The EU’s Attitude Towards Eastern Enlargement in Space

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Key words: Eastern Enlargement; EU integration; Spatial Econometrics

JEL classification: F15; C1; R12; R15

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This paper analyzes empirically the determinants of the EU countries’ attitude towards enlargement during the pre-enlargement phase. The empirical specification is motivated from the perspectives of old and new trade theory. A variety of spatial econometric estimators is employed to assess the importance of the trade-related determinants as well as the extent of spatial dependence in the EU’s opinion on accession countries. This spatial approach enables us to differentiate between straight-forward direct effects on the one hand and spatial feedback effects related to space and geography.

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1 Introduction

How do citizens of the European Union (EU) feel about Eastern Enlargement? Is their opinion systematically related to the economic characteristics of the incumbent and applicant economies? Are opinions formed for each applicant separately, or are they formed in a clustered way? What is the role of geography and sheer space in that regard? The enlargement of the EU on May 1 in 2004 by 10 economies represents a unique historic event of overwhelming significance and severe consequences for the future of the European Union, rendering these questions important and interesting. The upcoming further enlargement including Bulgaria and Romania in 2007, and the application for enlargement of Croatia plus the discussion about EU membership of Turkey illustrate that these issues will continue to be relevant.

Information about compliance/repudiation of enlargement by EU citizens has been collected systematically in opinion polls at an annual basis since the mid 1990s. This data set is available at the EU-member-to-applicant country-pair and annual level for the pre-Eastern-Enlargement period. This enables an investigation of whether the variance in the attitude towards enlargement is systematically determined. Specifically, we will elaborate on how economic fundamentals steer the attitude towards enlargement, while controlling for time-invariant (e.g., cultural or geographical) influences in a compulsory way.

We conjecture that EU citizens do not form their beliefs about the representative citizen in an applicant country independent of those in other countries. But rather, (un-)favorable opinions about, say, Estonians will likely be correlated with those about Latvians. Arguably, the opinions are formed in a geographically clustered way. This is well reflected in Figures 1 and 2, where we display the levels as of 1997 and the 1997-2002 changes of Eurobarometer scores reflecting a favorable attitude towards enlargement of the EU. The displayed values are averages of EU citizens specific for each applicant country. Obviously, both the levels and the changes of scores are geographically clustered. The increase in the score – reflecting an attitude that is favorable towards enlargement – is relatively high for both the Central European economies (Czech Republic, Hungary, Slovak Republic, and Slovenia; somewhat lower for Poland) and the Baltic countries (Estonia, Latvia, and Lithuania).

> Figures 1 and 2 <

Geographical interdependence in the attitude of EU citizens towards enlargement
seems important for two reasons. First, there may be limited scope for a single applicant country to influence the EU citizens’ opinion. Similarly, it may require particular effort by EU citizens to form accurate beliefs about a specific country. Second, geographical aspects may be important in co-dictating the formation of enlargement groups and the corresponding time pattern for the sake of political acceptance among citizens in the incumbent countries that fear losing from economic integration with the less developed applicant countries. Hence, knowledge about the spatial correlation in opinion formation may be relevant for political decisions related to EU enlargements. It is this paper’s purpose to shed light on these issues based on modern econometric techniques suited for the analysis of spatially correlated data.

The consideration of spatial interdependence does not only provide additional insights regarding the geographical pattern of determination of the EU incumbents’ attitude towards enlargement, but it even changes the quantitative estimates of the marginal effect of a determinant. For instance, positive (negative) spatial spillovers induce dissemination and feedback effects that magnify (reduce) the direct impact of an exogenous variable on the dependent variable. Consequently, disregarding existing spatial spillovers leads to an omitted variables bias and potentially misleading inference about the determinants of the EU’s attitude towards enlargement.

Previous empirical work on the determinants of the attitude towards enlargements of the EU did not consider geographical interdependence in opinion formation. However, a few related studies are worth mentioning. Caplanova, Orviska, and Hudson (2004) analyze the attitude towards enlargement among citizens in the Central and Eastern European applicant countries at the micro-level. They find that the winners of the transition process, namely well-educated individuals with a high income, are more likely in favor of their home country’s EU membership. Overall, the approach of Caplanova, Orviska, and Hudson (2004) differ from the one adopted here in three important ways: first, they focus on the applicant countries’ attitude while this paper’s research question is about the determinants of the attitude towards enlargement in the EU incumbent countries; second, while they consider a micro-level database of citizens in the applicant countries this paper employs a data-set where scores at the country-pair level are repeatedly observed across time; third, this paper considers the role of geographical interdependence in the EU country citizens’ opinion about the applicant economies while there is no interdependence in opinion formation in Caplanova, Orviska, and Hudson (2004).

Furthermore, there are two papers that use the Eurobarometer score database pri-
marily to study the role of bilateral opinions as reflected in the scores for outcome variables such as bilateral trade and investments. Guiso, Sapienza, and Zingales (2004) construct a variable referred to as trust based on questions conducted by Eurobarometer to investigate the role of trust for economic exchange among countries (trade, portfolio investment, and foreign direct investment). Disdier and Mayer (2005) study the impact of Eurobarometer scores on bilateral imports and exports in a gravity model of trade. Their findings suggest that a rise of ten percent in the level of positive bilateral opinion raises trade volumes by more than three percent. Both papers are related to ours since they treat the Eurobarometer scores as endogenous. Both papers use measures of cultural (e.g., common language), geographical (e.g., distance, adjacency), political (number of years at war in different periods), and religious proximity and country fixed effects as instruments for the Eurobarometer scores. Hence, the research in Guiso, Sapienza, and Zingales (2004) and Disdier and Mayer (2005) differs from the one here in three important ways: first, we adopt a fixed country-pair (rather than country) effects estimation strategy that controls for all time-invariant cultural, geographical, political, and religious variables in a compulsory way (see Baltagi, 2005); second, we determine Eurobarometer scores by economic fundamentals whose impact can be rationalized from general equilibrium models of trade and multinational firms; third, while Guiso, Sapienza, and Zingales (2004) and Disdier and Mayer (2005) assume that bilateral attitude towards enlargement of an applicant country is formed independently of other applicants, this paper puts special emphasis on the interdependence in opinion formation.

The remainder of the paper is organized as follows. The next section surveys general equilibrium models of international trade and multinational firms to derive hypotheses about the key determinants of the Eurobarometer scores among the economic fundamentals. Section 3 introduces the database and the empirical set-up. Section 4 describes the econometric approach and provides a brief discussion of the employed estimators, while Section 5 summarizes the findings and undertakes two experiments of thought to illustrate the role of space in this type of models. The last section concludes with a summary of the most important findings.

2 Theoretical background

This paper aims at determining how economic fundamentals affect the EU citizens’ attitude towards applicant countries that exhibit lower production costs than the
average EU incumbent country. This is not to say that economic determinants are the only ones being relevant for the EU citizens’ attitude towards enlargement. However, there is little theoretical guidance about the role of, e.g., cultural determinants. We capture all time-invariant variables comprehensively in an empirical specification that includes fixed country-pair effects. Therein, for instance, we implicitly account for cultural or institutional determinants of the EU countries’ attitude towards Eastern Enlargement. From an economic point of view, an EU enlargement is associated with a reduction in the barriers to trade and investment among the EU incumbent countries and applicant economies that are characterized by lower production costs than in the average EU country. Hence, it seems obvious to ask about the theoretical predictions for the impact of such an enlargement on the wages in the incumbent countries.\(^1\) Since this question is at the heart of research in international economics, answers to the latter question can readily be gathered from textbooks in the field (e.g., Dixit and Norman, 1980; Markusen, Melvin, Kaempfer, and Maskus, 1995; Feenstra, 2004).\(^2\) In the sequel, we focus on the predicted effects of an integration among the capital-abundant average EU incumbent country and a labor-abundant average applicant country on workers in the incumbent economy to formulate testable hypotheses about determinants of the Eurobarometer scores.

The first hypothesis relates to size differences among two integrating countries and their impact on wages. Consider a model where trade occurs due to comparative cost differences between countries. In this case, trade is mutually beneficial. For instance, in a Ricardian model with a single factor (workers), all workers will face real income gains once moving from autarky to free trade. However, more productive economies will enjoy higher gains. Furthermore, there is a crucial role to play for country size as a determinant of the cross-country pattern of the gains from trade: smaller (larger) countries likely gain from trade liberalization to a major (minor) extent as their terms of trade tend to rise (deteriorate). The latter enables us formulating the first country-size-related hypothesis.\(^3\)

\(^1\)For this, we assume implicitly that the average EU incumbent country is abundantly endowed with physical capital/skilled labor relative to the average applicant country.

\(^2\)Beyond that, the theory of endogenous protection stresses that different interest groups may have an incentive to lobby for protection if their members are worse off after trade liberalization (e.g., Trefler, 1993, and Rodrik, 1995; Mayda and Rodrik, 2005, examine the empirical determinants of protectionism at the micro-level). In that literature, estimating the impact of endogenous trade liberalization on trade volume is of particular interest. However, this paper’s focus is on the determinants of the attitude towards enlargement itself rather than its impact on trade volume, which avoids part of the problems raised in the endogenous protection literature.

\(^3\)For this, note that the average EU incumbent country is larger than the average applicant in terms of GDP.
**Hypothesis 1:** An increase in incumbent-to-applicant country size differences should have a negative impact on the average incumbent’s attitude towards enlargement.

While the first hypothesis relates to size differences, the second one focuses on relative factor endowment differences (i.e., relative factor price differences). For this, let us assume a Heckscher-Ohlin world with two factors of production, capital and labor. There, differences in relative factor endowments and, hence, in relative factor prices are the only source of trade. One central mechanism at work in the Heckscher-Ohlin model is formalized in the Stolper-Samuelson theorem: a relative increase in the price of a commodity will increase the real return to the factor used intensively in production of that commodity and reduce the real return to the other factor. As a country starts exporting (importing) the good that uses its abundant (scarce) production factor relatively intensively, trade increases (reduces) the demand for the country’s abundant (scarce) production factor. Hence, a country’s abundant factor will gain from trade liberalization, both in nominal terms and in real terms, whereas the scarce factor will lose. The larger the difference in relative goods and factor prices of two integrating countries before integration, the larger are both the potential overall gains from trade and the losses of the losers. The average EU15 country is relatively capital abundant compared to the average applicant country. Therefore, one would expect workers there to be less inclined towards integration the larger the capital-to-labor endowment ratio difference between the two.

**Hypothesis 2:** An increase in the incumbent-to-applicant country capital-to-labor endowment ratio difference should have a negative impact on the attitude of the average incumbent vis-à-vis the average applicant.

A third hypothesis relates to the wage/income inequality within an incumbent country and its impact on the attitude towards integrating with a labor-abundant applicant. Dutt and Mitra (2006) find that, in a Heckscher-Ohlin framework, an increase in inequality creates an incentive to raise (reduce) trade barriers in capital-abundant (labor-abundant) economies. The reason is that the rising inequality increases the demand for redistribution from capital to labor. This can be achieved by (trade) policies that raise wages relative to capital rentals. Consequently, a capital-abundant (labor-abundant) country will restrict (promote) trade.

**Hypothesis 3:** An increase in a very capital-abundant (labor-abundant) incumbent country’s inequality should have a negative (positive) impact on its attitude towards enlargement.
The models discussed above share one feature: they explain interindustry trade (e.g., trade of machinery in exchange for food) but not intra-industry trade (e.g., two-way trade of machinery). The ability to explain intra-industry trade overlap and the large extent of trade among the OECD economies, where neither technology nor relative factor endowment differences are large, is one of the major advantages of what is now referred to as new trade theory models. Let us consider the simplest model with these features introduced by Krugman (1979, 1980), which relies on the assumption of a single monopolistically competitive sector, free market entry and exit, and love-of-variety preferences and product differentiation à la Dixit and Stiglitz (1977). Absolute market size matters in this model due to imperfect competition and economies of scale at the firm level. With two monopolistically competitive sectors and some specific factors as in Krugman (1981), trade liberalization favors all production factors if there is sufficient product differentiation. The latter is especially true for two large markets, where intra-industry trade dominates.

**Hypothesis 4:** *Incumbent country workers will be especially in favor of enlargement if the applicant is similar and large.*

From the discussion of Hypotheses 2 and 3 it is obvious that trade is expected to reduce workers’ wages in a capital-abundant country relative to both workers’ wages abroad and the capital rental at home. Consequently, trade costs in these models constitute an obstacle to gains from trade but also the losses of workers in capital-abundant countries.

**Hypothesis 5:** *Workers in a capital-abundant incumbent country will be more in favor of enlargement the higher the trade costs vis-à-vis an applicant country are.*

In the derivation of Hypotheses 1-5 it was assumed that production factors such as capital were immobile across international borders. Yet, empirically we can not neglect the high volumes of FDI among the EU incumbent and the accession countries. Therefore, we consider an additional hypothesis relating to the costs of foreign plant set-up of multinational enterprises (MNEs). Previous research on MNEs indicated that MNEs tend to facilitate factor price equalization (Helpman, 1984; Markusen, 1984; Markusen and Venables, 1997; see also Markusen, 2002). Low barriers to foreign investment in a capital-abundant EU country would be expected to raise workers’ wages – and, hence, their attitude towards enlargement – there.

**Hypothesis 6:** *Workers in a capital-abundant EU incumbent country will gain from inward foreign direct investment associated with low investment barriers.* Hence,
they will be more favorable towards enlargement the lower the domestic investment costs are.

3 Database and empirical specification

Our endogenous variable is taken from the Eurobarometer Survey Series. We use the available data from 1997 to 2002 in order to obtain a balanced panel of country-pair data. Throughout, there are 15 EU incumbents for which opinion scores – defined as the share of supporters in total answers – are available regarding 13 applicant countries (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, Slovenia, and Turkey).

Most of the employed independent variables are based on data available from the World Bank’s World Development Indicators. As suggested by the discussion of the Ricardian model, size differences should have a negative impact on the attitude of the EU15 countries towards enlargement. Following Helpman and Krugman (1985), we use a non-linear measure of relative country size, defined as:

\[ SIMI_{ijt} = \ln \left[ 1 - \left( \frac{GDP_{it}}{GDP_{it} + GDP_{jt}} \right)^2 - \left( \frac{GDP_{jt}}{GDP_{it} + GDP_{jt}} \right)^2 \right] . \] (1)

This index increases as two economies become more similar in size. We expect a positive sign of the coefficient of \( SIMI_{ijt} \) (Hypothesis 1).

Relative factor endowment differences should be relevant according to the Heckscher-Ohlin model of trade. For this, we use a country’s capital stocks per worker measured by the relative capital per worker:

\[ RKPW_{ijt} = \ln \left( \frac{KPW_{it}}{KPW_{jt}} \right) , \] (2)

where \( KPW_{it} (KPW_{jt}) \) denotes the capital-per-worker ratio in the incumbent (applicant) country \( i (j) \) and year \( t \). We expect a negative influence of the relative capital-to-labor-endowment differences on the attitude towards integration (Hypothesis 2).

\(^4\)http://www.gesis.org/en/data_service/eurobarometer/

\(^5\)Specifically, we use the scores associated with the following question: “Several countries have applied to become members of the European Union. For each of the following countries, would you be in favor of or against it becoming part of the European Union?”.  

\(^6\)The computation of capital stocks follows the methodology in Leamer (1984) and Baier, Dwyer, and Tamura (2006). We gratefully acknowledge the provision of data by Scott Baier.
Furthermore, we presume that the inequality within a country plays a role. Accordingly, we use the incumbent country Gini-coefficient both as a main effect (\(GINI_{it}\)) and interaction effect with incumbent country capital per worker (\(GINI_{it} \times \ln KPW_{it}\)).

Following Dutt and Mitra (2006), we expect a positive coefficient of \(GINI_{it}\) and a negative one of \(GINI_{it} \times \ln KPW_{it}\) (Hypothesis 3).

Following the empirical literature on the implications of new trade theory for the volume and the structure of bilateral trade, we use the sum of an incumbent (\(i\)) and an accession country’s (\(j\)) gross domestic product (\(GDP\)) in year \(t\) as a measure of bilateral country size (see Helpman, 1987)

\[
SGDP_{ijt} = \ln(GDP_{it} + GDP_{jt}).
\]

We expect a positive impact of this variable on the attitude in favor of enlargement (Hypothesis 4).

As indicated above, an increase in trade costs at given incumbent-to-accession country technology/size and relative factor endowment differences leads to smaller gains from trade but also smaller losses of workers in the capital-abundant countries. We use the logarithm of iceberg trade costs (\(TC_{it}\)) based on cost-insurance-freight relative to free-on-board values of trade matrices.\(^8\) Iceberg trade costs are defined as the percentage of exported goods ‘iceberg’ that melts during transport. We expect workers in the EU incumbent countries to be more in favor of enlargement with applicant countries where trade costs are high (Hypothesis 5). Hence, the parameter of \(TC_{it}\) should be positive.

Finally, lower foreign investment costs in a capital-abundant country should foster inward direct investment and, hence, increase the workers’ attitude towards enlargement. Since there is no direct measure of investment costs available, we use an indicator available from the International Country Risk Guide (ICRG), capturing an incumbent country’s attitude towards foreign investors (\(ATTFOR_{it}\)). A higher index value is associated with lower impediments to foreign inward investments. Hence, we expect a positive coefficient of \(ATTFOR_{it}\) (Hypothesis 6). Table 1 pro-

\(^7\)Note that \(GINI_{it} \in [0, 100]\) and the Gini-coefficient increases if a country’s income inequality rises. The data are taken from Eurostat, the World Bank’s World Development Indicators, and UNICEF’s TransMONEE database.

\(^8\)In fact, we use the logarithm of the ratio of imports of country \(j\) from \(i\) in year \(t\) and \(i\)'s exports to \(j\) in the same year as an approximate measure of trade costs.
vides summary statistics of the dependent and the independent variables.

> Table 1 <

Beyond the discussed variables, we conjecture that the attitude of an EU country towards accession of an applicant economy also depends on the attitude towards other applicants’ accession. In particular, we argue that an applicant country surrounded by other applicant economies that are faced with a negative attitude towards enlargement by the average EU country will experience negative opinion spillovers, all else equal. Hence, we hypothesize that reservations and prejudices of the Western Europeans towards EU accession of the applicant countries are geographically interrelated, implying that people do not form their opinion on a specific country in a geographically independent way. This argument seems to be supported by Figures 1 and 2 above.

The impact of spatial spillovers among the accession countries may be captured by the spatially weighted average of the dependent variable which enters the empirical model as an additional regressor. Figures 1 and 2 suggest that interdependence declines in distance. Therefore, we construct a $13 \times 13$ weighting matrix with inverse distances $d_{j\ell}^{-1}$ between accession countries $j$ and $\ell$ for all $j \neq \ell$ and 0 for $j = \ell$ as its entries. $d_{j\ell}$ is the great circle distance between the capitals of the applicant countries $j$ and $\ell$. Then, we follow the literature and normalize this inverse-distance-based matrix by dividing each element by the sum of the elements in the same row to obtain a matrix $W_{1,t}$ whose entries sum up to unity in each row.\(^9\) In addition to that, we also allow for spatial dependence in the stochastic shocks as will be outlined in the next section.

4 Econometric approach

We adopt a mixed-regressive-spatial autoregressive model with a spatial autoregressive disturbance (see Anselin, 1988) to capture the spatial dependence mentioned above. In order to ensure proper identification, it is recommended to use different weighting schemes for the dependent variable and the error term (Anselin, 1988). Accordingly, we assume a steeper spatial decay for stochastic shocks than for the dependent variable and use borders rather than inverse distances in the weighting

\(^9\)I.e., $\sum_{\ell} d_{j\ell}^{-1} / (\sum_{\ell} d_{j\ell}^{-1}) = 1$. 

scheme of the errors (the corresponding spatial weighting matrix of the latter will be referred to as $W_{2,t}$).

Formally, we estimate the following model:

$$
y_{ijt} = \rho_1(W_1y_{ijt}) + \beta_1 SIMI_{ijt} + \beta_2 RKP_{ijt} + \beta_3 GINI_{it} + \beta_4 GINI_{it} \times KPW_{it}$$

$$+ \beta_5 SGDPI_{ijt} + \beta_6 TC_{it} + \beta_7 ATTFOR_{it} + \mu_{ij} + \lambda_t + u_{ijt},$$

$$u_{ijt} = \rho_2(W_2u_{ijt}) + \epsilon_{ijt},$$

(4)

where $y_{ijt}$ denotes the Eurobarometer scores. To guarantee the existence of $(I - \rho_k W_k)^{-1}$, $|\rho_k| < 1$ is assumed for all $k = 1, 2$. For each country-pair $ij$ we include a dummy variable with parameter $\mu_{ij}$. This aims at controlling for all unobserved effects in the cross-sectional dimension of the panel. Especially, the latter is eager to comprehensively account for potentially relevant cultural, institutional, and geographical variables in a period as short as the covered one (e.g., incumbent-to-applicant bilateral distance, adjacency, common language, religious proximity, etc.). Additionally, we include time dummies for each year with parameters $\lambda_t$ to capture the overall development of Eurobarometer scores in the course of years. $\epsilon_{ijt}$ denotes an independently and identically distributed disturbance term. Altogether, there are 1170 observations and the panel is balanced (i.e., there are no missing observations). The two spatial weighting matrices $W_1$ and $W_2$ are block-diagonal with six identical blocks each, referring to a single year, $W_{1,t}$ and $W_{2,t}$, respectively.

To estimate the model in (4) we use two different econometric approaches. The first one relies on the maximum likelihood estimation method (MLE, see Anselin, 1988). MLE assumes normally distributed errors $\epsilon_{ijt}$. In order to avoid the normality assumption, we apply generalized method of moments estimation as an alternative (GM, see Kelejian and Prucha, 1999).

Concerning MLE, the first order conditions reduce to a non-linear function of the two spatial parameters. When using MLE for spatial models, a well known problem is the computation of the determinant of the Jacobian term, i.e., $\ln |I - \rho W|$, especially for high-dimensional problems. To account for these numerical difficulties, we employ various decompositions and approximation techniques. The original solution to MLE of spatial models as proposed by Ord (1975) exploits the decomposition of the Jacobian based on the eigenvalues $\omega_i$ (with $i = 1, ..., n$) of a spatial weighting
matrix $W$:

$$\ln |I - \rho W| = \sum_{i=1}^{n} \ln(1 - \rho \omega_i).$$  \hfill (5)

Pace and LeSage (2004) propose a Chebyshev decomposition:

$$\ln |I - \rho W| \approx q + 1 \sum_{j=1}^{q+1} c_j(\rho) tr(T_{j-1}(W)) - \frac{n}{2} c_1(\rho),$$  \hfill (6)

where $T_0(W) = I$, $T_1(W) = W$, $T_2(W) = 2W^2 - I$, $T_{k+1}(W) = 2WT_k(W) - T_{k-1}(W)$ (Press, Teukolsky, Vetterling, and Flannery, 1996, p. 184). $tr(T)$ denotes the trace of the matrix $T$, and $q$ represents the highest power of the approximating polynomial which thus has $q + 1$ coefficients $c_j(\rho)$. $c_j(\rho)$ is given by

$$c_j(\rho) = \left(\frac{2}{q + 1}\right) \sum_{k=1}^{q+1} \ln \left[ 1 - \rho \cos \left( \frac{\pi(k - 0.5)}{q + 1} \right) \right] \cos \left( \frac{\pi(j - 1)(k - 0.5)}{q + 1} \right),$$  \hfill (7)

where $\pi$ is the constant pi-value. As shown by Pace and LeSage (2004), the used quadratic approximation ($q = 2$) leads to a sufficient accuracy of the log-Jacobian.

For a symmetric spatial weighting matrix (or for row-standardized weights transformed to symmetric form), the Cholesky factorization (see George and Liu, 1981) solves

$$I - \rho W = LL',$$  \hfill (8)

where $L$ is a lower triangular matrix, and $L'$ is its transpose. The determinant of the Jacobian is thus $|I - \rho W| = |L||L'| = |L|^2$. Hence the log-Jacobian is easily computed as

$$\ln |I - \rho W| = 2 \sum_{i=1}^{n} \ln(l_{ii}),$$  \hfill (9)

with $l_{ii}$ ($i = 1, ..., n$) as the diagonal elements of $L$.

All ML-techniques suggest an iterative approach. In a first step, the logarithm of the determinant of the Jacobian is calculated in dependence of $\rho$. In the second step, the log-likelihood is evaluated at each iteration, substituting a value for $\rho$. With this feasible estimate for $\rho$, the remaining parameters are easily obtained. Below,
the estimation algorithms and the corresponding results are referred to as "MLE Ord", "MLE Chebychev", and "MLE Cholesky", respectively. Alternatively, we apply a parameter grid search ($\rho_i = -0.99 : 0.05 : 0.99 \ \forall \ i \in \{1, 2\}$) and select the preferred estimator based on the maximum value of the log-likelihood function (referred to as "MLE grid search"). Our last MLE estimator employs non-linear optimization techniques (referred to as "MLE nl. opt."), based on the Nelder-Mead Simplex method (Lagarias, Reeds, Wright, and Wright, 1998).

The second applied methodology relies on GM estimation and adopts a two-stage least squares procedure and additional moment conditions to estimate the spatial parameters $\rho_1$ and $\rho_2$. In this set-up, $W_1y$ is endogenous. Accordingly, proper inference needs to rely on an instrumental variables estimator. Therein, all independent variables as well as the once and twice spatially lagged independent variables ($[X, W_1X, W_1^2X, W_2X, W_2^2X]$) serve as instruments as recommended by Kelejian and Prucha (1999). Here, only those instruments enter the model which pass the Sargan test (1958). Kelejian and Prucha (1999) proposed a three-step procedure. In the first step, a consistent estimate for the residuals is obtained by two-stage least-squares ignoring the spatial correlation of the error term. In the second step, these residuals are used in the moment conditions to estimate the spatial correlation coefficient of the error term. The resulting quadratic form is optimized by the Levenberg-Marquardt (Levenberg, 1944; Marquardt, 1963) algorithm. In the final step, a Cochrane-Orcutt type transformation is applied and the parameters are estimated by two-stage least-squares on the transformed values. This estimator is called "GM Kelejian-Prucha". Lee (2003) proved that these instruments do not lead to asymptotically efficient parameter estimates. He suggests using $H = (I - \hat{\rho}_2W_2)[X, W_1(I - \hat{\rho}_1W_1)^{-1}X\hat{\beta}]$ as instruments, where $\hat{\beta}$, $\hat{\rho}_1$, and $\hat{\rho}_2$ are the estimates from the first and second step. This variant of the model by Kelejian and Prucha is referred to as "GM Lee".

To test for spatial dependence in the error term, we rely on the standard error estimates by MLE. Regarding the GM approaches, we calculate the Moran $I$ test statistic according to Kelejian and Prucha (2001).
5 Results

5.1 Regression results

We summarize our empirical findings for the model in Equation (4) in Table 2. For reasons of comparison, the table provides a set of results based on a simple fixed country-pair effects model in the first place. This model ignores spatial correlation of any kind.\(^\text{10}\)

> Table 2 <

The parameters tend to be fairly similar across the estimated spatial models. Even the simple fixed effects model provides qualitatively similar results. The difference between the MLE and the GM estimators is negligible. The results are sufficiently robust so that we can proceed by focusing on the nonlinear MLE estimates in the subsequent discussion. According to both the standard error of \(\rho_2\) and the Moran I statistic, spatial correlation in the error term should not be ignored. The coefficient of the spatially lagged dependent variable is significant, suggesting that modeling interdependence only through fixed country-pair effects may cause an omitted variable bias.

There is strong support for all six hypotheses formulated above. Similarity in country size exhibits a positive impact on the EU member’s attitude towards enlargement (Hypothesis 1). Furthermore, an increase in the capital abundance of the EU countries reduces their citizens’ (workers’) attitude towards enlargement (Hypothesis 2). The income inequality affects the Eurobarometer scores as expected (Hypothesis 3): more unequal EU countries tend to be in favor of enlargement (the coefficient of \(GINI_{it}\) is positive) but very capital-abundant ones less so (the coefficient of \(GINI_{it} \times \ln KPW_{it}\) is negative). A larger bilateral market size – being associated with a higher level of intra-industry trade – renders EU citizens more favorable towards enlargement, all else equal (Hypothesis 4). The iceberg costs of trade between the EU economies and the applicant countries increases the Eurobarometer scores (Hypothesis 5). Finally, a more favorable treatment of foreign investors in

\(^{10}\)Note that our dependent variable varies between 0 and 100. To take account of the limited dependent variable character, we also estimated a logarithmically transformed model relying on \(\ln \left( \frac{y_{ijt}}{100-y_{ijt}} \right)\) instead of \(y_{ijt}\). The results of the two models are very similar, given the empirical support of the Eurobarometer scores. Therefore, we stick to the untransformed model in what follows, since the interpretation of the results is much easier.
the average EU country – associated with lower costs of foreign investment there – improves the attitude towards enlargement, there (Hypothesis 6).

> Table 3 <

With large cross-sections (and short time-series) the spatial weighting scheme cannot be estimated itself, but estimation has to rely on assumptions on its functional form. Accordingly, the sensitivity of the results with respect to the chosen weighting scheme may be a concern. We address this issue in Table 3 which summarizes our findings from a sensitivity analysis aiming at inferring the robustness of our results in this regard. Because of its good performance according to the log-likelihood statistic, we rely on the "MLE nl. opt." estimation throughout in that table. In the sensitivity analysis we proceed in two directions. First, we rely on distance-based weighting but assume an alternative degree and/or functional form of the spatial decay. The first five columns in Table 4 summarize the alternative results for this approach. Second, in the sixth column we adopt a conceptually different weighting scheme by using bilateral trade volumes rather than inverse distances as entries in the spatial weighting scheme. The latter implicitly assumes that the attitude towards enlargement by a specific applicant is positively associated with its economic (rather than only its geographical) adjacency to other applicants. Since we know that bilateral trade volumes are very well explained by bilateral country size and geographical and cultural proximity, we could think of trade weights as representing size-adjusted geo-cultural-proximity-based weights. A comparison of the reported estimates illustrates that the outcome seems very robust to the choice of the spatial weighting scheme.

5.2 Quantifying the spatial spillover effects

We continue with an illustration of the importance of the spatial structure of the EU’s attitude towards enlargement by computing the spatial multiplier and the associated overall marginal impact of the exogenous determinants. We shed light on the spatial dissemination of the effects of a shock in Eurobarometer scores due to spatial dependence and spatial feedback.

> Table 4 <
In the empirical model given in Equation (4), changes in the exogenous determinants of an applicant affect the EU’s attitude towards all other applicants due to spatial spillovers. This is implicitly captured by the significant impact of the spatially lagged dependent variable. The overall impact of a marginal increase in the $k$th exogenous variable in the model is given by $n^{-1}i'(I - \rho_1W_1)^{-1}i\beta_k$, where $(I - \rho_1W_1)^{-1}$ is called the spatial multiplier (see Anselin, 2003), $i$ is an $n \times 1$ vector of ones and $\beta_k$ is the parameter reflecting the direct impact. The spatial multiplier for a simultaneous change in an explanatory variable is identical across all observations.

In Table 4, we report the parameter estimates accounting for the spatial multiplier based on ”MLE nl. opt.” in Table 2. A simultaneous marginal increase in the $k$th exogenous variable changes the dependent variable by $1.956 \cdot \beta_k$, where 1.956 is the spatial multiplier according to Table 4. The computation of the standard errors of the variables’ overall (spatially multiplied) effect follows Bardsen (1989). These standard errors take the variance-covariance structure of the model appropriately into account. However, the insight about the significant effect of the determinants at conventional levels based on their direct effect remains unchanged. An omission of spatial dependence leads to biased estimates in this data-set. For instance, the marginal effect of an increase in total bilateral market size ($SGDP_{ijt}$) amounts to 2.721 in the naïve fixed effects model in Table 2 but it is 8.772 in the preferred spatial model in Table 4.

As indicated above, the results reported in Table 4 rely on the presumption that one variable at a time marginally changes for all observations simultaneously. Hence, the findings there are not helpful in shedding light on the role of an applicant country’s geographical location for the dissemination of a shock in space. To address this issue, we exogenously change a single applicant’s explanatory variable ceteris paribus.

To illustrate the importance of an applicant country’s geographical location, we undertake the following experiments of thought. Consider a standardized change of $\Delta (\hat{\beta}_kX_{k,2002}) = 1$ in the $k$th explanatory variable $X_{k,2002}$ in the year 2002. For instance, a standardized change of $\Delta (\hat{\beta}_1SIMI_{ij2002}) = 1$ corresponds to a change in $SIMI_{ij2002}$ of 0.194, since the parameter estimate is $\hat{\beta}_1 = 5.156$. Standardized changes in the other explanatory variables can be computed analogously. Due to the standardization, we can entirely focus on the spatial spillover effects when quantifying the impact on such a change on the Eurobarometer score. Whereas the size of the shock influences the size of the spillover effects, it is irrelevant for their relative
The direction of the impact of a standardized positive variable change on the attitude towards enlargement entirely depends on the sign of the estimated coefficient given in Table 4. If the estimated coefficient is positive (as for $SIMI_{ijt}$, $GINI_{it}$, $SGDP_{ijt}$, $TC_{ijt}$, and $ATTFOR_{it}$), an increase (decline) in an explanatory variable exerts a positive (negative) effect on the attitude towards enlargement for all applicant countries. The opposite holds true, if the estimated coefficient is negative (as for $RKPW_{ijt}$ and $GINI_{it} \times KPW_{it}$).\(^{12}\)

Table 5 summarizes the effects of a one unit (standardized) change in an explanatory variable for an accession country in a column on the attitude towards enlargement of the average EU incumbent on the accession countries in the rows. The main diagonal contains the total effect of such a standardized change on the applicant country in the column itself. The total effect consists of two components: (i) the direct effect due to the change in the explanatory variable, which by choice of normalization amounts to unity, and (ii) the indirect spatial spillover effect. The latter captures the feedback from the change’s impact on the other applicant countries. Hence, the direct effect of the change is augmented by the spatial spillover from the induced effects in the other applicants due to the presence of spatial correlation in the Eurobarometer scores.

Let us consider a shock in Bulgaria to explore the mentioned effect. A standardized change in an explanatory variable of Bulgaria increases the attitude towards enlargement by unity. The entry in the diagonal for Bulgaria is 1.0437 percent. Hence, there is a spatial feedback effect on Bulgaria of 0.0437 percentage points. The latter originates in the impact of the unitary shock in Bulgaria on other applicants, especially the adjacent ones. The spatial spillover effect from the shock in Bulgaria particularly affects applicant countries such as Hungary and Romania. The latter spillover effects induce the overall incremental change of 0.0437 in Bulgaria. Of course, the Bulgarian effect on the other applicant countries is stronger than the induced feedback effect on Bulgaria from the change, there. All entries in a row sum up to 1.9564, which is nothing else than the spatial multiplier associated

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\(^{11}\)The described standardized change regarding the independent variable can also be considered as a shock in the error term $u_{ijt}$.

\(^{12}\)Due to the chosen empirical specification, negative and positive shocks trigger a symmetric impact.
with a simultaneous unitary shock in all applicant countries. The heterogeneity in
the column sums reveals that the geographical location of a given applicant country
matters a lot for how shocks disseminate to other applicants. Obviously, the column
sums are largest – i.e., interdependence matters a lot – for the least remote applicant
countries in the sample such as Hungary or Slovak Republic. By way of contrast,
shocks in peripheral countries such as Malta and Cyprus affect other applicants to
a minor extent.

Furthermore, notice that the matrix of the standardized-shock-induced effects in
Table 5 is not symmetric. The reason is that each country’s location in space is
unique. For instance, the effect of a shock occurring in Estonia on the Latvian score
is 0.1354, whereas that one of Latvia on Estonia is 0.1804. The difference arises due
to the fact that Latvia is closer to other applicant countries than Estonia. It is a
general feature of the estimated model that the spatial spillover effect of a shock in
a remote country (such as Estonia) on a less remote one (such as Latvia) is smaller.

6 Conclusions

This paper provides an econometric analysis of the attitude towards integration of
the EU15 incumbent economies on the applicant countries of the late 1990s. A panel
data set of bilateral Eurobarometer scores of EU15 members and applicant countries
is employed. The scores are explained by a set of determinants motivated by models
of classical and new trade theory as well as the theory of multinational firms and
trade. In addition to these variables, we argue that a typical EU country’s attitude
towards accession of a specific applicant is not formed independently of the opinion
about the other applicants. Especially, we hypothesize that there is spatial clustering
of the attitude across the applicants. To infer these spatial correlations estimators
relying on maximum-likelihood and generalized method of moments techniques are
employed.

We find evidence for a negative impact of variables that indicate large losses of
workers in the EU incumbent countries from classical trade but also from new trade
and foreign direct investment. There is significant evidence for spatial clustering
in the attitude towards enlargement among the applicant countries. This spatial
clustering leads to feedback effects associated with spatial multipliers. Overall, the
spatial dissemination of an exogenous shock occurring in a specific applicant is larger
for less remote countries such as Hungary and Slovak Republic than for peripheral
ones such as Cyprus and Malta.

Altogether, the estimated spatial spillover give evidence for the clustering of the favorable attitude towards enlargement in the bulk of Baltic states (Estonia, Latvia, and Lithuania) and also the small Central and Eastern European countries adjacent to Germany and Austria (e.g., Czech Republic, Hungary, and Slovak Republic). Especially, the estimated model indicates that the change in favor of accession of these economies was driven by their economic growth and the increase in their capital-labor-ratios. Also the fact that several EU countries exhibit low investment costs and are favorable towards foreign investors plays an important role in explaining the positive attitude towards enlargement.
References


Table 1: Descriptive statistics

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<th>Mean</th>
<th>Std.dev.</th>
<th>Min</th>
<th>Max</th>
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<td>13.250</td>
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<td>12.073</td>
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# obs: 1170; # country-pairs: 195
Table 2: Spatial correlation of accession (distance) countries in the endogeneous variable and spatial correlation of accession (border) countries in the error term

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<th>MLE</th>
<th>MLE</th>
<th>MLE</th>
<th>GM</th>
<th>GM</th>
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<td>Cholesky</td>
<td>Grid search</td>
<td>nl. opt.</td>
<td>Kelejian-Prucha</td>
<td>Lee</td>
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<td>0.510</td>
<td>0.510</td>
<td>0.489</td>
<td>0.588</td>
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<td>(0.025)</td>
<td>(0.026)</td>
<td>(0.027)</td>
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<td>(1.107)</td>
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<td>4.570</td>
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# obs: 1170; # country-pairs: 196
Numbers in parentheses denote the corresponding standard errors.
a The Moran I test rejects the hypothesis of no spatial correlation in the error term.
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<td>-1102.400</td>
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# obs: 1170; # country-pairs: 195

Numbers in parentheses denote the corresponding standard errors.
Table 4: Quantifying the effects

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<th>$RKPW_{ij}$</th>
<th>$GINI_d$</th>
<th>$GINI_d\times KPW_d$</th>
<th>$SGDP_{ij}$</th>
<th>$TC_{ij}$</th>
<th>$ATTFOR_d$</th>
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<td>(11.558)</td>
<td>(1.249)</td>
<td>(1.474)</td>
<td>(2.210)</td>
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Spatial multiplier: 1.956

Numbers in parentheses denote the corresponding standard errors.
Table 5: Spatial effects of a standardized explanatory variable change of unity on an applicant country in a column on the attitude towards enlargement vis-à-vis the applicants in the rows

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<th>Effect on</th>
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<th>Cyprus</th>
<th>Czech R.</th>
<th>Estonia</th>
<th>Hungary</th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Malta</th>
<th>Poland</th>
<th>Romania</th>
<th>Slovakia</th>
<th>Slovenia</th>
<th>Turkey</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>1.0437</td>
<td>0.0519</td>
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Figure 1: Eurobarometer score levels of 1997

Figure 2: Eurobarometer score changes 1997 - 2002