Estimating Regional Trade Agreement Effects on FDI in an Interdependent World

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Abstract

Recent research on trade and multinationals highlights the complex integration strategies and the varying degree of vertical integration of multinational firms in a multilateral world. A high percentage of world trade is actually conducted by multinational firms, and most of the foreign direct investment (FDI) occurs within the block of developed countries. In addition, the most important regional trade agreements (RTAs) are implemented between members of the same block of economies. This paper is concerned with the impact of RTAs on FDI in an interdependent world. Economic interdependence has been shown to decline with geographical distance. Therefore, a spatial econometric approach is used. The paper focuses on the role of the Europe Agreements between the member countries of the European Union

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and 10 Central and Eastern European countries over the period 1989-2001. We apply recent Generalized Moments (GM) estimation and testing techniques developed by Kelejian and Prucha (1999, 2005). We find strong evidence for the impact of regional trade agreements on FDI. Computing the effect for all of the agreement ratification events on German outbound FDI into Europe, we find that the impact was strongest for Estonia in 1995, amounting to an increase in FDI by about 78 percent. The smallest impact of the Europe Agreements on FDI from the EU15 economies occurred for FDI into Iceland, due to its huge distance from continental Europe.

**Keywords:** Regional trade agreements; Multinational firms; Spatial econometrics; Generalized moments (GM) estimators  
**JEL:** C33; F14; F15

## 1 Introduction

The second half of the last century was characterized by a surge of "bilateralism" in trade policy. The foundation of the European Union (EU, formerly referred to as European Community), the European Free Trade Area (EFTA), the North American Free Trade Area (NAFTA), and the Europe Agreements between the EU and several Central and Eastern European countries are some of the most sizeable regional trade agreements (RTAs) that have been implemented within this period. Empirical research on trade issues confirms that this process resulted in a significant increase in bilateral trade volumes among member countries (see Baier and Bergstrand, 2004, or
Glick and Rose, 2002). At the same time, foreign direct investment (FDI) increased much faster than trade, even within the OECD and among the members of the mentioned RTAs. Although numerous studies on the impact of RTAs on bilateral trade are now available, evidence on impact of bilateral trade policy on FDI seems scarce.

The theory of horizontal multinational firms (Markusen, 1984) assumes that the avoidance of trade impediments (including tariffs but also other modes of trade costs) is a major reason for setting up plants abroad that serve the foreign market locally. By way of contrast, vertical multinational firms (Helpman, 1984) split up the production process across borders to exploit gains from comparative advantage within the firm. Here, the gains from ‘outsourcing’ of production stages to low-wage countries and the associated trade of intermediate goods within firms are important issues with vertical multinational firms. Therefore, we expect vertical FDI to increase through the implementation of RTAs. Hence, the sign of the coefficient of the RTA variable (typically a dummy variable) in empirical FDI specifications is of interest not only when it comes to determine the role of RTAs for FDI volumes, but also as an indicator of the relative importance of horizontal versus vertical FDI.

More recent theory points to the complex integration strategies of multinational firms, (see Yeaple, 2003, Grossman, Helpman, and Szeidl, 2004, Helpman, Melitz, and Yeaple, 2004, and Raff, 2004). In particular, this research avoids the restrictive features of models with simple horizontal or vertical multinationals. Whereas it may be optimal to set up foreign subsidiaries in some host countries to serve the consumers only locally there (the horizon-
tal motive), it may be optimal for the same firm to set up export platforms in other host countries that serve consumers there and elsewhere. Hence, this theory comes closer to empirical stylized facts of mixed horizontal-vertical integration strategies of multinationals. Three issues with complex multinational firms are of particular interest. First, in a multi-country world it is potentially insufficient to model bilateral FDI as a function of bilateral determinants only. Firms set up their foreign plants in accordance with the characteristics not only in a particular target market but also with the characteristics of other potential host countries. Second, the design of a multinational’s production and sales network likely entails strategic aspects of plant location in space.\footnote{Subsidiaries that produce intermediate goods for other downstream plants within the firm will be located such that the overall delivery costs are minimized. These costs cover both production and trade costs. Also, the location of foreign subsidiaries will not be independent of the location decisions of competing multinationals.} Third, the role of RTAs will be complex with complex FDI. Low trade barriers induce an incentive to export not only for national but also for complex multinational firms (similar to vertical multinationals). However, high trade barriers foster the location of locally selling foreign subsidiaries (similar to horizontal multinationals). Overall, the net effect of a reduction in trade barriers is less clear-cut than with simple forms of the multinational firm organization.

How does empirical work on the impact of RTAs on FDI relate to the theory of multinational firms? Only a few articles address this issue. Blomström and Kokko (1997) report on three case studies. They point out that the implementation of the U.S.-Canada Free Trade Agreement lead to a reduction in intra-regional FDI to both the U.S. and Canada (i.e., a negative impact
on bilateral FDI), whereas it increased extra-regional FDI into Canada (i.e., a positive third-country impact). Similarly, the establishment of NAFTA has fostered extra-regional FDI into Mexico, and Mercosur stimulated extra-regional FDI into the member countries. Levy Yeyati, Daude, and Stein (2002a,b), analyze the impact of RTAs on bilateral FDI stocks in a large sample of countries. They point out that the intra-regional effect of RTAs depends on the prevailing mode of FDI (horizontal, local market seeking versus vertical, low-cost seeking). By way of contrast, an RTA in place renders a host country unambiguously more attractive for extra-regional FDI. Their findings support a significantly positive average impact of regional integration agreements on bilateral FDI. However, Levy Yeyati, Daude, and Stein (2002a,b) do not consider interdependencies across host markets, which are at the heart of this paper’s analysis.

The recent empirical literature on the determinants of FDI support a significant impact of interdependencies across markets. Coughlin and Segev (2000) and Blonigen, Davies, Waddell, and Naughton (2004, 2005) find that FDI between two countries is not independent of that one in other economies, as expected from a general equilibrium perspective (see Blonigen, 2005, for a survey).

This paper focuses on bilateral outbound FDI stocks within Europe. The sample covers 28 host countries over the period 1989-2001. We allow for three types of spatial interaction: (i)Spatially lagged explanatory variables which are motivated by a three-factor knowledge-capital model (reflecting, e.g., third-country size and relative factor endowment effects on bilateral FDI; see Blonigen, Davies, Waddell, and Naughton, 2004); (ii) spatially lagged
endogenous FDI motivated by strategic aspects of the location of FDI in a multilateral world (see also Blonigen, Davies, Waddell, and Naughton, 2004, 2005); and (iii) spatial autoregressive errors to control for regional interdependencies of stochastic shocks between the host countries. The estimation results illustrate that third-country effects of all three kinds are important and lend support to a complex impact of the European Agreements on FDI. The findings support a positive effect of the reduction of trade barriers with some host country on FDI into other European host markets. This is consistent with both the prevalence of horizontal, local-market-seeking FDI due to big gains from multiplant economies of scale and the operation of vertical multinational networks that strongly rely on goods trade among their plants in non-distant locations.

The remainder of the paper is organized as follows. The next section outlines the specification of bilateral FDI as supported by recent general equilibrium theory. Section 3 provides details on the adopted econometric approach. Section 4 reports the findings regarding the impact of the Europe Agreements on bilateral FDI, and the last section concludes with a summary of the most important findings.

2 Determinants of bilateral FDI and the role of regional trade agreements

Prior research finds that the most important empirical determinants of bilateral multinational activity are country size, skilled labor endowments, trade and investment costs, and the corresponding interaction terms (Carr,
Markusen, and Maskus, 2001; Markusen and Maskus, 2002; Blonigen, Davies, and Head, 2003). The estimated models are often in levels rather than in logs, but the latter approach is typically preferable from an econometric point of view, as pointed out by Mutti and Grubert (2004). Taking this into account, the log of FDI from country $i$ to country $j$, $y_{ij}$, may be formulated as a log-linear function of the following explanatory variables (see Markusen, 2002). The sum of home and host country GDP, $SGDP_{ij} = \log GDP_i + \log GDP_j$, the similarity between the home and the host market in country size, $RGDP_{ij} = (\log GDP_i - \log GDP_j)$, and four interaction terms to account for the impact of skilled labour endowments ($SK$) on FDI: $INT1_{ij} = (\log SK_i - \log SK_j) \times (\log GDP_i - \log GDP_j) \times I(SK_i > SK_j)$, where $I(SK_i > SK_j)$ is an indicator variable that takes on the value 1 if the condition in parentheses holds and 0 otherwise; $INT2_{ij} = (\log SK_i - \log SK_j) \times SGDP_{ij} \times I(SK_i > SK_j)$; $INT3_{ij} = (\log SK_j - \log SK_i) \times SGDP_{ij} \times I(SK_i < SK_j)$; and $INT4_{ij} = (\log SK_j - \log SK_i) \times \log DIST_{ij}$, where $DIST_{ij}$ is the distance between the parent and the host countries’ capitals, serving as a proxy for trade costs. Whereas horizontal FDI should rise, if two markets grow larger and become more similar (i.e., $SGDP_{ij}$ and $RGDP_{ij}$ increase), vertical FDI should rise, if the parent country is small and well endowed with skilled labor and trade costs between the two markets are low. Accordingly, we expect a positive sign on the parameter estimates of $SGDP_{ij}$ and $RGDP_{ij}$ but a negative one for all skilled labor endowment interaction terms, $INT1_{ij}, ..., INT4_{ij}$.

Note that the sample of 24 parent and 28 host countries covers only member countries of the European Economic Area (EEA) and the ten CEEC that
have successfully applied for an EU membership (see the Appendix for a detailed list of these economies). Since there was no change in the composition of the EEA within the considered sample period, its effect is captured by the country-pair dummies. However, 10 Europe Agreements between the EU and a CEEC have been ratified within the considered period. These include the ones with Hungary and Poland in 1994, the ones with Bulgaria, Czech Republic, Romania, and Slovak Republic in 1995, the ones with Estonia, Latvia, and Lithuania in 1998, and the one with Slovenia in 1999 (see the Appendix for further details). We capture these agreements by the dummy variable $EA_{ij}$ that takes the value 1 in all years from the Europe Agreement ratification on for any two involved countries, and zero else. Hence, this dummy variable exhibits time and country-pair variation. Since we control for country-pair and time effects, the corresponding parameter estimate can be interpreted as a difference-in-difference direct effect of the Europe Agreements on bilateral FDI.

To simplify the exposition of our econometric approach, we collect all mentioned variables in the matrix $X_n = [SGDP_n, RGDP_n, INT1_n, ..., INT4_n, EA_n]$, where $X_n$ is an $n \times k$ matrix with $n$ being the number of observations and $k = 7$ denoting the number of variables in $X_n$. The Appendix provides details on the data sources and the descriptive statistics for both the dependent (log bilateral outbound FDI) and the independent variables. We will also allow for spatial externalities in $X_n$, since bilateral FDI not only depends on the parent and a given host countries’ characteristics but also on those of the competing European host markets). For this, we define a spatial weights matrix in the following section which serves to aggregate the
characteristics of a host market’s competitors. In this way, we are able to account for the possibility that the ratification of a Europe Agreement with a given CEEC may indirectly affect FDI decisions in the other competing host markets in addition to its direct effect on bilateral FDI. Beyond that, we will allow for spatial dependence in FDI itself (see Blonigen, Davies, Waddell, and Naughton, 2004, 2005). This also adds complexity to the impact of the European Agreements on FDI into Europe through the so-called spatial multiplier (i.e., spatial magnification) effects.

3 Econometric approach - estimation and testing using spatial GM methods

We consider the following first-order SARAR-model:

\[ y_n = X_n\alpha_n + W_nX_n\beta_n + D_n\mu_n + \lambda_nW_ny_n + u_n \tag{1} \]

\[ = Z_n\delta_n + u_n \]

\[ u_n = \rho_nW_nu_n + \varepsilon_n \tag{2} \]

where \( Z_n = [X_n, W_nX_n, D_n, W_ny_n] \) and \( \delta_n = [\alpha_n', \beta_n', \mu_n', \lambda_n]' \). The overall number of observations is \( n = \sum_{i=1}^{N} T_{ij} \), where \( N \) denotes the number of country-pairs and \( T_{ij} \) is number of years available for country-pair \( ij \). \( y_n \) is an \( n \times 1 \) vector of observations of the dependent variable (with elements \( y_{ijt} = \log FDI_{ijt} \)), \( X_n \) is the \( n \times k \) matrix of explanatory variables, including the Europe Agreements dummy variable \( EA_n \). \( D_n \) is an \( n \times l \) matrix of (country-pair and time) dummy variables, where \( l = N + T - 2 \), with \( T \) denoting the number of unique time periods in the sample. \( W_n \) is a block-
diagonal \( n \times n \) spatial weighting matrix, where each block includes the spatial weight among FDI-hosts for a given parent country at a given point in time. The diagonal elements of \( W_n \) are 0 and the off-diagonal elements in a specific year are defined as \( e^{-DIST_{jk}c^{-1}}/w^* \), for \( j, k = 1, \ldots, N_{it} \), where \( N_{it} \) denotes the number of covered host countries for a specific parent country \( i \) at time \( t \), and \( DIST_{jk} \) is the great circle distance between host countries \( j \) and \( k \). \( c \) is a normalizing constant which is set to 100.\(^2\) \( w^* \) is either defined as the row-specific sum of elements \( \sum_{k=1}^{N_{it}} e^{-DIST_{jk}c^{-1}} \) or as the maximum of the row-specific sums \( \max[\sum_{k=1}^{N_{it}} e^{-DIST_{jk}c^{-1}}] \). In the former case, the spatial weighting matrix is row-normalized, and in the latter case it is normalized by the maximal row sum as suggested by Kelejian and Prucha (2005). Below, we will discuss the issue of normalization in more detail. Furthermore, \( \delta_n \) is a \((2k+l+1) \times 1\) vector of unknown parameters. We refer to \( \bar{X}_n = W_n X_n, \bar{y}_n = W_n y_n, \) and \( \bar{u}_n = W_n u_n \) as the spatial lags of \( X_n, y_n, \) and \( u_n \), respectively. The parameters \( \lambda_n \) and \( \rho_n \) are the spatial autoregressive parameters. Our empirical analysis rests on a set of low level assumptions given in Kelejian and Prucha (2005). In particular, these assumptions entail the following: (1) all diagonal elements of \( W_n \) are zero, the spatial autoregressive parameters are bounded in absolute value, and the matrices \( I_n - \lambda_n W_n \) as well as \( I_n - \rho_n W_n \) are nonsingular; (2) the innovations \( \varepsilon_{ijt,n} \) are independent, \( E\varepsilon_{ijt,n} = 0 \), and the second and fourth moments exist and are bounded; (3) the row and column sums of the matrices \( W_n, (I_n - \lambda_n W_n)^{-1}, \) and \( (I_n - \rho_n W_n)^{-1} \) are uniformly bounded in absolute value.

\(^2\)The data set at hand supports values of \( c \) that are not substantially higher than 100. This indicates implicitly that the spatial decay with distance is quite fast.
In case of homoskedastic innovations, Kelejian and Prucha (1999, 2005) derive a two-step GM estimator of $\rho_n$ that is based on consistent estimates of the residuals in (1) and on the following moment conditions:

$$
\begin{bmatrix}
\varepsilon_n' A_{1,n} \varepsilon_n - \sigma_{\varepsilon_n}^2 \\
\varepsilon_n' A_{2,n} \varepsilon_n - \sigma_{\varepsilon_n}^2 \text{tr}(W_n' W_n) \\
\varepsilon_n' A_{3,n} \varepsilon_n
\end{bmatrix} = 0,
$$

where $A_{1,n} = I_n$, $A_{2,n} = W_n' W_n$, and $A_{3,n} = W_n$. In particular, the GM estimator of $\rho_n$ by Kelejian and Prucha (1999, 2005) can be represented as the solution of the following system of three equations

$$
\gamma_n - \Gamma_n \theta_n = 0
$$

with

$$
\gamma_n = \begin{bmatrix}
\frac{1}{n} u_n' \bar{u}_n \\
\frac{1}{n} \bar{u}_n' \bar{u}_n \\
\frac{1}{n} u_n' \bar{u}_n
\end{bmatrix}
$$

and $\theta_n = [\sigma_{\varepsilon_n}^2, \rho_n, \rho_n^2]$. Defining the empirical analogue as $\tilde{\gamma}_n - \tilde{\Gamma}_n \theta_n$, the GM estimator of $\sigma_{\varepsilon_n}^2$ and $\rho_n$, labelled as $\tilde{\sigma}_{\varepsilon_n}^2, \tilde{\rho}_n$, is given by

$$
(\tilde{\sigma}_{\varepsilon_n}^2, \tilde{\rho}_n) = \arg \min_{\sigma_{\varepsilon_n}^2, \rho_n} \left\{ \tilde{\gamma}_n - \tilde{\Gamma}_n \begin{bmatrix}
\sigma_{\varepsilon_n}^2 \\
\rho_n \\
\rho_n^2
\end{bmatrix} \right\}' \tilde{\Upsilon}_n \begin{bmatrix}
\sigma_{\varepsilon_n}^2 \\
\rho_n \\
\rho_n^2
\end{bmatrix}
$$

(5)
where $\tilde{\Upsilon}_n$ is a $3 \times 3$ symmetric positive semidefinite moments weighting matrix. In our case, it is the identity matrix. Kelejian and Prucha (2005) show that this estimator is consistent, if the following two assumptions apply in addition to the previous ones: (4) define the $1 \times (2k + l + 1)$ random vector $-z_{i,n}$ with $ij$-th element $z_{ij,n}$, the $(2k + l + 1) \times 1$ random vector $\Delta_n = \delta_n - \delta_n$, and let $\tilde{u}_{ijt,n}$ be the $ijt$-th element of $\tilde{u}_n$, i.e., the vector of first-step two-stage least-squares residuals; then, for some positive parameter $\kappa$, it is assumed that $E|z_{ijt,n}|^{2+\kappa} \leq c_d < \infty$, where $c_d$ is independent of $n$, and $n^{-1/2}||\Delta_n|| = O_p(1)$; (5) the smallest eigenvalue of $\Gamma_n'\Gamma_n$ is uniformly bounded away from zero, $\tilde{\Upsilon}_n - \Upsilon_n = o_p(1)$ with $\Upsilon_n$ being a $3 \times 3$ symmetric positive semidefinite matrix, and the largest (smallest) eigenvalues of $\tilde{\Upsilon}_n, \Upsilon_n$ are bounded uniformly from above (away from zero).

Kelejian and Prucha (2005) formulate two additional assumptions to derive the asymptotic distribution of the GM estimator for $\rho_n$: (6) $-n^{-1}Z_n'A_nu_n + n^{-1}EZ_n'A_nu_n = o_p(1)$ is assumed for any $n \times n$ real matrix $A_n$ with row and columns sums that are uniformly bounded in absolute value; (7) $n^{-1/2}\Delta_n = n^{-1/2}T_n'\varepsilon_n + o_p(1)$, where $T_n$ is an $n \times (2k + l + 1)$ real nonstochastic matrix whose elements are uniformly bounded in absolute value. Most importantly for our application, Kelejian and Prucha (2005) then derive the joint asymptotic distribution of the GM estimator for $\rho_n$ and the other model parameters $(\Psi_{o,n})$. The empirical counterpart of $\Psi_{o,n}$ is given by

$$
\tilde{\Psi}_{o,n} = \begin{bmatrix}
\tilde{\Psi}_{\Delta\Delta,n} & \tilde{\Psi}_{\Delta\rho,n} \\
\tilde{\Psi}_{\rho\Delta,n} & \tilde{\Psi}_{\rho\rho,n}
\end{bmatrix}
$$

Following Kelejian and Prucha (2005), it is useful to define the following
matrices to derive the one-step GM estimator

\[
\tilde{F}_n = (I_n - \tilde{\rho}_n W'_n)^{-1} H_n
\]  
(7)

\[
\tilde{P}_n = n (H'_n H_n)^{-1} (H'_n Z_n) \times (Z'_n H_n (H'_n H_n)^{-1} (H'_n Z_n))^{-1}
\]  
(8)

where \(H_n\) denotes the matrix of instruments including the exogenous variables in \(Z_n\). Kelejian and Prucha (2005) demonstrate that the three blocks of \(\Psi_{o,n}\) can be consistently estimated by

\[
\tilde{\Psi}_{\Delta\Delta,n} = n^{-1} \tilde{F}'_n \tilde{\Sigma}_n \tilde{F}_n
\]  
(9)

\[
\tilde{\Psi}_{\Delta\rho,n} = n^{-1} \tilde{F}'_n \tilde{\Sigma}_n [\tilde{F}_n \tilde{P}_n \tilde{\alpha}_{1,n}, \tilde{F}_n \tilde{P}_n \tilde{\alpha}_{2,n}, \tilde{F}_n \tilde{P}_n \tilde{\alpha}_{3,n}]
\]  
(10)

\[
\tilde{\alpha}_{r,n} = -n^{-1} [Z'_n (I_n - \tilde{\rho}_n W'_n) (A_{r,n} + A'_{r,n}) (I_n - \tilde{\rho}_n W_n) \tilde{u}_n]
\]  
(11)

for \(r = 1, 2, 3\), where \(\tilde{\Sigma}_n = \tilde{\sigma}^2_{\varepsilon_n} I_n\) under homoskedasticity. Finally, \(\tilde{\Psi}_{\rho\rho,n}\) exhibits typical elements

\[
\psi_{\rho\rho,n,rs} = (2n)^{-1} tr[(A_{r,n} + A'_{r,n}) \tilde{\Sigma}_n (A_{s,n} + A'_{s,n}) \tilde{\Sigma}_n] + \phi_{rs}
\]  
(12)

\[
\phi_{11} = \mu^{(4)} - 3\sigma^4_{\varepsilon_n}
\]  
(13)

\[
\phi_{12} = \phi_{21} = (2n)^{-1} (\mu^{(4)} - 3\sigma^4_{\varepsilon_n}) tr[W'_n W_n + W_n W'_n]
\]  
(14)

\[
\phi_{22} = (2n)^{-1} (\mu^{(4)} - 3\sigma^4_{\varepsilon_n}) tr[W'_n W_n + W_n W'_n]^2
\]  
(15)

\[
\phi_{13} = \phi_{31} = \phi_{23} = \phi_{32} = \phi_{33} = 0
\]  
(16)

where \(\mu^{(4)}\) denotes the fourth centered and standardised moment of \(\varepsilon_{ijt}/\sigma_{\varepsilon_n}\).

Defining the gradient of the moment conditions with respect to \(\sigma^2_{\varepsilon_n}\) and \(\rho_n\) as \(J_n\), Kelejian and Prucha (2005) derive a consistent estimate of the variance-covariance matrix of the parameters as

\[
\tilde{\Omega}_{o,n} = \begin{bmatrix} \tilde{P}'_n & 0 \\ 0 & (\tilde{J}'_n \tilde{Y}_n \tilde{J}_n)^{+} \tilde{J}'_n \tilde{Y}_n \end{bmatrix} \tilde{\Psi}_{o,n}^{-1} \begin{bmatrix} \tilde{P}'_n & 0 \\ 0 & \tilde{Y}_n \tilde{J}_n (\tilde{J}'_n \tilde{Y}_n \tilde{J}_n)^{+} \end{bmatrix}
\]  
(17)
and show that the random vector $[n^{-1/2}(\tilde{\delta}_n - \delta_n), n^{-1/2}(\tilde{\theta}_n - \theta_n)]$ converges in distribution to a normal distribution with variance-covariance matrix $\Omega_{\delta,n}$. Hence, hypothesis tests can be based upon this result. In fact, this is useful to test the joint hypothesis of a spatial lag in the error term, the dependent variable and the exogenous explanatory variables in the subsequent empirical analysis.

4 Empirical analysis - the impact of the European Agreements on bilateral FDI in Europe

We employ two different spatial weighting schemes. Both of them are based on inverse distances, i.e., the elements of the spatial weighting matrix are given by $w_{jk,n} = e^{-DIST_{jk}/100}$ for all host country pairings $j \neq k$. The two weighting schemes differ with respect to the normalization method, but both of them guarantee that the above assumptions apply. Most of the existing applications of spatial econometric models rely on row-normalized matrices $W_n$. However, Kelejian and Prucha (2005) point out that it is sufficient to normalize all entries of $W_n$ by the largest eigenvalue or, alternatively, by the largest row-sum of $W_n$. Whereas row-normalization imposes strong restrictions on the spatial process, since each row of $W_n$ is normalized differently, the normalization suggested by Kelejian and Prucha (2005) implies dividing the whole matrix $W_n$ by a single scalar. Also, there are potential objections against row-normalization from a theoretical point of view, at least in
case of models of multinational firms and trade. For instance, FDI in not too distant host markets is complementary to FDI into other hosts for vertically organized multinational networks, where plants are interrelated by intra-firm trade. The reason is that a larger distance between host markets renders intra-firm trade in goods more costly. However, a row-normalized weighting scheme does not support any role for distance in absolute terms, but rather it introduces distance relative to all other hosts in the spatial weighting scheme. To see this, suppose that one country’s host markets are 1000 miles away from each other, whereas for another country they are as close as 100 miles from each other. If all distances are the same among the host markets, the row-normalized weighting scheme would exhibit identical entries, even though absolute distances differ by a factor of 10. This is not the case for the alternative weighting scheme suggested by Kelejian and Prucha (2005), where the absolute role of distance is maintained, being in line with economic theory.

Table 1 summarizes our findings for the three specifications. Model 1 is a benchmark least-squares dummy variable (LSDV) estimator that ignores the possibility of interrelated host markets for a given parent’s FDI activity due to spatially lagged explanatory variables, an endogenous spatial lag, and spatial autoregressive residuals (SAR). The results indicate that parent and host country size and similarity in size are positively related to FDI as expected. The signs of the skilled labor endowment interaction term parameters differ from Carr, Markusen, and Maskus (2001) and Markusen
and Maskus (2002) in this European sample of countries. However, the latter papers did not control for country-pair and time effects in their panel. By and large, our estimation results implicitly indicate that parent to host skilled labor endowments could be more important for exporting than for FDI.\(^3\) Our variable of major interest, the Europe Agreement indicator is positive and significant. Note that in our specification this is a difference-in-difference estimator which compares the change in FDI before and after the ratification of the Europe agreements of the treatment group (new agreement ratified) with that of the control group (no such new agreement ratified). The effect of implementing such an agreement raises bilateral FDI by about \(100(e^{0.645} - 1) \approx 91\) percent in the LSDV model. This effect is comparable to the previous evidence on RTA effects on FDI such as the LSDV with time effects estimates of Levy Yeyati, Daude, and Stein (2002a, p. 31) that point to a somewhat larger effect of \(100(e^{0.770} - 1) \approx 116\) percent, using bilateral FDI stock data from the OECD.\(^4\)

However, Model 1 does not account for any spatial interdependence across host markets in terms of the time-variant observable (or unobservable) vari-

\(^3\)For instance, this can occur if multinationals have cheap access to foreign skilled labor for firm and plant set-up.

\(^4\)The estimated size of the Europe Agreement effects on FDI also compares well with the LSDV estimates of RTA effects on bilateral trade. For instance, the data used in Glick and Rose (2002) support an effect of regional trade agreements all over the world on bilateral trade flows of about \(100(e^{0.848} - 1) \approx 133\) percent (when including time dummies as we do), and Baier and Bergstrand (2005, p. 20) report an estimate of about 58 percent. Also, the estimated size of the Europe Agreement effect on FDI seems reasonable, since the absolute levels of outbound FDI into the CEEC had been relatively small prior to the ratification of the agreements.
ables. This restrictive assumption is relaxed in Models 2 and 3, where we allow for the three modes of spatial interaction to have an impact on FDI. First, host markets of a given direct investor are likely interdependent which can be accounted for through the inclusion of an endogenous spatial lag (see also Coughlin and Segev, 2000, or Blonigen, Davies, Waddell, and Naughton, 2004, for a motivation and an application). Second, in a multi-country world not only bilateral relative and absolute factor endowments (i.e., country size) matter, but endowments of all competing host markets are relevant (see also Head, Ries, and Swenson, 1995, and Blonigen, Davies, Waddell, and Naughton, 2004, for the inclusion of the impact of exogenous explanatory variables of adjacent/non-distant locations of FDI). Neglecting these two types of spatial interaction leads to biased parameter estimates. Beyond that, there may be spatial dependence in the stochastic innovations in the sense that stochastic shocks on FDI into host markets spill over to their most important (i.e., non-distant) competitors. An ignorance of this latter mode of spatial interdependence does not affect the consistency but the efficiency of the parameter estimates.

Model 2 relies on row-normalized spatial weights, being less suitable from a theoretical point of view than Model 3, which does not. Our estimation results in Table 1 indicate that Model 2 does not support any interdependence of the host markets beyond the multilateral impact of the independent variables. This does not hold true for Model 3, where all three modes of spatial

\[5\] For instance, knowing that a host market is growing is not sufficient for determining its impact on bilateral FDI. What is relevant is, whether it grows faster than the rest of the (relevant part of) the world or not.
effects matter as can be seen from the significance of the coefficients and the Wald tests of the joint hypotheses. Based on this result, we conclude that FDI in two (non-distant) host markets tend to be substitutive with respect to changes in the exogenous determinants. This can be deduced from the opposite signs of the parameter estimates of the spatially weighted explanatory variables (reflecting the indirect effects) and those of the parameter estimates of the unweighted variables (reflecting the direct effects). Since Model 3 is also more reliable from a theoretical viewpoint, we use it to give a more detailed discussion of the role of the Europe Agreements on bilateral FDI.

In particular, we focus first on the specific example of Hungary and Poland as host countries that both ratified their Europe Agreements in 1994. The distance between Hungary and Poland is $DIST_{HUN,POL} = 345.938$ kilometers. Hence, the corresponding element in the normalized spatial weights matrix of Model 3 is $w_{HUN,POL} = e^{-345.938/100}/1.355 = 0.023$, since $w^* = 1.355$.

The overall impact of the Europe Agreements on a parent country’s bilateral FDI with either Hungary or Poland consists of three components: (i) a direct effect based on the impact of $EA_n$ which amounts to an increase of $100(e^{0.565} - 1) \simeq 75.94$ percent in FDI; (ii) an indirect effect due to the spatially weighted impact $W_nEA_n$. This effect leads to a reduction in bilateral FDI of $100(e^{-0.401 \times 0.023} - 1) \simeq -0.92$ percent. The direct and indirect effects sum up to approximately $100(e^{0.565-0.401 \times 0.023} - 1) \simeq 74.33$ percent. (iii) Lastly, there is an additional spatial magnification (multiplier) effect that is associated with the positive spillovers among FDI decisions in non-distant economies due to the endogenous spatial lag. The spatial multiplier is defined as $(I_n - 0.761W_n)^{-1}$. The overall effect of the ratification of the
Europe Agreements with Hungary and Poland in 1994 on FDI of a typical parent country $i$ in logs is given by the vector $	ilde{\zeta}_i = (I_{i,1994,n} - 0.761W_{i,1994,n})^{-1}(0.565I_{i,1994,n} - 0.401W_{i,1994,n})\Delta EA_{i,1994,n}$, where $I_{i,1994,n}$ is an identity matrix of size $N_{i,1994}$, and $\Delta EA_{i,1994,n} = EA_{i,1994,n} - EA_{i,1993,n}$ is the change in the Europe Agreement dummy variable between periods 1993 and 1994.

The overall effect of parent country $i$’s FDI in Hungary amounts to about 76.83 percent. This overall effect exceeds the combined direct and indirect effects by about $(0.565I_{i,1994,n} - 0.401W_{i,1994,n})\Delta EA_{i,1994,n} - (0.565I_{i,1994,n} - 0.401W_{i,1994,n})\Delta EA_{i,1994,n} \simeq 1.46$ percentage points.

The spatial multiplier magnifies both the indirect and the direct effects to an extent that declines in space. Since the direct effects are much stronger than the indirect ones, their magnified positive impact on third countries in the sample outweighs the magnified negative indirect effect. For instance, the unweighted average magnified overall effect of the Europe Agreement ratification with Hungary and Poland on FDI to other CEEC (that have not ratified such an agreement in 1994) amounts to about 0.37 percent (the corresponding indirect effect is $-2.69$ percent). Due to the larger distance to the Western European economies (WEC), the unweighted average magnified effect on parent country $i$’s FDI is much smaller there and amounts to 0.09 percent (the indirect effect is $-0.50$ percent).

In Table 2, we give an example and compute the associated direct and indirect effects as well as the spillover effects on Germany’s bilateral FDI into both the WEC and the CEEC for each of the four Europe Agreement ratification steps (1994: Hungary, Poland; 1995: Bulgaria, Czech Republic,
Romania, Slovak Republic; 1998: Estonia, Latvia, Lithuania; 1999: Slovenia). In particular, this table provides a dissection of the overall impact of the Europe Agreements on Germany’s outbound FDI into the 27 countries of interest (excluding Germany from the set of 28 host countries) into three considered components.

> Table 2 <

We decompose the change in outbound FDI for each Europe Agreement ratification year separately. For each of these years, the direct and the indirect effects on FDI are displayed in the first two of the corresponding columns. The respective third column displays the overall, magnified direct plus indirect effects. The difference between the third and the sum of the first two columns is an approximate measure of the effect induced by the spatial multiplier \( (I_{i,t,n} - 0.761W_{i,t,n})^{-1} \). However, this approximation may be inaccurate, since the arithmetic sum differs considerably from the geometric one with the data at hand (i.e., the sums of the components do not add up exactly to the overall effect due to the inherent nonlinearities).

By and large, Table 2 indicates that the indirect impact on Germany’s FDI into the CEEC exceeds that of its FDI into the WEC, on average. Among the WEC, Austria (being adjacent to Czech Republic, Hungary, Slovak Republic, and Slovenia) as well as Finland and Sweden (being non-distant from the Baltic states) experienced large negative indirect effects from the Europe Agreement ratifications. However, the CEEC are on average closer

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6We have selected Germany as the parent country of interest in our example, because it is one of the most important direct investors in the sample. Also, it exhibits an interesting geographical location, being adjacent to both WEC and CEEC.
to other CEEC than to the WEC, which renders the indirect effects even stronger there. The overall effect (i.e., the spatial multiplier magnification of the combined direct and indirect effects) is nonnegative for each individual host country. The reason for this is that the indirect effects are relatively small and are outweighed by the spillovers from positive direct effects in the CEEC, even for the WEC. Altogether, the ratification of the Europe Agreements lead to an advantage for those host economies that are geographically close to the ones that ratified an agreement. This holds true for Austria (1994, 1995, and 1999), as well as Finland and Sweden (1998).

> Figures 1-4 <

Table 2 provides a dissection of the overall effect of the Europe Agreements on Germany’s outbound FDI for each ratification period (1994, 1995, 1998, 1999), Figures 1-4 display the overall spatial effects only. Again, this is done for each agreement year, separately (Figure 1: 1994; Figure 2: 1995; Figure 3: 1998; Figure 4: 1999). We define the spatial effects as the difference between the vector of the overall effects and the direct effects, \((I_{\text{GER},t,n} - 0.761W_{\text{GER},t,n})^{-1} (0.565I_{\text{GER},t,n} - 0.401W_{\text{GER},t,n}) \Delta E_{\text{GER},t,n} - 0.565 \Delta E_{\text{GER},t,n}\). This accounts for the scope of effects that are entirely due to spatial interaction. As before, the outcome is expressed in percent of Germany’s bilateral outbound FDI. In each agreement year, the overall spatial effects are strongest for both CEEC and WEC countries that are adjacent or close to the CEEC that ratified an agreement in the respective year. Among the WEC, the positive spatial effects are biggest for Austria, Finland, and Sweden, and they reach their lowest values for the WEC at the
Western boundary of Europe. However, the figures also illustrate that the overall spatial effects decline slowly in space, so that sizable effects can be observed not only in the adjacent countries.

In 1994, the difference between the smallest (in Iceland) and the highest (Austria and Slovak Republic) overall spatial effects amounts to more than one percentage point in Germany’s bilateral outbound FDI into Europe. This indicates that the inference regarding the impact of RTAs on FDI being based on the naive LSDV estimator can be substantially biased in a way that is systematically related to a country’s location in space. In our case, the bias defined as the absolute difference between the Europe Agreement effects under LSDV with first-order SARAR and the naive, non-spatial LSDV estimate amounts to about $11 - 14$ percentage points or about $13 - 16$ percent of the naive LSDV estimates.

5 Conclusions

This paper analyses the role of the Europe Agreements on bilateral FDI within Europe. These agreements were designed to liberalize trade between the EU member countries on the one hand and the Central and Eastern European economies that had applied for EU membership on the other hand. Our analysis indicates that regional trade agreements are important for bilateral FDI. General equilibrium theory points to the interdependence of economies. By and large we would expect FDI activities across adjacent host markets to be complementary if local foreign market seeking motives dominate (i.e., if horizontal FDI prevails and the multiplant economies of scale are huge).
By way of contrast, if low-cost seeking motives are the driving force behind FDI (i.e., vertical motives dominate), we would expect the activities to be substitutive across adjacent host markets since multinational firms will then tend to supply their goods not only to consumers in that host market. However, even vertical FDI may be complementary across adjacent host markets if the vertical integration structure of multinationals entails sizable intra-firm trade in goods across production plants.

In general, the interdependence of the host markets will be related to their geographic proximity. Hence, the empirical analysis of bilateral FDI needs to account for third market influences that decline in geographical proximity. Accordingly, it seems natural to apply recently developed methods for spatially dependent data. In this paper, we apply GM methods developed by Kelejian and Prucha (1999, 2005) for estimation and testing. In particular, we apply joint hypothesis tests regarding the three possible modes of spatial autocorrelation: in the dependent variable, in the exogenous determinants, and in the stochastic innovations.

In our sample of bilateral outbound FDI stocks within Europe, we find strong evidence for a positive direct impact of the Europe Agreements on FDI. But our results also indicate that all three modes of spatial dependence are present in the data. This leads to non-trivial effects of the Europe Agreements on bilateral FDI. Computing the effect for all of the agreement ratification events on German outbound FDI into Europe, we find that the impact was strongest for Estonia in 1995, amounting to an increase in FDI by about 78 percent. The smallest impact of the Europe Agreements on FDI from the EU15 economies occurred for FDI into Iceland, due to its huge...
distance from continental Europe. Altogether, the Europe Agreements exerted a positive overall effect not only on bilateral FDI among the ratifying economies but also on these countries’ neighbors. This points to the prevalence of either horizontal FDI due to multiplant economies of scale or of vertically integrated multinationals that heavily rely on intra-firm trade in components across plants in non-distant markets.

6 References


Levy Yeyati, E., Daude, C., Stein, E., 2002a. Regional Integration and the location of FDI, unpublished manuscript, Inter-American Development Bank.

Levy Yeyati, E., Daude, C., Stein, E., 2002b. The FTAA and the location of FDI, unpublished manuscript, Inter-American Development Bank.


Appendix: Data and descriptive statistics

1. Data on foreign direct investment
We use bilateral outward FDI stock data into Europe as published by UNCTAD (FDI Country profiles), covering the period 1989-2001.

Parent country coverage:
Our sample contains a total of 24 parent economies. WEC: Austria, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom. CEEC: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, Slovenia.

Host country coverage:
There are 28 host countries in the sample. WEC: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom. CEEC: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia.

2. Data on country size and factor endowments
Real GDP figures at constant U.S. dollars (base year is 2000) are available from the World Bank’s World Development Indicators. A country’s skilled labor endowment are measured by the gross secondary school enrolment from the same source.

3. Ratification of the Europe Agreements
The Europe Agreements between the members of the European Union and Central and Eastern European countries were ratified in the following years:

4. Descriptive statistics

> Table A.1 - Descriptives <
Table 1 - The Impact of the Europe Agreements on Bilateral FDI in Europe (LSDV Estimates)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Parameter</th>
<th>Std.</th>
<th>Parameter</th>
<th>Std.</th>
<th>Parameter</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unweighted exogenous variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EAijt: Dummy variable for Europe Agreements</td>
<td>0.64521</td>
<td>0.08818 ***</td>
<td>0.64578</td>
<td>0.08621 ***</td>
<td>0.56504</td>
<td>0.09120</td>
</tr>
<tr>
<td>SGDPijt: log(GDPit+GDPjt)</td>
<td>3.25993</td>
<td>0.67445 ***</td>
<td>2.90922</td>
<td>0.64587 ***</td>
<td>3.08056</td>
<td>0.63986 ***</td>
</tr>
<tr>
<td>RGDPijt: (log GDPit - log GDPjt)^2</td>
<td>1.10238</td>
<td>0.27695 ***</td>
<td>1.17882</td>
<td>0.28892 ***</td>
<td>0.97948</td>
<td>0.25954 ***</td>
</tr>
<tr>
<td>INT1ijt: (log SKit - log SKjt)×(log GDPit - log GDPjt)×I(SKit&gt;SKjt)</td>
<td>-0.00289</td>
<td>0.00114 **</td>
<td>-0.00351</td>
<td>0.00099 ***</td>
<td>-0.00369</td>
<td>0.00112 ***</td>
</tr>
<tr>
<td>INT2ijt: (log SKit - log SKjt)×SGDPijt×I(SKit&gt;SKjt)</td>
<td>-0.00035</td>
<td>0.00015 **</td>
<td>-0.00034</td>
<td>0.00013 ***</td>
<td>-0.00039</td>
<td>0.00015 ***</td>
</tr>
<tr>
<td>INT3ijt: (log SKjt - log SKit)×SGDPijt×I(SKit&lt;SKjt)</td>
<td>-0.00006</td>
<td>0.00016</td>
<td>-0.00018</td>
<td>0.00013</td>
<td>-0.00021</td>
<td>0.00015 ***</td>
</tr>
<tr>
<td>INT4ijt: (log SKjt - log SKit)×(log DISTij)</td>
<td>0.00001</td>
<td>0.00001</td>
<td>0.00002</td>
<td>0.00001 **</td>
<td>0.00002</td>
<td>0.00001 *</td>
</tr>
<tr>
<td><strong>Spatially weighted variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yijt: Endogenous spatial lag of FDI</td>
<td>-</td>
<td>-</td>
<td>-0.07596</td>
<td>0.10152</td>
<td>0.76075</td>
<td>0.13319 ***</td>
</tr>
<tr>
<td>EAijt: Dummy variable for Europe Agreements</td>
<td>-</td>
<td>-</td>
<td>0.0659</td>
<td>0.09792</td>
<td>-0.40119</td>
<td>0.25427</td>
</tr>
<tr>
<td>SGDPijt: log(GDPit+GDPjt)</td>
<td>-</td>
<td>-</td>
<td>0.13860</td>
<td>0.12811 ***</td>
<td>-0.04780</td>
<td>0.01748 ***</td>
</tr>
<tr>
<td>RGDPijt: (log GDPit - log GDPjt)^2</td>
<td>-</td>
<td>-</td>
<td>-0.04989</td>
<td>0.12159</td>
<td>-0.69450</td>
<td>0.12515 ***</td>
</tr>
<tr>
<td>INT1ijt: (log SKit - log SKjt)×(log GDPit - log GDPjt)×I(SKit&gt;SKjt)</td>
<td>-</td>
<td>-</td>
<td>0.00494</td>
<td>0.0114 **</td>
<td>0.01869</td>
<td>0.00421</td>
</tr>
<tr>
<td>INT2ijt: (log SKit - log SKjt)×SGDPijt×I(SKit&gt;SKjt)</td>
<td>-</td>
<td>-</td>
<td>0.00011</td>
<td>0.00018 ***</td>
<td>-0.00106</td>
<td>0.00076</td>
</tr>
<tr>
<td>INT3ijt: (log SKjt - log SKit)×SGDPijt×I(SKit&lt;SKjt)</td>
<td>-</td>
<td>-</td>
<td>0.00041</td>
<td>0.00018 ***</td>
<td>-0.00024</td>
<td>0.00074</td>
</tr>
<tr>
<td>INT4ijt: (log SKjt - log SKit)×(log DISTij)</td>
<td>-</td>
<td>-</td>
<td>-0.00003</td>
<td>0.00001 ***</td>
<td>-0.00004</td>
<td>0.00004 ***</td>
</tr>
<tr>
<td>σ^2</td>
<td>0.53261</td>
<td>-</td>
<td>0.34324</td>
<td>0.47078</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ρ^2</td>
<td>-</td>
<td>-</td>
<td>0.14202</td>
<td>0.09158</td>
<td>-0.37896</td>
<td>0.08377 ***</td>
</tr>
<tr>
<td>R^2</td>
<td>0.965</td>
<td>0.965</td>
<td>0.962</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fixed country-pair effects (p-value of χ^2-test) | 0.000 | 0.000 | 0.000 |
Fixed time effects (p-value of χ^2-test) | 0.000 | 0.001 | 0.000 |

Joint test on spatial autocorrelation in X (p-value of Wald test) | - | 0.000 | 0.000 |
Joint test on spatial autocorrelation in y and u (p-value of Wald test) | - | 0.756 | 0.000 |
Joint test on spatial autocorrelation in y, X, and u (p-value of Wald test) | - | 0.000 | 0.000 |

Note: The estimation is based on 2870 observations. For the preliminary estimates of the SARAR-models, which ignore the spatial correlation of the error term, the Sargan test for the appropriateness of the instruments does not reject. Also, the instruments are relevant according to a F-test of the first stage regression. A Hausman-Wu test on the endogeneity of spatially lagged FDI rejects at 1%.
### Table 2 - Dissecting the Overall Impact of the Europe Agreements on German Bilateral Outbound FDI into Europe (Figures are Percentage Changes)

<table>
<thead>
<tr>
<th>Host countries</th>
<th>1994&lt;sup&gt;a&lt;/sup&gt;</th>
<th>1995&lt;sup&gt;b&lt;/sup&gt;</th>
<th>1998&lt;sup&gt;c&lt;/sup&gt;</th>
<th>1999&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct</td>
<td>Indirect</td>
<td>Overall</td>
<td>Direct</td>
</tr>
<tr>
<td>Austria</td>
<td>0</td>
<td>-7.05</td>
<td>1.19</td>
<td>0</td>
</tr>
<tr>
<td>Belgium</td>
<td>0</td>
<td>-0.04</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>Denmark</td>
<td>0</td>
<td>-0.50</td>
<td>0.06</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>0</td>
<td>-0.11</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>0</td>
<td>-0.02</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>Greece</td>
<td>0</td>
<td>-0.03</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Iceland</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Ireland</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>0</td>
<td>-0.17</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>0</td>
<td>-0.10</td>
<td>0.04</td>
<td>0</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0</td>
<td>-0.05</td>
<td>0.02</td>
<td>0</td>
</tr>
<tr>
<td>Norway</td>
<td>0</td>
<td>-0.05</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>Portugal</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Spain</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Sweden</td>
<td>0</td>
<td>-0.20</td>
<td>0.03</td>
<td>0</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0</td>
<td>-0.13</td>
<td>0.05</td>
<td>0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0</td>
<td>-0.01</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>Western European Countries (WEC)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>0</td>
<td>-0.50</td>
<td>0.09</td>
<td>0</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0</td>
<td>-0.61</td>
<td>0.07</td>
<td>75.95</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>0</td>
<td>-2.73</td>
<td>0.53</td>
<td>75.95</td>
</tr>
<tr>
<td>Estonia</td>
<td>0</td>
<td>-0.19</td>
<td>0.04</td>
<td>75.95</td>
</tr>
<tr>
<td>Hungary</td>
<td>75.95</td>
<td>-0.93</td>
<td>76.86</td>
<td>0</td>
</tr>
<tr>
<td>Latvia</td>
<td>0</td>
<td>-1.11</td>
<td>0.12</td>
<td>75.95</td>
</tr>
<tr>
<td>Lithuania</td>
<td>0</td>
<td>-2.96</td>
<td>0.25</td>
<td>75.95</td>
</tr>
<tr>
<td>Poland</td>
<td>75.95</td>
<td>-0.93</td>
<td>76.23</td>
<td>0</td>
</tr>
<tr>
<td>Romania</td>
<td>0</td>
<td>-0.63</td>
<td>0.07</td>
<td>75.95</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>0</td>
<td>-10.56</td>
<td>1.07</td>
<td>75.95</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0</td>
<td>-2.76</td>
<td>0.46</td>
<td>75.95</td>
</tr>
</tbody>
</table>

**Notes:**

<sup>a</sup> The overall effect is the geometric sum of the direct effect, the indirect effect, and the spatial multiplier effect.
<sup>b</sup> Europe Agreement ratification with Hungary and Poland.
<sup>c</sup> Europe Agreement ratification with Bulgaria, Czech Republic, Romania, and Slovak Republic.
<sup>d</sup> Europe Agreement ratification with Estonia, Latvia, and Lithuania.
<sup>e</sup> Europe Agreement ratification with Slovenia.
<sup>f</sup> Numbers reflect unweighted averages.
Table A.1 Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std.</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unweighted bilateral FDI stocks</td>
<td>4.751</td>
<td>3.878</td>
<td>-6.209</td>
<td>12.517</td>
</tr>
<tr>
<td>Unweighted exogenous variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\text{EA}_{ijt}$: Dummy variable for Europe Agreements</td>
<td>0.315</td>
<td>0.465</td>
<td>0.000</td>
<td>1.000</td>
</tr>
<tr>
<td>$\text{SGDP}<em>{it}$: log($\text{GDP}</em>{it}$+$\text{GDP}_{jt}$)</td>
<td>26.743</td>
<td>1.204</td>
<td>23.303</td>
<td>28.828</td>
</tr>
<tr>
<td>$\text{RGDP}<em>{it}$: (log $\text{GDP}</em>{it}$ - log $\text{GDP}_{jt}$)$^2$</td>
<td>-0.211</td>
<td>2.130</td>
<td>-5.403</td>
<td>5.836</td>
</tr>
<tr>
<td>$\text{INT1}<em>{ijt}$: ($\text{SK}</em>{it}$ - $\text{SK}<em>{jt}$)×(log $\text{GDP}</em>{it}$ - log $\text{GDP}<em>{jt}$)$^2$×I($\text{SK}</em>{it}$&gt;$\text{SK}_{jt}$)</td>
<td>9.634</td>
<td>38.550</td>
<td>-102.386</td>
<td>353.120</td>
</tr>
<tr>
<td>$\text{INT2}<em>{ijt}$: ($\text{SK}</em>{it}$ - $\text{SK}<em>{jt}$)×$\text{SGDP}</em>{it}$×I($\text{SK}<em>{it}$&gt;$\text{SK}</em>{jt}$)</td>
<td>287.291</td>
<td>437.522</td>
<td>0.000</td>
<td>2299.714</td>
</tr>
<tr>
<td>$\text{INT3}<em>{ijt}$: ($\text{SK}</em>{it}$ - $\text{SK}<em>{jt}$)×$\text{SGDP}</em>{it}$×I($\text{SK}<em>{jt}$&lt;$\text{SK}</em>{it}$)</td>
<td>279.437</td>
<td>490.759</td>
<td>-25.114</td>
<td>2310.039</td>
</tr>
<tr>
<td>$\text{INT4}<em>{ijt}$: ($\text{SK}</em>{it}$ - $\text{SK}<em>{jt}$)×(log $\text{DIST}</em>{ij}$)</td>
<td>5051.754</td>
<td>8039.903</td>
<td>0.002</td>
<td>43733.380</td>
</tr>
</tbody>
</table>
Figure 1: The overall spatial effect of the Europe Agreements on German outbound FDI in 1994
Figure 2: The overall spatial effect of the Europe Agreements on German outbound FDI in 1995
Figure 3: The overall spatial effect of the Europe Agreements on German outbound FDI in 1998
Figure 4: The overall spatial effect of the Europe Agreements on German outbound FDI in 1999