELEM – French CEPII data base. Calculations by the authors.

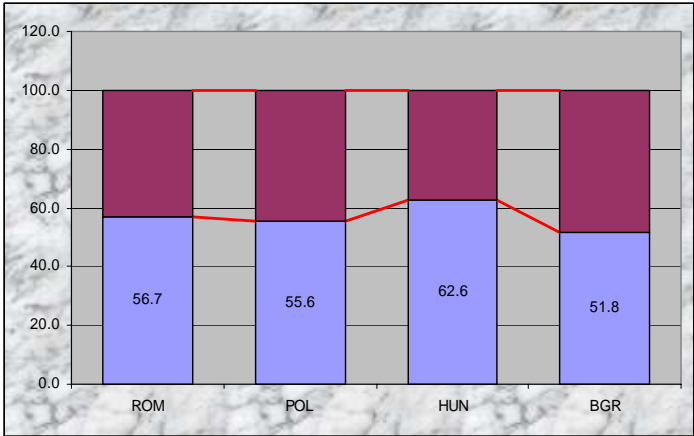Graph.2.c. Evolution of exports, imports and trade balance of Hungary with EU-15

Data source : CHELEM – French CEPII data base. Calculations by the authors.

Graph.2.d. Evolution of exports, imports and trade balance of Bulgaria with EU-15

Data source : CHELEM – French CEPII data base. Calculations by the authors.

Graph.3 – Imports of intermediate goods and equipment as a % of total imports, 2004

Data source : CHELEM – French CEPII data base. Calculations by the authors.