HUB-AND-SPOKE OR ELSE?
FREE TRADE AGREEMENTS IN THE ENLARGED EU

A GRAVITY MODEL ESTIMATE

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ENEPRI Working Paper No. 37/June 2005

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Abstract

The aim of this paper is to estimate the effect of the EU's eastern enlargement on the trade patterns of the Central and Eastern European countries (CEECs) that joined the Union in May 2004. In particular, the paper investigates whether and how the EU's free trade agreements (FTAs) with the CEECs have affected centre-periphery and intra-periphery trade flows. It also evaluates whether the EU-membership factor has had the added positive effects on exports from the CEECs as anticipated.

The analysis focuses on bilateral trade flows between eight CEECs and the EU-23, for which a gravity equation is estimated using a system GMM dynamic panel data approach. The results support the assumptions that gravity forces and 'persistence effects' do indeed matter. With respect to the effect of FTAs, evidence is found that FTAs between EU countries and CEECs matter. Yet there is also evidence that the presence of intra-periphery agreements have helped to expand intra-periphery trade and limit the emergence of a hub-and-spoke relationship between the EU and the CEECs.

These results have important policy implications for the trade strategy of EU candidate countries in south-eastern Europe as well as in the southern Mediterranean. According to the empirical results, these countries should move towards a regional free trade area as exemplified by the Central European Free Trade Agreement and the Baltic Free Trade Agreement to avoid hub-and-spoke effects.

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Introduction

The aim of this paper is to estimate the effect of the EU's eastern enlargement on the trade patterns of the Central and Eastern European countries (CEECs)[1] that joined the EU in May 2004. In particular, the paper investigates whether and how the EU free trade agreements (FTAs) with the CEECs affected centre-peripheral and intra-peripheral trade flows. It also evaluates whether the prospect of joining the EU had the added positive effects on the export flows of the CEECs that had been anticipated.

Although the formal beginning of negotiations for the EU's enlargement is more recent, to some extent the CEEC accession process began in the early 1990s, shortly after the free market system got under way. During that period and afterwards the acceding countries signed bilateral agreements with the EU (i.e. the Europe [Association] Agreements), which represented an advance in the path towards integration through stipulating a progressive liberalisation of trade.

It is worth recalling that in 1992, the Czech Republic, the Slovak Republic, Hungary and Poland established the Central European Free Trade Agreement (CEFTA) and in 1996 Slovenia joined CEFTA as a full member. In 1994, the Baltic Free Trade Agreement (BAFTA) also entered into force. In addition, the CEECs have signed several bilateral trade agreements among themselves.

Thus the paper explores whether the progressive integration of the CEECs within the Union and among themselves has involved not only increased trading with the 15 EU member states prior to accession (EU-15), but also a geographical restructuring of the trade flows across the EU (relating to both the centre and the periphery). In particular, we investigate whether and how the FTAs signed by CEECs have exerted an impact on centre-peripheral and intra-peripheral trade relationships. We especially consider whether there a 'hub-and-spoke' trade relationship has emerged between the CEECs and the EU as a result of the bilateral FTAs.

The literature on the effects of trading blocs typically focuses on the Vinerian model of trade creation and trade diversion effects, while the impact of economic integration and the creation of trade blocs on intra-bloc trade has typically received minor attention. Here the bilateral trade flows between the eight CEECs and the EU-23 (comprising the EU-15 plus the CEECs as partner countries) are analysed. We estimate a gravity equation using a system GMM dynamic panel data approach.

The paper is organised as follows. The first section surveys theory and empirics. The path towards integration through stipulating a progressive liberalisation of trade for the CEECs is briefly analysed in section 2. Section 3 describes the estimated equation, the empirical strategy and the data. The results are presented in section 4, followed by the conclusions.

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[1] The acronym CEECs is used hereafter to refer to the eight Central and Eastern European countries that joined the EU in May 2004: Hungary, Poland, the Czech Republic, the Slovak Republic, Slovenia, Lithuania, Latvia and Estonia.

1.   A review of the literature on regional integration in Eastern Europe

In the last 10 years, gravity models have been widely used in empirical studies of integration processes to explore the main changes in geographical trade patterns and to analyse the effects of FTAs, regional trade agreements (RTAs), and currency unions (CU) on trade flows.

After 1991, special attention in the literature on gravity models was given to estimating the potential trade flows between the countries belonging to the European Free Trade Association (EFTA), the EU, the CEECs and the Baltic countries. (See for example Baldwin & Portes, 1997; Gros & Gonciarz, 1996; Brenton & Di Mauro, 1999; Nilsson, 2000; Lasser & Schrader, 2002; and Brenton & Manzocchi, 2002).

Most of the above-mentioned studies found out that the RTAs (i.e. the Europe Agreements) put into place to prepare the transition countries for accession to the EU prompted substantial growth in EU-CEEC trade flows (i.e. regional dummies have positive and significant coefficients). Therefore, most of the adjustments in trade flows have already occurred and the expected further effects arising from the completion of EU enlargement will be modest.

In the empirical literature on EU enlargement, however, only minor attention has been paid to the study of the geographical restructuring of the trade flows arising from the entry into force of RTAs and FTAs among the EU-15 and the new member states.

Martin & Turrion (2001) analyse the determinants of trade patterns between the CEECs and the OECD countries since the former began the processes of transition and opening up within the framework of the Europe Agreements with the EU. To anticipate the trade impacts of their accession to the EU, the authors estimate a gravity model for a set of countries consisting of the EU members, the CEECs and the other members of the OECD (by way of a control area). The results confirm that the Europe Agreements have led to a preferential expansion of exchanges between the EU and the CEECs. In fact, as regards regional dummies, they find that the increase in the export shares of the CEECs in the EU is sharper that the increase of those of third countries (the coefficient of the dummies are 2.38 and 1.35 respectively).

The gravity model estimates by Laaser & Schrader (2002) suggest that in the specific cases of Estonia, Latvia and Lithuania, regional integration is much more intense than normally observed. The authors observe that the role of distance (and the costs of transport) for the Baltic countries is much more important in shaping their regional trade patterns than institutional integration with the EU through the Europe Agreements. Their estimates show that the process of EU association was not a determinant, despite the expectation that the trade agreements with the EU would have fostered Baltic-EU trade flows, while regional determinants dominated. Hence they conclude that the process of European integration mainly runs through neighbouring Baltic countries and that the transport system dominates the trade regime by shaping trade flows in the region (the coefficient of distance is close to 1 in all the estimates).

Damijan & Masten (2002) explore the time-dependent efficiency of FTAs in a panel framework using static and dynamic model specifications. They show that trade liberalisation per se needs time to become efficient. Using the illustrative case of the rapid expansion of Slovenian imports in the period 1993-98 from the other CEFTA member countries, the paper demonstrates that tariff reductions become effective in the second to third year after the FTA came into force. Regarding the effect of the CEFTA, the analysis revealed that being a party to the CEFTA increased the exports of the other CEECs towards Slovenia by 18.5%.

Paas (2003) finds that the pattern of bilateral trade flows within the countries involved in EU enlargement is in accordance with the normal rules of gravitation. He also finds that there are statistically significant spatial biases caused by the trade relationship between the countries in the Baltic region, the border countries and the EU candidate countries. The East-West trade

relationships are still rather weakly developed and there is a statistically significant difference in international trade patterns between the two groups: bilateral trade relations between the EU-15 member states and the CEECs are still less developed than trade relations among the EU-15.

Adam et al. (2003) explore the effectiveness of the CEFTA and BAFTA. Estimates from a gravity model and bilateral trade data support the view that both of these agreements helped expand regional trade and limit the emergence of a hub-and-spoke relationship between the CEECs and the EU. In the regression, all the preferential trade agreement variables are positive and statistically significant. The authors conclude that all the agreements were trade-creating for their members. Results showed the BAFTA to be more effective than the CEFTA and interestingly, the parameter estimate for the Europe Agreements is smaller than for either the CEFTA or BAFTA. Thus, the bulk of the increase in EU-CEEC trade was owing to a return to normal trading patterns rather than to specific trade advantages offered by Europe Agreements.

2.   EU enlargement and the CEECs

At the end of the EU enlargement process, the new members will embark on the highest stage of economic integration with the EU: they will join economic and monetary union (EMU), as no opt-out clause is allowed for new entrants. In May 2004, the new members entered the EU at the level of the Single Market. Participation in the EMU from the start of accession was not considered possible given that most of the acceding countries did not yet fulfil the convergence criteria provided by the Maastricht Treaty.[2]

In the case of EU enlargement, we have to deal with the standard effects of regional integration, pure trade effects, plus a specific aspect: the EU-membership factor. Pure trade effects are the traditional trade impacts of economic integration that occur through trade creation and trade diversion. Trade creation refers to increases in trade that generate new economic activity, whereas trade diversion refers to the redirection of existing trade as a result of changes in tariffs and other barriers owing to a regional customs union. EU membership effects are the positive effects exerted on trade and economic activity by the participation in European Single Market.

2.1   RTAs and ETAs in the enlarged Union: Hub-and-spoke or else?

With respect to the pure trade effects, it should be recalled that the EU concluded Europe Agreements with the CEECs during the 1990s. That implies that an asymmetric tariff reduction has taken place in trade between the EU and the CEECs. Since 1997, the EU has eliminated practically all tariffs (except on agricultural and other sensitive products) on imports from the CEECs. Since joining the EU in 2004, the CEECs have entered the EU's customs union (Common External Tariff and Common Commercial Policy), thus participating in the Single Market and the abolition of border controls.

Although the trade components of the Europe Agreements with some CEECs went into effect on different dates – ranging from 1992 (for former Czechoslovakia, Hungary and Poland) to 1996 (for Slovenia) – schedules for the elimination of duties and non-tariff barriers on industrial products had one important component in common. They all had 1 January 2002 as the date to complete the process of liberalisation.

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[2] The statement by the ECOFIN Council of 7 November 2000 on the implications of the accession process upon the exchange rate arrangements in the acceding countries identified three distinct stages for the full monetary integration of candidate countries. These stages are: i) the pre-accession stage (free choice of an exchange rate regime); ii) the accession stage (new member states shall treat their exchange rate policy as "a matter of common interest" [EC Treaty Art. 124]); and iii) after accession the new member countries are expected to join the exchange rate mechanism (ERM II).

Europe Agreements are bilateral agreements between the EU and individual applicant countries, which are shown in Table 1. It should be emphasised that these agreements do not exist between applicant countries. The Europe Agreements thus could have led to the emergence of the so-called 'hub-and-spoke' pattern, creating trade between the EU and each applicant country separately, while discouraging trade among the applicant states.

Table 1. Free trade agreements

	Date of entry into force						
	CMEA	EU GSP	CEFTA	BAFTA	OECD	WTO	EA
CZ	1 Jan 1949	1991	1 Mar 1993	–	21 Dec 1995	1 Jan 1995	1 Mar 1992
EE	1 Jan 1949	1992	–	1 Apr 1994	–	13 Nov 1999	1 Jan 1995
HU	1 Jan 1949	1990	1 Mar 1993	–	7 May 1996	1 July 1995	1 Mar 1992
LV	1 Jan 1949	1992	–	1 Apr 1994	–	10 Feb 1999	1 Jan 1995
LT	1 Jan 1949	1992	–	1 Apr 1994	–	31 May 2001	1 Jan 1995
PL	1 Jan 1949	1990	1 Mar 1993	–	22 Nov 1996	1 Jul 1995	1 Mar 1992
SL	1 Jan 1949	1991	1 Mar 1993	–	14 Dec 2000	1 Jan 1995	1 Mar 1992
SI	–	1980*	1 Jan 1996	–	–	30 Jul 1995	1 Jan 1997

* Slovenia retained preferential status for its exports under the so-called 'autonomous trade preferences' granted by the EU to former Yugoslavia in the 1980 Cooperation Agreement.

Notes: CMEA = Council for Mutual Economic Assistance; GSP = Generalised System of Preferences; CEFTA = Central European Free Trade Area; BAFTA = Baltic Free Trade Agreement; EA = Europe Agreement

Source: WTO (retrieved from http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm1_e.htm).

Several CEECS have also signed free trade agreements among themselves (Tables 1 and 2). The first preferential agreement among the CEECs was the CEFTA,[3] which entered into force in 1993. Its membership gradually expanded over time. The Baltic States signed a free trade agreement (the BAFTA) among themselves in 1995.

Table 2. Bilateral, intra-periphery free trade agreements

	Date of entry into force					
	EE	HU	LV	LT	PL	SL
Czech Rep.	12 Feb 1998	–	1 Jul 1997	1 Jul 1997	–	1 Jan 1993
Estonia	–	1 Mar 2001	–	–	–	–
Hungary	–	–	1 Jan 2000	1 Mar 2000	–	–
Latvia	–	–	–	–	–	–
Lithuania	–	–	–	–	–	–
Poland	–	–	1 Jun 1999	1 Jan 1997	–	–
Slovakia	12 Feb 1998	–	1 Jul 1997	1 Jul 1997	–	–
Slovenia	1 Jul 1997	–	1 Aug 1996	1 Mar 1997	–	–

Source: WTO (retrieved from http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm1_e.htm).

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[3] The CEFTA provides a framework for bilateral agreements among seven states. More precisely, the CEFTA system has two components: multilateral and bilateral. A multilateral component comprises commonly agreed preferences, whereas a bilateral one those negotiated bilaterally and not extended to all CEFTA members.

2.2 The opening up of trade in the CEECs: Some stylized facts

To examine some features of the opening up of trade in the CEECs, Tables 3 and 4 provide information on bilateral trade flows coming from CEECs directed towards the centre (the EU-15) and the periphery (the CEECs).

In short, the features found in the trading pattern of the CEECs suggest that the share of exports to the EU-15 was relatively high in the first half of the 1990s, partly because of the reduction in trade barriers that were taking place.

In fact after 1989, the EU applied the generalised system of preference (GSP) status to Hungary and Poland (1990), then to Bulgaria and the former Czechoslovakia (1991), and subsequently to Estonia, Latvia and Lithuania (1992). Slovenia retained preferential status for its exports under the so-called 'autonomous trade preferences' granted by the EU to the former Yugoslavia in the 1980 Cooperation Agreement (Table 1). The GSP status significantly improved the access of exporters from the CEECs to EU markets, especially, for industrial products.[4]

Following the demise of central planning and the associated collapse of the Council for Mutual Economic Assistance (CMEA), trade linkages among the CEECs contracted dramatically and still remain very weak. The share of this trade increased between 1989 and 1993 but mainly because of the dissolution of former Czechoslovakia.

Table 3. Share of exports to the former centrally planned economies (CPEs)* and the EU (%)

	CPEs**		EU	
	1988	1992	1988	1992
Czechoslovakia**	47.7	19.7	38.4	61.8
Hungary	43.6	7.7	39.1	75.1
Poland	35.7	15.7	49.2	62.3
Estonia	n.a.	29.2	n.a.	68.5
Latvia	n.a.	58	n.a.	38.5
Lithuania	n.a.	57.8	n.a.	39.1

* The CPEs include the former Soviet Union (including the Baltic countries), Bulgaria, former Czechoslovakia, Hungary, Poland and Romania.

** Excludes intra-Czech-Slovakian trade,

Source: Hoekman & Djankov (1996).

The bulk of intra-CEEC trade takes place between the Czech Republic and Slovakia, which until 1992 had been part of the same national economy. Combined exports from the Czech Republic and Slovakia to the CEECs (Table 4b) account for around two-thirds of intra-CEEC exports (Kaminsky, 2001).

The geographical redistribution of trade flows in the period 1993-2003 in the EU-23 seems to have been generally in favour of the centre (EU-15). The only relative exceptions are Hungary, Poland and Slovenia (Table 4b). With respect to the world total, data show an increase in intra-periphery trade flows for all CEECs with the exceptions of the Czech Republic and Slovakia (Table 4a).

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[4] GSP preferential rates embraced 63% of all combined nomenclature tariff lines in EU imports with most of them (94% of GSP items) subject to zero rates. The interim trade component of the Europe Agreements overshadowed GSP arrangements by retaining preferential tariffs and making them permanent rather than subject to annual reviews (Kaminsky, 2001).

It is a very difficult task to identify with any precision the extent to which preferential access to EU markets was responsible for a reorientation in the geographic patterns of CEEC trade. Under the central planning regime, the CEECs undertraded with the EU and overtraded with each other and other members of the former CMEA.[5] A sizable portion of the adjustment can be attributed to a correction of these earlier trends.

The shift from a supply-constrained economic regime to a demand-constrained regime, combined with the collapse of import demand in the CMEA countries, could have been the major force behind the expansion of trade between the CEECs and the EU. Nevertheless, we assume that the measures introduced by the EU to support transition and accelerate re-integration of the CEECs into EU markets have also contributed to trade expansion.

Table 4. Trade integration in the periphery versus the trade integration in the EU

Table 4a	*Percentage of the world total*					
	1993			2003		
	EU/WT	C/WT	P/WT	EU/WT	C/WT	P/WT
Czech Rep.	73	48	25	63	51	12
Estonia*	39	30	09	81	67	14
Hungary	35	34	1	66	60	6
Latvia	43	33	10	83	67	16
Lithuania	47	36	11	53	39	14
Poland	71	67	4	77	66	11
Slovak Rep.	79	28	51	65	46	19
Slovenia	55	54	1	63	56	7
Table 4b	*Percentage of EU-15 + CEECs*					
	1993			2003		
	C/EU	P/EU		C/EU		P/EU
Czech Rep.	66	34		81		19
Estonia*	64	36		83		17
Hungary	97	3		92		8
Latvia	76	24		81		19
Lithuania	62	38		73		27
Poland	94	6		86		14
Slovak Rep.	36	64		71		29
Slovenia	99	1		89		11

*1994

Notes: EU = EU-15 + CEECs; C = centre (the EU-15); P = periphery (the CEECs)

Source: International Monetary Fund (IMF), Direction of Trade Statistics.

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[5] The Council for Mutual Economic Assistance, (COMECON or CMEA), refers to an international organisation active between 1956 and 1991 for the coordination of economic policy among certain nations then under the Communist regime, including Albania (after 1961), Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Romania and the Soviet Union. Yugoslavia participated in matters of mutual interest. Although it was formed in 1949, a formal charter was not ratified until 1959. The charter gave COMECON the same international status as the European Economic Community (Common Market), but the structure was controlled by heads of state.

2.3 The EU-membership factor

Concerning the effects of EU membership, we refer to the boost that trade receives through movements of factors of production and other dynamic effects such as capital accumulation, technology transfer, increased competition and exploitation of economies of scale.

EU membership, which also implies for these countries a commitment to a pegged exchange rate (ERM II) and eventually to a single currency, will likely change the international assessment of risk in these countries. The exchange rate stabilisation, the EU's 'seal of approval' and the macroeconomic stabilisation programmes that accompany accession are the source of standard returns from a centre-peripheral type of integration to the periphery. These usually include increased trade flows as well as foreign direct and portfolio investment as investors face lower institutional and policy risks. Although it is too early to account for the post-accession effects of EU membership, it seems in some way reasonable to measure the anticipated effect of the 'EU factor' on bilateral trade.

As previously noted, although the formal accession occurred in May 2004, the process began in the early 1990s. At the European Council summit in Copenhagen (June 1993), the EU invited the CEECs to accede to the EU and formulated the three accession criteria (under the headings of democracy, market economy and the *acquis communautaire*). In late 1997, Hungary, Poland, the Czech Republic, Slovenia and Estonia (the 'Luxembourg group') started negotiations, whereas the other CEECs (the 'Helsinki group') started in 1999. Eventually, at the European Council of Laeken (December 2001) the Council agreed with the European Commission's report that all the candidates, with the exceptions of Romania, Bulgaria and Turkey, were suitable to join the European Union.

We intend to test what role, if any, the pure trade and EU-membership effects had the on the bilateral trade flows between the CEECs and the EU-15.

3.   Equation, empirical strategy and data description

We introduce three sets of variables: i) gravity variables, ii) controls for heterogeneity and iii) controls for dynamics, as described below. Dummy variables to test the effects of FTAs on bilateral trade flows between the CEECs and the 23 importer countries (CEECs plus the EU-15) are also introduced in the estimates.

i)   *Standard gravity variables*. Bilateral distance is used as a proxy for transport costs and the importer's and exporter's GDPs are used as proxies for demand and production factors respectively. We add to this standard specification an index of relative country size, an index of absolute difference in relative factor endowments (see Helpman & Krugman, 1985) between trading partners and an exchange-rate volatility index.

ii)   *Controls for heterogeneity*. Following Baltagi et al. (2003), we introduce fixed effects for importer and exporter countries. In contrast with their study, we do not control for country-pair effects (i.e. the interaction effect between the exporter and importer country picking up unobserved characteristics of a country pair) because this kind of variable would include the impact of bilateral trade agreements, which we want to control by specific dummies. Again, as opposed to Baltagi et al. (2003), we do not introduce interaction terms between the exporter and importer countries and time (*it* and *jt*).[6]

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[6] This approach, allowing for each country to have a separate parameter for each time period when it is an exporter and another one when it is an importer, leads to a maximum flexibility in the *it* and *jt* dimensions of the panel: all possible nation-specific variables can move unrestrictedly over time.

Following the study performed by Bun & Klaassen (2004), we instead introduce a set of country-pair specific time trends, the reason being that trade flows tend to grow over time.

Although using panel data allows for time effects to correct for any residual trend common to all bilateral trade flows, trends may vary across country pairs. For instance, transportation costs depend on country-pair distance and the structure of trade; these elements vary between country pairs. Transportation costs have decreased over time and this could have increased bilateral trade flows; it is unlikely that the standard (common) trend correction could completely avoid omitted trend variables bias.

As Bun & Klaassen (2004) underline, this approach is more flexible in the cross-sectional dimension (*ij*) with respect to the Baltagi et al. (2003) formulation: it allows the trade development over time to be driven by factors other than national ones (i.e. transportation costs). We impose linearity for trends (at the cost of restricting the *it* and *jt* dimensions) instead of allowing for unrestricted time variation (at the cost of restricting the *ij* dimension). Linear trends usually capture the most part of the trending variables. The estimates are also robust when we generalise the linearity hypothesis by allowing for quadratic trends.

Controlling for exporter, importer and bilateral time trend effects it is possible to proxy for the 'multilateral trade resistance index' (see Anderson & van Wincoop, 2003), obtaining a specification of gravity equation that can be interpreted as a reduced form of a model of trade with micro foundations.[7]

iii) *Controls for dynamics*. It is worth highlighting that when considering the time dimension, one should not forget that accession is a very recent phenomenon.

Given the novelty of the phenomenon, the traditional static gravity models that generally deal with long-run relationships are not well-suited to interpreting the repercussions of the accession. For this purpose, we need to make the gravity equation more oriented to the short term, by explicitly introducing dynamics, controlling for the lagged effects of the dependent variable and detecting the short-term influences of the 'forthcoming accession' and of all the other variables affecting bilateral trade in an enlarged EU.

Indeed, the 'short term' can generally be highly relevant in trade analyses, since countries that trade a lot with each other tend to keep on doing so. Such *inertia* mainly derives from the sunk costs exporters have to bear to set up distribution and service networks in the partner country, leading to the emergence of substantial entry and exit barriers (see Eichengreen & Irwin, 1996). This sticky behaviour seems all the more important in the case of the CEECs and the EU-15, where trade relationships are affected not only by past investment in export-oriented infrastructures, but also by the accumulation of invisible assets such as political, cultural and geographical factors characterising the area and influencing the commercial transactions taking place within it.

It is worth noting that, notwithstanding the general importance of the 'persistence effects', quite a few studies, based on a panel estimation of gravity equations, have considered the possibility of controlling for them (Egger, 2000; De Grauwe & Skudelny, 2000; Bun & Klaassen, 2002; and De Nardis & Vicarelli, 2003).

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[7] Anderson & van Wincoop (2003) pointed out that trade between a pair of countries depends on their bilateral trade barriers with all trading partners: trade will be stronger for those countries with relatively low trade barriers. Rose & van Wincoop (2001) approximate the multilateral trade resistance index using country-pair fixed effects. Ritschl & Wolf (2003) and Estevadeordal et al. (2003) propose using country-group dummies; our approach follows this suggestion.

The introduction of dynamics into a panel data model raises an econometric problem. If trade is a static process, the 'within' estimator (fixed-effect estimator) is consistent for a finite time dimension T and an infinite number of country-pairs N. But if trade is a dynamic process, the estimate of a dynamic panel such as our model (a static one with the lagged dependent variable) is more difficult. The reason is that the transformation needed to eliminate the country-pair fixed effects produces a correlation between the lagged dependent variable and the transformed error term that (for a finite T and an infinite N) renders the least square estimator biased and inconsistent.

There are alternative estimators with which to bypass this inconsistency problem. Arellano & Bond (1991) have suggested transforming the model into first differences and run it using the Hansen two-step GMM estimator. First-differencing the equation removes the random effects that are independent and identically distributed among individuals and produces an equation estimable by instrumental variables.

As far as the gravity model is concerned, the proposed strategy is not, however, without cost. On the one hand, first-differencing the equation removes the fixed effects but also the time invariant regressors that are in the specification. If those regressors are of interest, the loss of information implied can be of no second order. On the other hand, the first-differenced GMM estimator performs poorly in terms of precision if it is applied to short panels (along the T dimension) including highly persistent time series (Blundell & Bond, 1998). Lagged levels of time series that have near-unit root properties are in fact weak instruments for subsequent first-differences. Since bilateral exports between (old and new) industrialised countries are expected to change sluggishly, one might suspect that this would affect our estimates.

Arellano & Bover (1995) describe how, if the original equations in levels were added to the system of first-differenced equations, additional moment conditions could be brought to bear to increase efficiency. They show how the two key properties of the first-differencing transformation – eliminating the time-invariant individual effects while not introducing disturbances for periods earlier than period t-1 into the transformed error term – can be obtained using any alternative transformation (i.e. forward orthogonal deviations).

Blundell & Bond (1998) articulated the necessary assumptions for this 'system GMM' estimator more precisely and tested it with Monte Carlo simulations.[8] As far as we know, very few studies have adopted this methodology in the context of a gravity approach.[9]

The estimated equation is:

$$Ln(Exp_{ijt}) = b1ln(Exp_{ijt-n}) + b2ln(GDP_{it}) + b3ln(GDP_{jt}) + b4(SIMIL_{ijt}) +$$
$$b5(ENDOW_{ijt}) + b6ln(Dist_{ij}) + b7VOL_{ijt} + b8\ FTAP_{ijt} + b9\ FTAEU_{ijt} + b10\ Entr_{ijt} +$$
$$b11\ Lux_{ijt} + b12\ Helsinki_{ijt} + b13\ \alpha_i + b14\ \beta_j + b15(\tau_{ij}t)$$

where

ln = the natural logarithm, i is the exporter country, j is the importer country and t is the year, n is a lag structure for the dependent variable;

Exp_{ijt} = the exports in value from country i to country j;

GDP_{it} = the gross domestic product of the exporter country;

GDP_{jt} = the gross domestic product of the importer country;

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[8] Bond (2002) offers a good introduction to these estimators and their use.
[9] See for example De Benedictis & Vicarelli (2005).

$SIMIL_{ijt}$ = the similarity index of the GDPs of two trading partners as a measure of relative country size. This is calculated as:

$$\ln\left[1-\left(\frac{GDPit}{GDPit+GDPjt}\right)^2-\left(\frac{GDPjt}{GDPit+GDPjt}\right)^2\right]$$

where

$ENDOW_{ijt}$ = the absolute difference in relative factor endowments between country-pairs. This is calculated as:

$$\left|\ln\left(\frac{GDPit}{POPit}\right)-\ln\left(\frac{GDPit}{POPit}\right)\right|$$

where

POP = the population;

VOL_{ijt} = the exchange rate volatility between counties i and j at time t; it has been measured by the standard deviation of the first difference of the monthly natural logarithm of the bilateral nominal exchange rate at the current year y;

$Dist_{ij}$ = the distance between country pairs;

$FTAP_{ijt}$ = a dummy variable that assumes the value of 0 for the absence of free trade agreements or customs unions among periphery countries; it assumes the value of 1 (year of entry into force) if these agreements are present;

$FTAEU_{ijt}$ = a dummy variable that assumes the value of 0 for the absence of free trade agreements or customs unions among the periphery and the EU-15 countries; it assumes the value of 1 (year of entry into force) if these agreements are present;

$Entr_{ijt}$ = a dummy variable embodying the 'announcement effect' of the entrance of the eight new member countries into the EU. This announcement corresponds to the date of European Council meeting of Laeken in December 2001; the dummy assumes the value of 1 since 2002 for all country pairs in the sample;

Lux_{ijt} = a dummy variable embodying the 'announcement-of-negotiations effect' for Hungary, Poland, the Czech Republic, Slovenia and Estonia; the dummy assumes the value of 1 for exports coming from each of these countries and 0 otherwise;

$Helsinki_{ijt}$ = a dummy variable embodying the 'announcement-of-negotiations effect' for Latvia, Lithuania and the Slovak Republic; the dummy assumes a value of 1 for exports coming from each of these countries and 0 otherwise;

α_i = an exporter country dummy, which assumes a value of 1 if export flows come from exporter country i to each one of importer countries j and 0 otherwise;

β_j = an importer country dummy, which assumes a value of 1 if export flows come from each one of the exporter countries i to importer country j and 0 otherwise;

τ_{ij} t = the bilateral trend variables.

The data sources for these variables are can be found in the appendix in Table A.1.

We expect that bilateral export flows are positively influenced by a number of factors. These can be identified as:

- the lagged endogenous variable. We expect that countries trading a great deal with each other would continue to do so, thus reflecting entrance and exit barriers owing to sunk costs.

- the real GDP of importer and exporter countries. In gravity models, trade flows are positively influenced by the dimension of origin and destination countries proxied by GDP.

- the presence of bilateral and multilateral free trade agreements. These dummies proxied the pure trade effects and are expected to have a positive impact on trade flows.

- the announcements of entry into the EU. These dummies proxied the effects of the EU-membership factor and are expected to have a positive impact on trade flows.

We also expect that bilateral export flows are negatively influenced by tow factors: distance, which is used as a proxy for the transport costs and cultural proximity between two countries; and exchange rate volatility.

We have no *a priori* expectations on the signs of relative country size index or the differences of factor endowments index. A positive (negative) sign of the first index and a negative (positive) sign of the latter could support the hypothesis that bilateral flows are higher (lower) the more similar two countries are (in terms of size) and the more dissimilar they are in terms of relative factor endowments.

4.   Estimate results

The equation has been estimated for the group of the eight CEECs (CEEC-8) as reporting countries and the EU-15 plus the eight CEECs as trading partners. Table 5 shows the results of the test[10] and the estimates. The autoregressive process tests AR(1) and AR(2) show the consistency of the GMM estimator and the inconsistency of the OLS procedure. Hence, by introducing dynamics, the proper estimation method is the former one. The Sargan test of over-identifying restrictions shows that the hypothesis that all moment restrictions are satisfied for dynamic specification is not rejected.

Not all the regressors are statistically significant and show the expected sign; among the coefficients of major interest, the agreement dummy between the intra-periphery, centre and periphery and Luxembourg dummy coefficients are statistically significant. The 'announcement effect' dummy also seems to play a role in explaining bilateral trade flows. Further points about the results that deserve highlighting include:

i)   *Gravity standard variables*. An inverse relationship between exports and distance is confirmed by the results. The sign of the exporter countries' GDP is negative; there are big differences between the GDPs of the CEEC-8 countries (which are all exporters in our estimate), and the group of importer countries has had a detrimental role in explaining bilateral trade flows. The positive sign of the relative country size index and the negative one of the relative factor endowment index (although the latter is statistically not significant) confirms that trade relationships are more intense (higher) the more similar two countries are in terms of country size and less intense the more dissimilar two countries are in terms of relative factor endowments.

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[10] Arellano & Bond (1991) propose a test of the hypothesis of no second-order serial correlation in the disturbances of the first-differenced equation. This is a necessary condition for the valid instrumentation. The Arellano-Bond test performed for our estimate confirms that the GMM estimator is consistent. A test for the hypothesis of no first-order serial correlation is also reported: the rejection of the null hypothesis (i.e. the presence of first-order serial correlation) indicates the inconsistency of the OLS estimator.

This latter result seems to support Linder's hypothesis, as in Baltagi et al. (2003). On the other hand, the positive sign of the importer countries' GDPs is statistically significant.

ii) *Lagged dependent variable.* This variable is statistically significant until a 1-period lag; the magnitude of the persistence effect seems a little bit lower with respect to other findings based on a more integrated and developed group of countries (see De Nardis & Vicarelli, 2003; and Bun & Klassen, 2002). This gap can be explained by the fact that the CEEC-8 as a group are less integrated than the EU-15 and by the inclusion of a bilateral time trend in the regression, capturing part of the persistence effect.

iii) *Pure trade variables – FTA-periphery, FTA-EU.* Both of these free trade agreements dummies are positive and statistically significant (t=2.2, t=1,6). The coefficient shows that being part of a free trade agreement as opposed to not being part of one increases bilateral trade on average by more than 14% with respect to intra-periphery agreements and by more than 11% with respect to Europe Agreements.[11]

iv) *EU membership variables – EU membership, Luxembourg group and Helsinki group.* The results for inclusion in the EU and the Luxembourg group are positive and significant, supporting the assumption of an anticipated effect on trade of participation in the EU's Single Market. The magnitude of this effect seems to be relatively high. In contrast, the dummy for being part of the Helsinki group is not significant.

Table 5. Estimate of bilateral exports coming from the CEEC-8 (1993-2003)

Num. obs= 1712	Num. group=176	F (216,1495) = 441.46	Prob>F=0.000	Sample period 1990-2003
	Coeff.	Std. Err.	t	P>|t|
$Ln(exp_{ij})$ t-1	0.4455	0.088	5.03	0.000
$Ln(GDP_{it})$	-0.355	0.142	-2.50	0.013
$Ln(GDP_{jt})$	0.195	0.087	2.23	0.026
$Ln(DIST_{ij})$	-1.08	0.172	-6.30	0.000
$Ln(SIMIL_{ijt})$	0.149	0.054	2.75	0.006
$ENDOW_{ijt}$	-0.047	0.063	-0.75	0.455
VOL_{ijt}	-0.06	0.075	-0.84	0.402
$FTAEU_{ijt}$	0.105	0.064	1.63	0.103
$FTAP_{ijt}$	0.135	0.062	2.16	0.031
$Entr_{ijt}$	0.095	0.036	2.60	0.010
Lux_{ijt}	0.095	0.052	1.84	0.066
$Hels_{ijt}$	0.008	0.063	0.13	0.894
	Yes	–	–	–
j	Yes	–	–	–
ij t	Yes	–	–	–

Notes: Arellano-Bond test for AR(1) in first differences: z = -5.71 Pr>z = 0.000; Arellano-Bond test for AR(2) in first differences: z = 0.08 Pr>z = 0.934; Sargan test of over-identifying restrictions: chi2 (63) = 62.38 Prob> chi2 =0.498.

Source: Authors' calculations.

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[11] Since the parameters of the dummy FTA are respectively 0.135 and 0.105, the variation of trade induced by being part of a trade agreement (FTA=1) as opposed to not being part of any agreement (FTA=0), i.e. [(EXP equals being part of a trade agreement and /EXP equals not being part of a trade. agreement) -1]x100 is given, other things being equal, by [(e0.135x1/ e0.135x0) –1]x100=14.4% and [(e0.105x1/ e0.105x0) –1]x100=11.1%.

5. Conclusion

According to the findings of the study and the previous section in particular, the following conclusions can be drawn. First, with regard to pure trade effects, free trade agreements are important in explaining bilateral export flows coming from the CEECs: trade agreement dummies are positive and statistically significant.

Second, being a party to an FTA with the EU-15 (through the Europe Agreements) increased the CEECs' bilateral trade by more than 11%, while intra-periphery agreements increased trade by around 14% on average. The relatively lower impact of Europe Agreements on export flows compared with intra-periphery agreements could be explained by the fact that from the end of the 1980s, trade flows between the CEECs and the EU-15 had already increased owing to the reduction of trade barriers that had taken place.

Moreover, the trade regime that had dominated the CMEA (and for a while after its collapse in 1991) meant that trade between the CEECs had not been driven by economic factors and were underdeveloped. Therefore, it is reasonable to expect that the introduction of FTAs and RTAs were able to restore and develop trade relations within a broader EU framework.

It is notable that the estimate results seem to support the evidence coming from the data (see section 2). Starting from a very low level, the rate of growth of intra-periphery trade has been higher than core-periphery trade, *ceteris paribus*, because of a higher impact from the FTA. From this perspective, trade agreements between the centre and periphery did not hamper the trade relationships among periphery countries, while the CEFTA and BAFTA helped to limit the emergence of a hub-and-spoke relationship between the CEECs and the EU.

These results have important policy implications for the trade strategy of EU candidate countries in south-eastern Europe as well as in the southern Mediterranean. According to the empirical results, these countries should move towards a regional free trade area as exemplified by the Central European Free Trade Agreement and the Baltic Free Trade Agreement to avoid hub-and-spoke effects.

Concerning the EU-membership factor, the dummies for inclusion in the Luxembourg group and the EU are positive and significant, suggesting that in both cases the trade flows coming from CEECs have already factored in the effects of news about forthcoming EU membership. Nevertheless, the attempt to further estimate the effect of accession by means of the introduction of exchange rate volatility did not yield any significant results.

Appendix

Table A.1. Sources and definitions of variables

Variables	Sources	Sample period
Bilateral export flows (current price, $US millions)	Direction of Trade Statistics, IMF	1990-2003
Free trade agreement	European Commission and the WTO	1990-2003
GDP (current price $US millions)	World Economic Outlook database, IMF	1990-2003
Distance	Brenton & Di Mauro (1999)	1990-2003
Population	Queen database, Eurostat	1992-2003
GDP per capita	Queen database, Eurostat	1992-2003
Exchange rate	International Financial Statistics, IMF and ECB	1992-2003

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