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A Gravity Approach to Modelling International Trade in South-Eastern Europe and the Commonwealth of Independent States: The Role of Geography, Policy and Institutions

Oxana Babecká Kucharčuková, Jan Babecký and Martin Raiser*

Abstract

Since the beginning of market reforms in 1989, the countries of South-Eastern Europe (SEE) and the Commonwealth of Independent States (CIS) have been trading significantly less with the world economy than those Central and Eastern European (CEE) countries which later joined the EU. To explain why this is the case, a number of hypotheses have been proposed in the literature. The key novelty of our study consists in a simultaneous assessment of the contribution to trade of geographical, policy and institutional factors during the EU pre-accession period (1997–2004). An augmented gravity model is proposed and estimated for a reference group of 82 countries, employing the Poisson and Tobit estimation techniques. We find that low quality of economic institutions in the SEE and CIS countries accounted for a considerable proportion of their below-potential international trade. We perform policy simulations using institutional data up to 2008 to identify channels for increasing the international trade of the SEE and CIS countries.

JEL Codes: F13, F15, P33.

Keywords: Gravity model of trade, Poisson estimator, Tobit estimator, transition economies.

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Nontechnical Summary

The issue of international trade in the countries of Eastern Europe and the former Soviet Union following the start of market reforms in 1989 is the subject of growing empirical research. Formerly a relatively isolated trade bloc whose limited interactions with the world economy were based on state trading arrangements rather than market prices and decisions, the region as a whole now sends and receives more than two thirds of its goods and services to and from the rest of the world. The countries have also undergone radical policy changes, both in trade policy and in deeper institutional reforms. However, the expansion of international trade has not been uniform across countries. Trade with the rest of the world increased rapidly in those transition countries which later joined the European Union. In South-Eastern Europe (SEE) and in the Commonwealth of Independent States (CIS), the exposure to international trade has remained far smaller.

There is a broad agreement that a combination of geographical, policy and other factors has contributed to these diverging patterns of trade. However, the relative importance of these different factors on international trade, when considered altogether, remains unclear. Therefore, the aim of this paper is to simultaneously identify geographical, political and institutional determinants of international trade in the SEE and CIS countries and, as a result, to answer what trade gains are to be expected from different policy measures. This is done within the gravity modelling framework, a method commonly used in the literature on the determinants of international trade.

Our contribution to the literature consists in specifying and estimating an augmented gravity model and performing simultaneous testing for the importance in promoting trade of policy, institutional and geographical factors which have not received much attention to date. We have been able to collect variables which are specific to the economies in transition and which have been typically omitted in the past or captured by constant terms at best. These characteristics include, inter alia, restrictiveness of the trade regime, quality of countries' institutions, and quality of infrastructure. Our analysis is thus based on one of the richest specifications found in the literature. Moreover, in our empirical analysis we employ recent estimation methods which correct for a number of biases.

Overall, our results indicate that the international trade of the SEE and CIS countries is still below its potential, as predicted by macroeconomic fundamentals. The next question is how the situation can be improved. We use our best model estimates to conduct policy simulations to explore the potential for trade growth in the SEE and CIS countries stemming from the improvement of institutions, trade policies and regional agreements. The simulations indicate that improving the quality of institutions is one feasible road to follow. Moreover, improvements in infrastructure and opening-up to regional cooperation are complementary tools to stimulate the trade of the SEE and CIS regions with the rest of the world.

1. Introduction

Gravity isn't easy, but it's the law.
Author unknown

Following the start of deep political transformations and market reforms in 1989, the international trade of the countries of Central and Eastern Europe (CEE) and the former Soviet Union (FSU) experienced substantial changes as well. The process, known as the reorientation of trade "from East to West", considerably altered the pattern and the intensity of trade flows. Formerly a relatively isolated trade bloc whose limited interactions with the world economy were based on state trading arrangements rather than market prices and decisions, the region as the whole now sends and receives more than two thirds of its goods and services to and from the rest of the world. Two decades after the beginning of the transition from a planned toward a market economy, the CEE and FSU countries have made considerable progress in many areas, including with trade policy and institutional reforms. The region, however, is far from becoming more homogeneous, including as regards exposure to international trade. Trade with the rest of the world has increased substantially in those transition countries which joined the European Union[1] – the ratio of the CEE countries' exports and imports to GDP had tripled from 20 per cent at the beginning of the 1990s to 60 per cent by the 2004 round of EU enlargement. International trade in the countries of South-Eastern Europe (SEE) and of the Commonwealth of Independent States (CIS) has altered to a much smaller extent: the corresponding change in the ratio of SEE exports and imports to GDP was from 20 to 30 per cent over the same period, while for the CIS region the numbers remained virtually unchanged at 20 per cent.

These different patterns in international trade in transition countries have been the subject of a growing empirical literature. Interest has been focused on understanding the reasons why countries which started from fairly similar initial conditions (formerly centrally planned economies characterised by low exposure to international trade) experienced such different dynamics in trade patterns in the subsequent years. Early studies (see, for example, the two influential works by Hamilton and Winters, 1992, and Baldwin, 1994) predicted a rise in trade-to-output ratios for both the CEE and FSU regions, with a somewhat higher increase for the CEECs due to their proximity to Western markets.

Subsequently, along with progress in transition towards a market economy, growing differences among the CEE, SEE and CIS countries in terms of the dynamics and volumes of international trade contributed to a debate on the role played by geographical, political, institutional and other factors.[2] Geographical features are indeed important determinants of international trade. For example, longer distance from major markets and an absence of access to the sea represent

[1] Eight of the 27 transition countries joined the EU in 2004 (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia) and two more joined in 2007 (Bulgaria and Romania).

[2] See Landesmann and Szekely (1995), Kaminski (1996), Brenton and Gros (1997), Michalopoulos and Tarr (1997), Havrylyshyn and Al-Atrash (1998), Sheets and Boata (1998), Buch and Piazolo (2001), Djankov and Freud (2002), Fidrmuc and Fidrmuc (2003), EBRD (2003), Babetskaia-Kukharchuk and Maurel (2004), Freinkman et al. (2004), Broadman (2006), Bussiere et al. (2008), Caporale et al. (2009) and Rault et al. (2009). A detailed analysis of export reorientation in transition economies is provided by Kandogan (2006); for a study of trade reorientation on the enterprise level, see Winiecki (2000).

obstacles to trade. However, these time-invariant factors alone cannot explain the changes in trade patterns over time. A number of studies stress the importance of free trade agreements (FTAs), also known as reciprocal trade agreements (RTAs).[3] Other studies highlight the role of transition-specific factors, which are difficult to measure.[4]

Two broad agreements emerge from the literature. First, it is a combination of country-specific political, institutional, geographical and other factors that has contributed to the differences in trade among transition countries. Second, SEE and particular CIS countries are found to trade below their potential. In other words, these countries' volumes of total exports and imports are below their potential values as predicted on the basis of macroeconomic, geographical and other factors. However, it is still unclear what the relative contributions of these factors are in terms of the overall impact on international trade in transition economies.

The key novel contribution of this paper consists in specifying and estimating an augmented gravity model which allows for simultaneous testing of the importance in promoting trade of policy, institutional and geographical factors which have not received much attention to date. We are able to collect and apply explicit control variables for factors specific to the economics of transition which have been omitted or at best addressed by the use of country-specific constant terms (Bussiere et al., 2008).

Specifically, we test for the importance of trade regime (measured by the IMF's trade restrictiveness index) separately from a country's membership in a specific trade bloc or free trade area (FTA) as well as its membership in the World Trade Organisation (WTO). We also test the effect of the quality of country's institutions, as measured by the World Bank governance indicators, up to 2008. In addition to these variables, we include a rich set of variables measuring geographical distance, the effect of borders, the quality of infrastructure and the volatility of the bilateral exchange rate. Our analysis is thus based on one of the richest specifications of the gravity equation found in the literature. Other contributions of this paper to the existing literature lie in choosing, for such a rich specification, a large reference sample of 82 countries over the EU pre-accession period 1997–2004, and in employing advanced estimation methods – the Poisson estimator and the Tobit estimator – to estimate the gravity equation for developing countries, with a focus on the SEE and CIS countries.

We find that even after controlling for geographical, political and institutional factors, the international trade of the SEE and CIS economies with the world economy is still largely below its potential over the estimation period. Although trade has been significantly reoriented away from the former socialist trading bloc and towards western market economies over the past two decades, the SEE and CIS countries still trade much less than one might predict given their income levels and geographical location. Our estimations show that low quality of economic institutions in the SEE and CIS countries explains a considerable proportion of their below-potential international trade. For SEE, the reasons need to be sought largely in relation to the past regional conflicts in the Balkans, while in the CIS, the main explanation of the underdevelopment

[3] See Caporale et al. (2009) and Spies and Marques (2009) for recent evidence on the impact of FTAs on trade in transition economies. Cipollina and Salvatici (2010) present a meta-analysis of the effect of various trade agreements on bilateral trade based on an examination of evidence from 85 studies, including developed, developing and transition economies.

[4] See, e.g., Egger and Pfaffermayr (2003) and Bussiere et al. (2008).

of international trade is the weakness of economic institutions. Moreover, the lack of regional cooperation, particularly in the Caucasus and in Central Asia, greatly increases transport and transit costs to world markets and is an obstacle to international trade.

Our policy simulations indicate that for the landlocked economies of Central Asia, trade reorientation towards South and East Asia through additional infrastructure investments and trade facilitation measures is advisable. For those CIS and SEE countries without realistic EU accession prospects, a free trade area agreement with the EU and WTO membership offer the best policy prospects for promoting international trade.

The remainder of the paper is structured as follows. Section 2 introduces the gravity approach to measuring obstacles to international trade, focusing on conceptual issues, modelling framework and estimation techniques. Section 3 presents the data, estimation results and policy simulations. Section 4 concludes with some thoughts on policies that might increase exposure to international trade for the SEE and CIS countries.

2. A Gravity Approach to Measuring Obstacles to International Trade

2.1 Conceptual Issues

Empirical research on the determinants of international trade using gravity models has seen significant growth in recent years. Gravity models can be theoretically derived from different classes of trade theories, including factor-endowment theories (Deardorff, 1998), home preferences ("Armington preferences", Anderson, 1979; Anderson and van Wincoop, 2003; Spies and Marques, 2009), increasing returns to scale (Helpman and Krugman, 1985; Evenett and Keller, 2002), incomplete specialisation models (Cieslik, 2009) and a micro-founded general equilibrium framework (Novy, 2010). Empirical applications include the study of trade protection (Harrigan, 1993), exchange rate variability (Frankel and Wei, 1993; Lizardo, 2009; Chit et al., 2010), currency unions (Rose, 2000; Frankel and Rose, 2002), regional versus multilateral trade agreements (Schiff and Winters, 2003; Rose, 2005; Subramanian and Wei, 2003; Cipollina and Salvatici, 2010[5]), home bias (Whalley and Xin, 2009), democracy (Decker and Lim, 2009; Yu, 2010), corruption (Musila and Sigue, 2010), development aid (Martinez-Zarzoso et al., 2009), cultural specificities (Felbermayr and Toubal, 2010; Tadesse and White, 2010) and institutional reforms and their impact on trade (Babetskaia-Kukharchuk and Maurel, 2004).

This research has highlighted a number of specification and estimation issues. Anderson and van Wincoop (2003) derive a theoretical gravity equation and show that it is important to include country-specific trade resistance terms if unbiased coefficients are to be obtained. We choose a gravity equation with country-specific dummies to represent country-specific trade resistance. Moreover, the paper is one of the first applications to use Poisson estimation to account for biases in the trade of SEE and CIS countries introduced by the log-form of the gravity equation, while simultaneously correcting for the well-known problem of "missing trade" between two countries (see Santos Silva and Tenreyro, 2006). We also apply Tobit estimation as an alternative approach to dealing with missing trade.

[5] A meta-analysis based on 85 studies.

It is important to note that this paper does not attempt to draw a link between the extent of international trade and measures of economic development such as income per capita or the growth rate of GDP. There is an ongoing debate about whether trade promotes economic growth or whether greater involvement in international trade is merely a correlate of growth and both are driven by improvements in the quality of domestic institutions supporting economic activity (Frankel and Romer, 1999; Rodrik et al., 2004; Dollar and Kraay, 2003). Our results are consistent with both possibilities. However, in emphasising the importance of behind-the-border issues (i.e. non-geographical determinants of trade), we lend support to those who do not regard opening of the trade regime as a recipe for improved economic prospects.

In explaining bilateral trade intensity, one approach would be to define variables for each of the obstacles to trade and to introduce these directly in a regression of the ratio of trade to GDP. The introduction of regional dummies could then illustrate whether transition economies show a degree of openness that is significantly different from that in other regions when these obstacles are accounted for. This is essentially the approach followed by Freinkman et al. (2004). However, the trade barriers and transport and transit obstacles faced by traders depend very much on the trade route chosen and on the trading partner for the specific transaction. An aggregation to the level of a country's total trade misses this important variation.[6] A gravity model explains the degree of bilateral trade between two countries, taking into account their location relative to each other, the nature of the trade route (e.g. how many borders need to be crossed, or how good the transport infrastructure is) and trade policies and institutional quality in both the home and the sending country. This is the approach pursued in this paper.

2.2 Modelling Framework

Our gravity equation specification is motivated by the theoretical framework proposed by Anderson and van Wincoop (2003). This framework is based on a Constant-Elasticity of Substitution (CES) utility function and full specialisation of production across countries. The introduction of symmetric trade costs into the model leads to the well known gravity equation, whereby the level of bilateral trade between two countries is a function of their respective levels of income, a vector of transport and trade costs between them, and a measure of each country's propensity to trade with all other countries. Anderson and van Wincoop (2003) call this "multilateral resistance". In log-linear form, the model becomes:

$$lnX_{ijt} = \alpha + \beta\, lnY_{it} + \gamma\, lnY_{jt} + \delta\, lnDist_{ij} + \zeta\, C_i + \eta\, C_j \qquad (1)$$

where X_{ij} are exports from country i to country j, Y_i is GDP in country i. $Dist_{ij}$ is a vector of bilateral transport and trade obstacles, and C_i, C_j are the multilateral resistance terms. Given the panel structure of the data, time dummies are introduced to control for possible time effects.

The model proposed by Anderson and van Wincoop (2003) imposes the constraint $\beta=\gamma=1$, but in many empirical applications this is relaxed. Moreover, allowing for non-homothetic preferences (an assumption of the theoretical gravity model) it additionally introduces the size of both countries' populations into (1). For our purposes, the interest lies mainly in defining the vector $Dist_{ij}$ and the country-specific constants C_i and C_j. Many researchers have tried to approximate

[6] In fact, trade obstacles are likely to vary by traded product categories as well. Wang (2001), Amin et al. (2009) and Uzagalieva et al. (2010) are examples of gravity-type analysis at the sectoral level.

the terms C_i, C_j with measures of a country's remoteness from world markets, using a trade-weighted average distance measure. As Anderson and van Wincoop (2003) argue, this is largely ad hoc. Instead, they suggest estimating (1) with non-linear methods, thereby expressing C_i, C_j as non-linear combinations of Y_i, Y_j and $Dist_{ij}$, or replacing these terms simply with fixed country effects. We follow the latter route.

We use the coefficient estimates from (1) to simulate the effect that changing the values of one of the elements of $Dist_{ij}$ would have on the average level of trade for a particular country or region.[7] Specifically, we estimate the impact on trade of the transition economies in a hypothetical scenario where these countries adopt trade policies and institutions similar to those prevailing in the EU. The gravity estimates also allow inference on the additional gains for trade from WTO accession in those CIS countries which are not yet members (all SEE countries belong to the WTO) and from the formation of a free trade area between SEE or the CIS and the EU. Finally, we estimate the relative gains derived for the CIS from its higher density of transport infrastructure – one of the positive legacies of the Soviet Union – relative to other countries with similar levels of income (such as North Africa and the Middle East), and the potential for increased trade with South and East Asia for the countries of Central Asia once new trade routes are developed through China and Afghanistan.

The elements of $Dist_{ij}$ are defined and the sources of data are given in **Table 1**. The elements are grouped in the following way:

i) **Geographical distance** – this is simply measured as the average distance between two countries, as represented by their capitals and assuming they are connected by a straight line ($lnDist_{ij}$). For large countries such as the USA, Canada and Russia several economic centres are accounted for.

ii) **Exchange rate volatility** – this is defined as the standard deviation of the bilateral exchange rate between two countries, normalised by its mean (Vol_{ij}). Yearly averages are calculated upon monthly dollar-denominated rates.[8]

iii) **Border effect** – this has two components: a) a dummy for the existence of a common border between two countries, a variable used in many other studies ($Contig_{ij}$), and b) a variable measuring the number of borders between two countries ($n\_borders_{ij}$).

iv) **Infrastructure** – this is measured by the road and rail density in both the home and the partner country ($DnInfra_i$; $DnInfra_j$), defined as the length of roads and railroads per square kilometre. In principle it might be possible to create a variable that measures the quality of infrastructure for each trade route $DnRoute_{ij}$, but this is beyond the scope of this paper.

v) **Trade Policy** – measured by WTO membership and a trade restrictiveness index constructed by the IMF. WTO membership is entered only when both countries are

[7] In an earlier version of this paper, we chose a different route in trying to aggregate the multilateral resistance terms C_i, C_j by region to examine whether there are any unexplained trade gaps in the transition economies that could not be explained by the inclusion of a wide set of elements in the vector $Dist_{ij}$. The estimates of C_i, C_j reveal some interesting cross-country patterns, but the regional aggregations are problematic since some country dummies are not significant. In the interest of brevity we have dropped this discussion from the revised version of this paper. See Bussiere, Fidrmuc and Schnatz (2008) for a similar approach.

[8] We also tried to estimate the effect of a common currency on bilateral trade, following Rose (2005). However, we were unable to retrieve significant effects. This was probably largely due to the smaller number of currency unions used in this paper, but may also reflect the fact that we introduce measures of institutional quality not used in Rose's analysis. By setting *Vol* to zero we can nonetheless simulate the effect of a common currency on trade.

members (following Rose, 2005). Trade policies are entered for both home (Imf_or_{it}) and partner country (Imf_or_{jt}). In addition, we control for the effect of Free Trade Agreements (FTAs) on bilateral trade flows, using the same set of FTAs as reported in Subramanian and Wei (2003).

vi) **Institutions** – measured by the average of the World Bank's governance indicators for the rule of law, the extent of corruption and the quality of regulation.[9] The institution scores are entered separately for country *i* (WB_{it}) and country *j* (WB_{jt}).

Despite the importance of FDI for transition economies, this variable is not included in the specification due to the endogeneity problem. However, there is substantial research on interactions between trade and investment as well as on the impact of institutions on investment. We also experimented with entering infrastructure, institutions and trade policies as a product of country *i* and country *j* on the basis that improvements in one country may be less effective in supporting trade if not accompanied by similar improvements in their trading partners.

Overall, the results do not change much, but the significance of the interactive terms is affected by multicolinearity. We therefore stick to the additive specification for ease of interpretation. The specification is semi-logarithmic in form. This should be borne in mind in interpreting the coefficient sizes below.

Note that while dummy variables to account for a common language and country pairs having been part of the same federation are often included in the gravity equation, the impact of these variables on trade is to a large extent already captured by regional dummies for the transition countries which are the focus of our paper, e.g. the CIS bloc/FSU (Russian being a common language) and SEE/former Yugoslavia. For this reason, the above-mentioned dummies are not considered in the paper.

2.3 Estimation

In proceeding to estimation, we face two problems. First, as pointed out by Santos Silva and Tenreyro (2006) the log-linear gravity equation specified in (1) is biased because of Jensen's inequality: $E(\ln y) \neq \ln E(y)$, which implies that in the presence of heteroscedasticity coefficients in the log-linearised specification will be biased.[10] In addition, OLS or fixed effects estimations assume non-zero trade between all pairs of countries, while in practice for some country pairs trade could be equal to zero. Traditionally, this problem has been handled by simply deleting all zero values, or setting all zero values to equal very small numbers instead. However, both procedures will lead to inconsistent estimates of (1). Pseudo-maximum likelihood estimation techniques such as Poisson regression allow us to correct biases resulting both from heteroscedastic errors and from missing trade between country pairs, Santos Silva and Tenreyro

[9] The indicators can be found at www.worldbank.org/governance. It should be noted that these indicators are based on a wide range of different sources. However, for some of the transition economies, in particular those with weaker governance in Central Asia and in the Caucasus, the number of sources is still quite small, and the governance indicators hence rely on a small group of experts outside the country. As a growing number of enterprise surveys on the investment climate become available, and work continues on the construction of "objective" measures of business obstacles (e.g. the World Bank's Doing Business Indicators), the governance indicators might be replaced with survey-based measures of institutional quality directly relevant to trade operations. As such measures become available, the findings in this paper should be subjected to further tests.

[10] It is quite plausible that the error term ε_{ijt} in (2) is correlated with income and measures of $Dist_{ij}$.

(2006) test this estimator against alternative techniques and find that it performs quite well even in the presence of measurement errors in the dependent variable.

Alternatively, the gravity model can be estimated with binary or censored methods to account for missing trade. Ranjan and Tobias (2007) use the threshold Tobit estimator with a gravity model. Martin and Pham (2008) show that the Tobit model performs better than the Poisson estimator when the proportion of zero-trade flows is considerable. Santos Silva and Tenreyro (2010) emphasise that in this particular case the maximum likelihood estimator may fail to converge. Thus, the authors propose a way of overcoming the problem using the coefficients from a log-log model as starting values. The dataset used in our paper contains less than 10% of missing values and all regressors are identified. This makes the Poisson estimator preferable to the Tobit model.

To sum up, the advantage of the Poisson estimator as compared to the alternative binary techniques is that it allows for a continuous dependent variable. Moreover, compared to the censored models (Tobit estimators), the Poisson estimator allows for correction of another bias resulting in heteroscedastic standard errors due to the log-linear nature of the gravity equation. Correction for this bias is the key to conducting policy simulations, as we do in our study.

This paper follows Santos Silva and Tenreyro (2006) and Tenreyro (2007) in applying Poisson estimation techniques to estimate the gravity equation, as they better model the behaviour of trade, constraining the trade volumes to be non-negative. In addition, the obtained coefficients are easier to use for the simulation exercise owing to the absence of Jensen's inequality problem. The results differ significantly from simple OLS estimates, particularly in the size of the estimated coefficients on income levels and geographical distance, which suggests the biases that we attempt to correct are not trivial (the results are reported in the next section). For Poisson estimation, the basic model is specified in exponential form $y_i = \exp(x_i'\beta) + v_i$, which ensures that y_i is non-negative. Santos Silva and Tenreyro (2006) show that under the assumption that the conditional variance is proportional to the conditional mean ($Var(y_i \mid x) = E(y_i \mid x) = \exp(x_i'\beta)$), β can be estimated by maximising the following function: $\tilde{\beta} = \arg\max_b \sum_{i=1}^{n} (y_i * (x_i\beta) - \exp(x_i\beta))$. The resulting Poisson estimator is consistent even if the underlying data for y_i are not integers.

We use a panel of bilateral trade flows to estimate the gravity model. In the case of a panel estimator ε_{ijt} can be divided up into a fixed bilateral effect, a time-varying bilateral effect and white noise. A standard Hausman test did not reject the hypothesis of correlation between the fixed bilateral effect and the other regressors, implying that a fixed effects estimator should be used. This has the disadvantage that all time-invariant variables are dropped from the model.[11] Instead, we proceed with estimation using a pooled cross section estimator and including both country and time-specific dummies.[12] For clarity, the difference between a fixed effects estimator and our approach is that the fixed effects in a gravity model are estimated for each bilateral pair of countries, whereas the country dummies we estimate average these bilateral effects across all

[11] To resolve this inconvenience, we tried to apply a Hausman-Taylor estimator, but failed to obtain sufficiently strong instruments among the set of regressors. See Carrere (2006) for details on the Hausman-Taylor method in the context of a gravity panel estimation.

[12] An alternative approach is two-stage fixed effects estimation, where the country fixed effects are first retrieved from the baseline gravity estimation and then regressed in a second stage against time-invariant elements of $Dist_{ij}$ (see Bussiere, Fidrmuc and Schnatz, 2008).

trading partners for each country, although we allow for two country dummies depending on whether a country is an exporter or an importer in the relationship.

Finally, we should note that Poisson estimation does not eliminate the need to correct for heteroscedasticity, although it corrects the possible biases resulting from heteroscedastic error terms in log-linear specifications. We use Huber-White's method to correct for heteroscedasticity, which is equivalent to using the "robust" command in Stata.

3. Results

3.1 Data

We collected data for 82 countries and for eight years of the EU pre-accession period (1997–2004), yielding 47,684 observations. Our focus on the period from 1997 till 2004 is for three reasons: i) To focus on the effects of EU accession on international trade. Data for earlier years are incomplete for SEE and the CIS and thus our analysis starts in 1997. Furthermore, only the period up to but not beyond the completion of the accession process in CEE is considered here. This sample allows us to have a similar group of countries (formerly transition economies), some of which have prospects of joining the EU while the others do not (CIS countries). ii) To bring value added to the existing literature by assessing the simultaneous impact on trade of geographical, institutional and policy factors. To our knowledge, as of August 2010, there is no study on the determinants of trade in the SEE/CIS countries using a sample going beyond 2004 (with one exception – Caporale et al., 2009, who examine the period 1987/1991–2005. However, this study does not use such a reach specification as in our study. Furthermore, Caporale et al. (2009) employ fixed and random effect estimation techniques, which are subject to bias in the case of zero/missing trade between country pairs); iii) Examination of the effects of the 2008/2009 crisis is left for future research. For the above reasons the sample stops in 2004.

We exclude countries from Sub-Saharan Africa because of incomplete data on trade and several other variables used in our estimations. The sample represents roughly 95 per cent of world GDP and 82 per cent of total worldwide trade flows, and includes all major economies in emerging Asia, Latin America, as well as all OECD countries, in addition to the 27 countries of Eastern Europe and the former Soviet Union (see Annex 1 for a complete list of countries).

3.2 Estimations

The econometric specification for the full model in exponential form is:

$$Xijt = exp(\alpha 1 ln(GDP\_ppp)it + \alpha 2 ln(GDP\_ppp)jt + \alpha 3 ln(Pop)it + \alpha 4 ln(Pop)jt + \alpha 5 Volijt + \alpha 6 ln(Dist)ij + \alpha 7 DnInfrai + \alpha 8 DnInfraj + \alpha 9\ Contigij + \alpha 10 Nbordersij + \alpha 11 FTAijt + \alpha 12 WTOijt + \alpha 13 Imf\_orit + \alpha 14 Imf\_orjt + \alpha 15 WBit + \alpha 16 WBjt + \alpha 17 Ci + \alpha 18 Cj) + \varepsilon ijt, \qquad (2)$$

where *exp* is the exponent, *ln* stands for the log operator, the *t* subscript indicates time and all variables are defined as in **Table 1**. Note that the infrastructure and border effects (variables $DnInfra_i$, $DnInfra_j$ and $Contig_{ij}$, $Nborders_{ij}$ respectively) are constant over time, while trade policy and institutional quality variables are time-dependent. The constant terms C_i and C_j above are

approximated by country dummies (two for each country, depending on whether it is the exporter or the importer in the bilateral trade flow X_{ij}).

Table 2 reports the regression results of the full model in (2) for the period 1997–2004, estimated for six alternative specifications. Our preferable specification estimated with the pseudo-ML Poisson estimator is in column 4. The specifications in other columns serve to illustrate the potential biases introduced by OLS estimation (columns 1–2), Tobit estimation (column 3) and Poisson estimation when trade is restricted to positive values (column 5) and when multilateral resistance terms are omitted (column 6).

All regressions except column 6 are estimated with exporter and importer fixed effects. The regression in column 6 contains time dummies. Columns 1 and 2 show the basic regression results, estimated by OLS. The estimates in column 2 are obtained for the case when missing bilateral trade is replaced by unity values.

The results in column 4 conform to prior expectations. The elasticity of trade with respect to GDP is close to unity, as required by the model in Anderson and van Wincoop (2003). The Wald test rejects the restriction of the unitary coefficient on GDP at the 5 per cent significance level for the OLS and Tobit regressions. For the Poisson specifications in columns 4 to 6 the coefficient on GDP is not significantly different from unity. The coefficient on population is not statistically significant, although this depends on the specification chosen. Based on a comparison of the results in columns 5–6 it seems that the country-level multilateral resistance terms are correlated with country size and capture most of the explanatory power of the population variable. Exchange rate volatility has a significant negative impact on bilateral trade volumes as expected.

The coefficients of regression 4 are broadly in line with the Tobit regression (Column 3). The main difference is in the bloc geography. Distance has a much larger effect on trade in the Tobit regression. The impact of distance, however, is outweighed by the insignificant coefficient on the number of borders. Therefore, the total impact of geography on trade should be comparable with the Poisson regression in column 4. The Tobit regression is designed for a binary dependent variable. Furthermore, it has considerably lower R2 compared to the other specifications. For these reasons, the Poisson regression presented in column 4 is used for the simulations.

While bilateral GDP represents a dominant determinant of trade (which is not surprising, since by definition net exports are part of GDP), the effects of policy, institutional and geographical variables are also important. Turning to the various trade and transport obstacles, geographical distance exerts a strongly negative effect on bilateral trade flows. A 1 per cent increase in distance reduces trade by around 0.6 per cent in our estimations, which is within the range obtained by other studies. A common border increases bilateral trade by around 60 per cent, and for each additional border that goods need to cross trade declines by another 15 per cent. This is around half the value of the estimates in Raballand (2003) and in Bussiere, Fidrmuc and Schnatz (2008), but in line with the magnitudes found by Anderson and van Wincoop (2003). Road and rail density varies in our sample between a low of around 0.1 kilometre per one square kilometre in North Africa and the Middle East and a high of around 1.3 in the EU. This difference accounts for a less than 10 per cent difference in the total trade of country *i* or country *j*. The impact of infrastructure on trade is, therefore, significant but quantitatively not so important (according to the close-to-zero coefficients in Table 2).

More liberal trade policies contribute to greater integration. Trade between two WTO members is, other things being equal, around 50 per cent higher (calculated as (*exp(coefficient) -1)*100*) than trade between non-members. This is similar in magnitude to the estimates in Subramanian and Wei (2003) for industrial WTO member countries. Joint membership in an FTA also boosts bilateral trade by around 120 per cent in our sample, which is higher than the quantitative estimates in Subramanian and Wei (2003) of around 80 per cent. Compared to the impact of WTO or FTA membership, trade liberalisation – measured by the IMF index – has a much smaller impact. Moreover it is significant only for the importing country (Imf_or_j). The IMF index ranges from 1 (fully liberal) to 10 (fully restrictive). According to our estimates, the difference between a fully liberal and a fully restrictive trade regime would account for a 30 per cent difference in imports into country *j*. Although the quantitative effect is not very large the asymmetry between exporting and importing countries in the impact of trade liberalisation is interesting. Trade theory generally assumes that import taxes are equivalent to export taxes by raising the costs of tradable inputs into the export production process.

By and large, our results indicate significant potential benefits from trade liberalisation in the context of regional or multilateral agreements, with little additional explanatory power offered by the nature of a country's own trade regime. We posit that this is due to the considerable discipline imparted by recent regional trade agreements and by WTO membership on countries' trade policies. Fifteen or twenty years ago, when implementation was sketchy and exceptions were the rule, trade policy may have had a larger impact, and WTO membership and membership in an FTA a smaller impact. Unfortunately, the IMF data series does not extend prior to 1997.

The impact of institutional quality on trade flows is also sizeable. A one point increase in the average governance score (which ranges from –2.5 to +2.5) leads to a 15 per cent increase in exports from country *i* and a 40 per cent increase in imports into country *j*. The asymmetry parallels the findings for trade liberalisation. We have no obvious explanation for this. One possibility may be that the quality of institutions matters more for importers because it is the credibility of the contractual regime in the buyer's country that determines the propensity of suppliers to enter into exchange. This would be the case if exporters provide trade credit to importers, for instance, or rely on local bank guarantees to finance trade.

3.3 Policy Simulations

The above results can help us to account for the different extent of international integration in CEE, SEE and the CIS. We illustrate this using a set of simulations contained in **Table 3** (Annex 2 contains detailed methodological notes on the simulations carried out). All these simulations are based on the regression results in column 4 of **Table 2**.[13] First, we explore the impact of institutional reforms, approximated by improvements in the Wb_i and Wb_j variables up to the average level in the EU, for two periods, in 2004 and 2008. This benchmark is certainly relevant for CEE and for SEE; for the CIS other benchmarks may be more appropriate, but we stick to the

[13] Possible determinants of or impediments to trade integration are introduced simultaneously in order to avoid omitted variable bias. The inconvenience of this approach is that it is impossible to control for all possible interactions among the explanatory variables in the model. An alternative technique would be to put the determinants into the regression one by one and to compare the respective changes in the coefficients of the variables in question. Such an approach is applied in Babetskii et al. (2003), whose results are broadly in line with the present estimates with regard to the relative importance of the various determinants.

EU for ease of comparison. In 2004 the average scores on institutional quality for CEE, SEE and the CIS are 0.75, 0.29 and -0.95 respectively, relative to the EU15's average score of 1.55 (max. 2.5; min. -2.5). This results in potential trade gains from achieving the same institutional quality as in the EU in 2004 of around 50 per cent in CEE, 150 per cent in SEE and 230 per cent in the CIS. The gap between the best performer Estonia (26.4 per cent), which would achieve only modest additional gains from institutional reforms, and the worst performer Turkmenistan is a staggering 300 per cent. When using the EU15 average institutional quality in 2008 as the benchmark, the potential trade gains are lower for all considered cases except the Kyrgyz Republic (a rise from 190 per cent to 217 per cent). The overall decrease in the trade gain in 2008 as compared to 2004 is due to an increase in the average values of institutional quality in transition economies. As a result, with catching-up with the EU15, the differences in institutions become smaller, hence the trade gain diminishes. On the contrary, as institutions in the Kyrgyz Republic worsened in 2008 compared to 2004, this is reflected by a higher trade gain upon the hypothetical adoption of the EU15 average institutional value.

Second, we examine the impact of trade liberalisation, as reflected by the IMF trade restrictiveness index. Again we choose the EU as a benchmark, although it should be noted that the EU actually scores relatively poorly on this index, with a score of 4, considerably above the scores for some of the CEE countries pre-accession. Because CEE had to adopt the EU's trade policies and external tariff upon joining the enlarged EU, we do not consider them in this simulation. For SEE, the gains from further trade liberalisation on average are insignificant: just 0.1 per cent. Even for the CIS, the gains are small, at 5.4 per cent on average. Uzbekistan, the country with the most restrictive trade regime according to the IMF, would achieve a 24 per cent increase in trade levels from adopting EU-type trade policies. However, we should emphasise that these magnitudes reflect the marginal impact of trade liberalisation, net of the effect of WTO membership and membership in a free trade area.

Next we look at the impact of the transition economies joining an FTA with the EU. Among the SEE countries, Bulgaria, Romania and, since 2001 and 2002 respectively, Macedonia and Croatia have FTAs with the EU15. We therefore concentrate on the results for Albania, Bosnia-Herzegovina and Serbia-Montenegro. We simulate the impact of an FTA with the enlarged EU25 (for those countries which already have FTAs with the EU15, enlargement adds only modest additional trade opportunities given the dominance of the EU15 in trade patterns of SEE relative to CEE). Among the CIS countries, FTAs have been under discussion with Ukraine, Russia and the Southern Caucasus. Formally, the CIS is in itself an FTA, so any one CIS country joining an FTA with the EU would entail complicated rules of origin procedures for the rest of the CIS, which would be difficult to enforce. For illustration purposes we focus on the case of Ukraine and on the CIS as a whole.

For Ukraine, the EU25 accounts for around one third of its total trade; for the CIS, the average share is around half. Consequently, the trade gains from an FTA for Ukraine would be 45 per cent, compared to 66 per cent for the CIS on average. For comparison, Albania's and Serbia and Montenegro's trade is expected to increase by about 90 per cent. For Bosnia and Herzegovina the respective trade gains equal 67 per cent. These numbers are huge and reflect both the significant impact that FTA membership exerts on bilateral trade flows in our gravity model and the large share of the EU in the foreign trade of the CIS and SEE.

WTO accession is mainly an issue for the CIS countries. In the SEE bloc only two countries, namely Serbia and Montenegro[14] and Bosnia and Herzegovina, do not have WTO membership. In contrast, among the CIS, only Armenia, Georgia, the Kyrgyz Republic and Moldova are WTO members. For the remaining seven countries, the gains from membership depend on whether they trade primarily with WTO members or with non-members, since the WTO dummy is specified to account for the effect on trade if both trading partners are WTO members. On average, CIS trade with WTO members amounts to around 85 per cent of total trade. Including all intra-CIS trade, this rises to 96 per cent, so that if all CIS countries joined the WTO at once, their collective trade would increase by close to 50 per cent. If they joined independently, the gains would be lower, ranging between 18 per cent for Belarus and 45 per cent for Russia depending on the weight of intra-CIS in the total trade of each country. It should be noted that the EU has made it clear that it will not consider FTA arrangements with countries in the region which are not in the WTO. In this sense, these simulations present a wrong juxtaposition. The combined effect of WTO membership and an FTA agreement with the EU is clearly potentially very large (although in reality somewhat dependent on how broadly the FTA is structured – i.e. to what extent it covers agriculture and other sensitive goods).

Table 3 contains three further simulations (see also Annex 2 for a technical note). The first estimates the impact on total trade of selected CIS countries from having a common border with the EU as a result of enlargement. This impact is the sum of the impact of having a common border and the reduction in the number of borders with the EU. We concentrate on the trade gains for Europe's "new neighbours", Belarus, Moldova and Ukraine, as well as Croatia and Serbia, who have also become neighbours of the EU as a result of enlargement. The highest increase in trade is obtained for Croatia (45.5 per cent). The trade gains for Belarus, Ukraine and Serbia and Montenegro are between 20 and 30 per cent. Moldova did not benefit much from the first wave of enlargement, since it did not have a common border with the EU during the time period under study. With Romania and Bulgaria's accession in January 2007, this has obviously changed. The second round of EU enlargement generates trade gains of 34.6 per cent for Moldova according to our estimates, compared to a close-to-zero gain for the first wave of enlargement.

The second is an estimate of the gains for SEE and the CIS from the Soviet legacy of relatively high investment in physical transport infrastructure. As our comparator in this case we choose North Africa and the Middle East, comparable in terms of average per capita incomes. The higher density of roads and railways in SEE and the CIS relative to this region accounts for a 10 and 5 per cent difference in total trade levels, a modest amount. In Kazakhstan and Turkmenistan the infrastructure density on average is even lower than in North Africa, highlighting urgent investment needs.

The third simulation uses the gravity equation to look at the potential reorientation of trade in Central Asia towards South and East Asia following the end of the civil war in Afghanistan and investments in new trade routes south towards the Persian Gulf and East to the Chinese province of Xinjiang. In trade-weighted terms, Central Asia's potential trade with South and East Asia is around three times larger than its actual trade, with the potential trade gains ranging from 450 times with the Philippines, where actual trade is only 0.2 per cent of its potential level, to around

[14] One country during the estimation period.

two times with China and Korea. Trade with India, Pakistan and Japan currently reaches only 10–12 per cent of its potential level.

Finally, an interesting simulation concerns the potential impact of adopting the euro on trade in the new member states (CEE). Because exchange rates were relatively stable over the estimation period, setting exchange rate volatility to zero for the CEE generates only a 1.3 per cent gain in trade.

4. Conclusions and Policy Recommendations

Our main finding suggests that the low quality of institutions in many SEE and CIS countries represents the biggest obstacle to greater trade integration. Indeed, were the CIS countries to achieve the same institutional quality as the EU, their total trade would increase by 230 per cent, while for SEE the increase would be 150 per cent. Trade liberalisation is important in some CIS countries, which maintain restrictive policies to date, although the weight of trade liberalisation depends on the specification used (it is of little importance in our preferred specification). WTO membership influences trade positively, but, on average, by less than membership in a free trade area. Geographical disadvantages resulting from distance to major markets and from landlockedness for some of the CIS countries, particularly in Central Asia, are quantitatively less important than weaknesses related to the quality of institutions or the quality of infrastructure.

Our results are in line with the arguments presented in Broadman (2006), but in contrast to this comprehensive study we are able to demonstrate the importance of non-geographical determinants of trade in a unified framework that controls simultaneously for border effects, institutions, infrastructure and other factors. Our findings also support the position of Berkowitz et al. (2006), who argue that a country's ability to benefit from globalisation depends on the quality of its legal framework for contract enforcement (see also Aghion et al., 2005, and Rodrik, 2002 for related arguments). Babetskaia-Kukharchuk and Maurel (2004) also argue that institutions are the key to increasing integration of the CIS into the world economy, but their results are based on a much smaller sample, a simpler specification and a different measure of institutional quality.[15]

There has been much debate about the potential role of the WTO as an anchor for institutional reform. This role would be reinforced if institutional issues were to be tied to progress in multilateral trade liberalisation under the WTO, as suggested for instance by the EU. The EU is also planning to use the incentive of greater market access as an anchor to promote deeper institutional reforms in SEE and in the CIS. Our results suggest that WTO membership could give a significant boost to trade in the CIS, a boost that would be reinforced if it goes hand in hand with improvements in institutional quality. Furthermore, the creation of an FTA between the EU and the CIS would create even greater trade gains for the latter, providing significant incentives to adopt EU market rules and regulations in order to be granted access to the EU market. Against such harmonisation, it may be argued that it would lead to the importation of inappropriate institutions to the SEE and CIS countries, particularly without the ultimate prospect

[15] The World Bank governance indicators have defects of their own, which we highlight briefly below, but still present probably the most comprehensive publicly available data source on institutional quality across a wide sample of countries.

of membership in the common market. This may be true in some areas, and yet the experience of the new member states suggests that there are huge potential gains for SEE and the CIS in harmonising their regulatory framework with that of the EU in return for greater market access. Our results on WTO accession and on the role of FTAs are consistent with the findings of Subramanian and Wei (2003), who argue that WTO accession since the Uruguay round has promoted trade, whereas this was not the case in the previous rounds for most developing countries.

Landlockedness plays an important role in our estimates of international trade.[16] This paper suggests that, while important, geographical obstacles are not the primary constraints for greater integration of this remote region. However, in one simulation using our basic gravity specification, we find that there is huge potential to increase Central Asia's trade with South Asia, in particular India and Pakistan. Realising this potential will, *inter alia*, require significant additional investments in transport infrastructure and improved border management (Byrd et al., 2006). For Central Asia in particular, the fact that several borders need to be crossed to gain access to its main markets is an important drawback. The only major markets for which this is not the case are China and Russia, which may explain the rapid growth in trade with the former and the reintegration under way with the latter. At the same time, countries like Belarus, Moldova and Ukraine should benefit significantly from the fact that they face only one border between them and the EU market. For Belarus and Ukraine, for instance, the current share of trade with the EU is still well below the level predicted by our gravity equation, implying unexploited trade potential. However, while borders matter, this is not mainly because of weak transport links. Instead what is needed is greater attention to trade facilitation measures, such as customs harmonisation, enforcement of the TIR convention, road axle load regulations and visa regulations for foreign truck drivers.

What can be done to increase international trade in the non-accession countries? This paper contributes to uncovering the factors that are needed for countries to take advantage of the opportunities offered by the process of international integration. Turning these findings into policy actions is a difficult challenge but one that will bear rich fruit. The results in this paper indicate that institutional reforms are key. Our results suggest that the returns to such reforms could be very large.

[16] Several studies have emphasised the geographical and border-related obstacles to trade (Limao and Venables, 2001; Gallup et al., 1999; and specifically for the countries of Central Asia, Raballand, 2003; Raballand et al., 2005; Molnar and Ojala, 2003).

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Appendix

Table 1: Data Description and Sources

Sample coverage: annual, 1997–2004 (main sample) and 1997–2008 (institutions)

Group	Variable	Description	Formulas	Source
	LnX_{ij}	Log of bilateral trade (export of country *i* to country *j*), Exports - US$ million		IMF-DOTS
Baseline model	$LnGDP\_ppp_i$	LnGDP for country *i*, GDP in PPP, US$ million		WDI
	$LnGDP\_ppp_j$	LnGDP for country *j*, GDP in PPP, US$ million		WDI
	$LnPOP_i$	Log of population in country *i*, POP - millions of people		WDI
	$LnPOP_j$	Log of population in country *j*, POP - millions of people		WDI
	Vol_{ij}	Bilateral exchange rate volatility	$vol = \sigma\left[\frac{e_{ij} - e_{avg}}{e_{avg}}\right]$	Authors' calculation using Bloomberg and IMF-IFS exchange rate data
	$LnDist_{ij}$	Log of bilateral distance		www.cepii.fr
Border effects	$Contig_{ij}$	Dummy for common border	1 if common border; 0 otherwise	Authors' calculation using World Factbook
	$Nborders_{ij}$	Number of borders to cross to reach partner country	equal to [0, 1, 2, or 3]	Authors' calculation using World Factbook
Infrastructure	$DnInfra_i$	Density of roads and railroads (length per square kilometre) in country *i*	$DnRoute_i=(dnrail_i+dnroad_i)/1000$	Authors' calculation using World Factbook
	$DnInfra_j$	Density of roads and railroads (length per square kilometre) in country *j*	$DnRoute_j=(dnrail_j+dnroad_j)/1000$	Authors' calculation using World Factbook

(To be continued)

Table 1: (continued): Data Description and Sources

Group	*Variable*	Description	Formulas	Source
Trade policy	*WTO*	Dummy for WTO membership (both are WTO members)	1 if both are WTO members; 0 otherwise	Authors' calculation using WTO web site
	FTA	Dummy for FTA	1 if there is an FTA between two countries; 0 otherwise	Authors' calculation using WTO web site
	Imf_or_i	IMF Trade Restrictiveness index. Country *i*'s Overall Rating	ranges from 1 to 10; higher values mean more restrictive trade policy	IMF Trade Restrictiveness index
	Imf_or_j	IMF Trade Restrictiveness index. Country *j*'s Overall Rating	ranges from 1 to 10; higher values mean more restrictive trade policy	IMF Trade Restrictiveness index
Institutions	Wb_i	Average of WB inst. (corruption, rule of law, regulation quality) for country *i*	$wb_i=(wb\_c_i+wb\_rl_i+wb\_rq_i)/3$; ranges from [-2,5; +2,5]	Authors' calculation using WB Indicators
	Wb_j	Average of WB inst. (corruption, rule of law, regulation quality) for country *j*	$wb_j=(wb\_c_j+wb\_rl_j+wb\_rq_j)/3$; ranges from [-2,5; +2,5]	Authors' calculation using WB Indicators

Table 2: Regression Results, Full Model

Reg.number:	1		2		3		**4 - preferable**		5		6	
Restrictions			including Xij=0						Xij>0		no FEi & FEj	
Estimation by	OLS		OLS		Tobit		Poisson		Poisson		Poisson	
lngdp_pppi	1.16	***	0.67	***	0.67	***	0.85	***	1.11	***	0.96	***
	(0.06)		(0.04)		(0.04)		(0.12)		(0.16)		(0.04)	
lngdp_pppj	0.76	***	0.51	***	0.51	***	0.95	***	1.16	***	1.01	***
	(0.05)		(0.04)		(0.04)		(0.14)		(0.19)		(0.04)	
lnpopi	0.02		0.24	***	0.24	***	0.03		-0.39	**	-0.15	***
	(0.06)		(0.04)		(0.04)		(0.13)		(0.18)		(0.04)	
lnpopj	0.13	**	0.20	***	0.20	***	-0.15		-0.64	***	-0.17	***
	(0.06)		(0.04)		(0.04)		(0.14)		(0.19)		(0.04)	
vol	-0.05		-0.09	*	-0.09	*	-0.31	**	0.16		0.04	
	(0.08)		(0.06)		(0.06)		(0.14)		(0.15)		(0.15)	
lndist	-1.38	***	-1.10	***	-1.10	***	-0.55	***	-0.23	***	-0.40	***
	(0.01)		(0.01)		(0.01)		(0.01)		(0.02)		(0.03)	
contig	0.86	***	0.82	***	0.82	***	0.55	***	1.41	***	0.81	***
	(0.04)		(0.03)		(0.03)		(0.03)		(0.05)		(0.05)	
nborders_ij	0.13	***	0.01		0.01		-0.15	***	0.81	***	-0.04	*
	(0.03)		(0.02)		(0.02)		(0.03)		(0.08)		(0.02)	
dninfrai	0.00	***	0.00	***	0.00	***	0.00		0.00	***	0.00	***
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
dninfraj	0.00	***	0.00	***	0.00	***	0.00	***	0.00	**	0.00	***
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
WTO	0.47	***	0.36	***	0.36	***	0.41	***	0.29	***	-0.03	
	(0.03)		(0.02)		(0.02)		(0.04)		(0.08)		(0.04)	
FTA	0.51	***	0.50	***	0.50	***	0.80	***	0.98	***	0.49	***
	(0.02)		(0.02)		(0.02)		(0.03)		(0.06)		(0.06)	
imf_ori	0.01		0.00		0.00		-0.01		-0.01		-0.10	***
	(0.01)		(0.01)		(0.01)		(0.02)		(0.02)		(0.01)	
imf_orj	-0.03	***	-0.02	***	-0.02	***	-0.03	*	-0.02		-0.12	***
	(0.01)		(0.01)		(0.01)		(0.02)		(0.02)		(0.01)	
wbi	0.17	***	0.14	***	0.14	***	0.15	*	0.04		0.09	**
	(0.06)		(0.05)		(0.04)		(0.09)		(0.14)		(0.04)	
wbj	0.44	***	0.35	***	0.35	***	0.42	***	0.29	**	0.21	***
	(0.06)		(0.04)		(0.04)		(0.09)		(0.13)		(0.03)	
_cons	-10.07	***	-2.94	***	-2.94	***	-13.24	***	-21.23	***	-14.19	***
	(0.70)		(0.48)		(0.48)		(1.90)		(2.50)		(0.71)	
Number of obs	47684		47684		47684		47684		53303		47684	
Test Wald / F test	1117		1644		1651		183836		127750		36748	
Prob > chi2 or F	0		0		0		0		0		0	
Pseudo R2 or R2	0.80		0.83		0.37		0.94		0.90		0.89	

Notes: All specifications include exporter and importer fixed effects. Column 4 is our preferable specification based on which the policy simulations are conducted.
Standard errors corrected for heteroscedasticity are in parentheses. ***, ** and * denote 1%, 5% and 10% significance levels respectively. Time and country dummies are not reported.

Table 3: Simulating the Impact of Different Variables on Trade in the Transition Economies

Trade gains by region in per cent if not specified otherwise

	Institutional quality		Trade liberalisation	WTO membership	FTA with the EU	Wave of EU Enlargement		Infrastructure benefit	Trade potential with South and East Asia *	Introduction of the euro
	2004	2008				2004	2007			
Regional Simulations										
CEE	53.2	48.2								1.3
SEE	148.1	120.2	0.1					10.0		
CIS	230.2	205.1	5.4	48.9	65.8			5.2	30.5**	
Selected country simulations										
Azerbaijan	209.1	192.6	-3.0	39.0	58.1			8.4		
Belarus	283.9	235.3	17.4	17.9	36.5	27.6	27.6	9.7		
Kazakhstan	232.3	193.0	5.3	34.4				-0.3	34.0	
Kyrgyz Rep.	190.3	217.3	-3.0					1.5	39.1	
Moldova	189.4	161.1	5.3		42.4	0.3	34.6	13.0		
Tajikistan	255.5	237.6	-3.0	28.2				2.8	8.4	
Turkmenistan	340.1	322.2	14.3	22.1				-0.9	7.3	
Ukraine	197.9	178.0	5.3	31.8	45.0	20.2	20.2	8.6		
Uzbekistan	317.7	266.8	24.0	28.9				2.3	36.1	
Croatia	105.0	92.5	-3.0			45.5	45.5	10.8		
Serbia and Montenegro	186.1	135.8	8.2	50.0	89.0	29.2	29.2	10.1		

Notes: Simulations based on the coefficients from model 4 in Table 2. Insignificant coefficients have been set to zero.

* These estimates show how distant actual trade is from its potential level, which is equal to 100%. For figures below 100% an increase in trade is expected, and for figures above 100% a decrease in trade is expected.

** For five countries of Central Asia (Kazakhstan, Kyrgyz Rep., Tajikistan, Turkmenistan and Uzbekistan)

ANNEX 1: List of Countries

EU-15 (15)

country	
Austria	AUT
Belgium	BEL
Denmark	DNK
Finland	FIN
France	FRA
Germany	DEU
Greece	GRC
Ireland	IRL
Italy	ITA
Luxembourg	LUX
Netherlands	NLD
Portugal	PRT
Spain	ESP
Sweden	SWE
United Kingdom	GBR

CEE (8)

country	
Czech Republic	CZE
Estonia	EST
Hungary	HUN
Latvia	LVA
Lithuania	LTU
Poland	POL
Slovak Republic	SVK
Slovenia	SVN

S.Am (7)

country	
Argentina	ARG
Bolivia	BOL
Brazil	BRA
Ecuador	ECU
Paraguay	PRY
Uruguay	URY
Venezuela, Rep. Bol.	VEN

OCE (2)

country	
Australia	AUS
New Zealand	NZL

E.S-E.ASIA (9)

country	
China, P.R.: Mainland	CHN
Indonesia	IDN
Japan	JPN
Korea	KOR
Malaysia	MYS
Philippines	PHL
Singapore	SGP
Thailand	THA
Vietnam	VNM

SEE (7)

country	
Albania	ALB
Bosnia & Herzegovina	BIH
Bulgaria	BGR
Croatia	HRV
Macedonia, FYR	MKD
Romania	ROU
Serbia & Montenegro	SCG

CIS (12)

country	
Armenia	ARM
Azerbaijan, Rep. of	AZE
Belarus	BLR
Georgia	GEO
Kazakhstan	KAZ
Kyrgyz Republic	KGZ
Moldova	MDA
Russia	RUS
Tajikistan	TJK
Turkmenistan	TKM
Ukraine	UKR
Uzbekistan	UZB

NAFTA (3)

country	
Canada	CAN
Mexico	MEX
United States	USA

N.Af.M.East (10)

country	
Algeria	DZA
Cyprus	CYP
Egypt	EGY
Iran, I.R. of	IRN
Israel	ISR
Morocco	MAR
Saudi Arabia	SAU
Tunisia	TUN
Turkey	TUR
United Arab Emirates	ARE

S.ASIA (4)

country	
Bangladesh	BGD
India	IND
Nepal	NPL
Pakistan	PAK

OTHERS (5)

country	
Iceland	ISL
Malta	MLT
Mongolia	MNG
Norway	NOR
Switzerland	CHE

ANNEX 2: Explanatory Note to Simulation Results in Table 3

In order to estimate changes in **institutions**, **policy** and **infrastructure** due to convergence of the respective variables to the benchmark level we first calculate the difference between the benchmark value (VAR_B) and the actual value (VAR_a) of the variable and then multiply it by the corresponding regression coefficient $COEF\ \text{var}_{i/j}$ and take the exponent. Hence, the trade gain is obtained as:

$$\text{(A1)} \qquad \begin{aligned} Trade\ Gain_a = &((\exp(COEF\ \text{var}_i * (VAR_B - VAR_a)) - 1) + \\ &(\exp(COEF\ \text{var}_j * (VAR_B - VAR_a)) - 1)) * 100 \end{aligned}$$

For policy and institutions, the average score for the EU15 in 2004 is used as one benchmark. As an alternative benchmark for institutions, the EU15 average score is taken in 2008. Infrastructure is compared with four North African countries. Since the latter are expected to have poorer infrastructure than the CIS or SEE, we rearrange the difference: (VAR_a - VAR_B).

The trade gain for the whole regional bloc is estimated as the simple average of the individual trade gains for the member countries.

Gains from **WTO or FTA membership** or a **reduction in exchange rate volatility** are estimated as the average gain obtained from the regression multiplied by the corresponding trade share:

$$\text{(A2)} \qquad Trade\ Gain_K = \left((\exp(COEF_{VAR} * VAR) - 1) * 100\right) \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} Trade_i^{\text{with } m}}{\sum_{i=1}^{n} Trade_i^{TOTAL}},$$

where *K* is a bloc composed of *n* countries trading with *m* member countries of the WTO, the FTA or the euro area.

Since exchange rate volatility has a negative impact on trade we reverse 1 and exp(.) in (A2) to compute the gains from a decrease in exchange rate volatility. In other words, we calculate the trade gain from setting the exchange rate volatility between the EU12 and CEE to zero. We use the average volatility over the whole sample and the whole period. The average trade gain is then multiplied by the ratio of CEE trade with the euro area to total CEE trade in 2004.

The impact of **EU enlargement** on selected non-member states is assessed for two waves, those of 2004 and 2007. After the 2004 wave of EU enlargement, the selected countries (Belarus, Moldova, Ukraine, Croatia and Serbia), with the exception of Moldova, become "bordering" countries with the EU. Therefore, the number of borders to cross and the common border between the above countries and the EU25 are set to 1. For Moldova, variable *contig* is 0, and the number of borders is set to 2. After the 2007 wave of EU enlargement, with Romania and Bulgaria's accession, Moldova obtained a border with the EU, and the variables *contig* and $nborders_{ij}$ were adjusted accordingly. The trade gain for an individual country a is estimated as the ratio of the sum of the exponents of the predicted values of trade with all partners, estimated with modified *contig* and $nborders_{ij}$ variables, to the sum of the exponents of the predicted values of trade with all partners, based on the regression results:

$$\text{(A3)} \quad Trade\ Gain_a = \left(\frac{\sum_{j=1}^{81} \left(\exp\left(PREDICT_{aj}^{ENLARGEMENT} \right) \right)}{\sum_{j=1}^{81} \left(\exp\left(PREDICT_{aj}^{ACTUAL} \right) \right)} - 1 \right) * 100$$

Trade potential for the five Central Asia (*CA5*) countries is estimated as the ratio of actual to potential trade. Potential trade is estimated as the sum of the exponents of the linear prediction (*PREDICT*) obtained from regression 2 (Table 2). The predicted value is calculated for each pair of countries.

$$\text{(A4)} \quad Trade\ Potential_{CA5} = \frac{\sum_{a=1}^{5} \sum_{j=1}^{12} ACTUAL_j^a}{\sum_{a=1}^{5} \sum_{j=1}^{12} \left(\exp\left(PREDICT_j^a \right) \right)} * 100$$

where $a \in CA5$, $j \in E.\ \&\ S.E.Asia$ or $S.Asia$. If actual trade is missing, potential trade is not reported.

Simulations are performed based on 2004 values for the macroeconomic variables, using the significant regression coefficients from specification 4, Table 2. The impact of EU enlargement is simulated for the rounds of 2004 and 2007. The impact of institutional quality is assessed using the EU15 average scores for 2004 and 2008.

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