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Spatial Competition

Empirical Evidence from Small-scale Banking

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E-mail address: Franz.Hahn@wifo.ac.at
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Medieninhaber (Verleger), Hersteller: Österreichisches Institut für Wirtschaftsforschung • 1030 Wien, Arsenal, Objekt 20 • Tel. (43 1) 798 26 01-0 • Fax (43 1) 798 93 86 • http://www.wifo.ac.at/ • Verlags- und Herstellungsort: Wien

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Spatial Competition

Empirical Evidence from Small-scale Banking

Franz R. Hahn
Austrian Institute of Economic Research
Arsenal, Object 20
1030 Vienna
Austria
Franz.Hahn@wifo.ac.at

Abstract

Stylized facts suggest that there is some 'spatial structure' in the dynamics of cross-border lending of Austrian regional banks that seems to be closely related to the eastward enlargement of the European Union. This short paper provides evidence that a stark space-related dependency of competition has been at work governing the cross-border lending behavior of the Austrian regional banks since 1995.

JEL classification: C23, E51, F33, N20

Keywords: spatial econometric analysis, cross-border bank lending, institutions

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1. Introduction

Stylized facts suggest that as to foreign lending activities Austrian regional banks headquartering in districts farther away from the eastern border line appear to be more likely to follow their neighboring competitor banks than banks located in the border districts. The paper shows that spatial dependency of competition can be captured by a spatial lag model that not only is capable of reflecting the interactions of cross-border lending activities among neighboring banks but also allows for testing whether there is a linkage between spatial interaction and institutional convergence of Austria's eastern neighbors towards EU norms. The latter is assumed to have governed the banks' foreign lending behavior unequally across regions. In order to capture this spatial-institutional link we propose to apply a spatial lag model with two different spatial regimes. In so doing, we adapt the design of the two-regime spatial lag model introduced in *Elhorst – Fréret* (2009).

The paper is organized as follows: In the next section we present stylized facts featuring the impact of pro-EU convergence of East European countries on the development of cross-border lending of Austrian small-sized to medium-sized banks over the period from 1995 to 2008. Section 3 carries out detailed spatial econometric analyses that are aimed at underlining, at the multivariate level, the occurrence of spatial competition among banks triggered by the EU-centered, institutional convergence of Austria's eastern neighboring countries.

2. Stylized Facts: Cross-border Bank Lending, Geography and Institutional Convergence

The process of EU eastern enlargement began with the start of the accession negotiations between the European Union and a group of 10 European states, including the Czech Republic, the Slovak Republic, Hungary, and Slovenia in 1999[1]). These four East European countries share borders with Austria and used to belong to the Habsburg Empire until 1918 for centuries. In 2003, the EU accession negotiations were successfully closed and all four countries became EU member countries in 2004.

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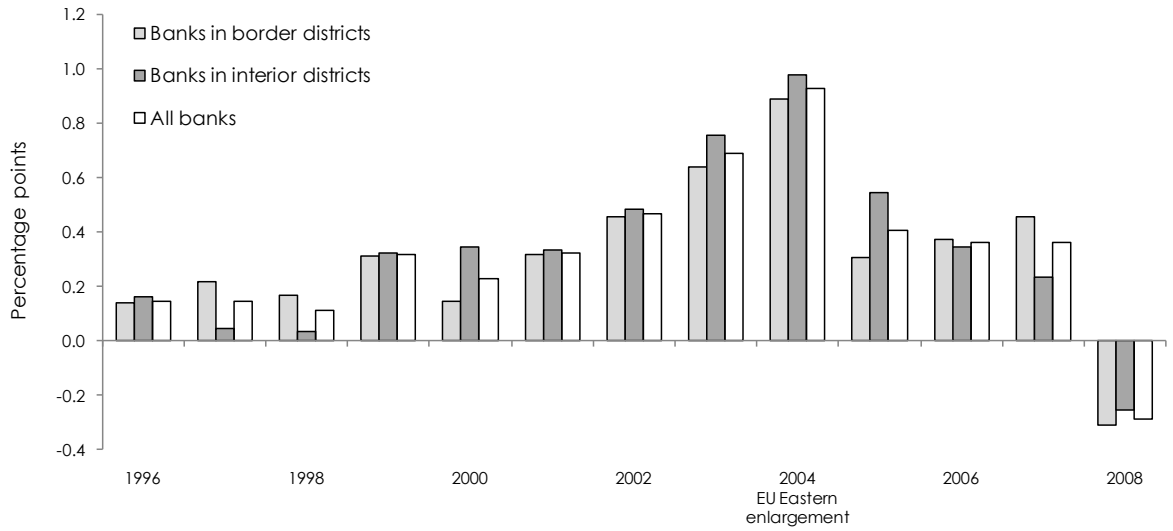
[1]) It is worth mentioning that the common currency Euro as book money was also introduced in this very year.

Figure 1: Cross-border Lending of Austrian Commercial Banks per District
Foreign assets as percent of total assets, annual changes



Source: WIFO bank-panel dataset.

Figure 1 displays the development of cross-border lending of 543 small-sized to medium-sized Austrian commercial banks assigned to their home districts from 1995 to 2008. A glance at the graph suggests that cross-border lending activities of all Austrian banks considered accelerated significantly in 1999 (Austria's eastern neighbors starting EU accession talks), picked up further momentum around 2004 (Austria's eastern neighbors getting full EU membership status) and then leveled off somewhat on average, but not so with those banks located and operating in the eastern border districts[2]). Of course, the year 2008 marks the onset of the global financial crisis with a sharp decline of cross-border lending transactions across-the-board.

3. Econometric Analysis and Findings

3.1 Data and Variables

To check the proposed hypothesis we use a sample consisting of a balanced panel of annual report data of 543 Austrian banks (unfortunately, access to quarterly or monthly data was not made possible). The bank data were extracted from non-consolidated income statement and balance sheet data ranging over 1995 to 2008. The data have been deflated by the GDP deflator (2005=100) and adjusted for

[2]) For more stylized facts, see Hahn (2011).

inconsistent data-related outliers, respectively[3]). The dataset is unique in the sense that it provides almost full coverage of Austrian regional banking at the individual bank level. We will use this specific balanced dataset for all empirical tests conducted in this paper.

Since the aim of the paper is to find causes for spatial competition in cross-border lending activities since 1995 we confine the dataset to small and regional banks that do not run subsidiaries abroad. Hence, the data set does not include the larger Austrian banks (with a strong foothold in Eastern Europe in the form of subsidiary companies). The exclusion of the larger Austrian banks from analysis does not lessen the scope of the findings drawn from our data set. Quite the contrary, since the larger banks, all of which all-finance groups, tend to provide financial services on site by setting up operating local units (that is, foreign subsidiaries or foreign branches), they have restrained from engaging in cross-border lending on a notable scale altogether.

In order to filter out disturbing noise that may blur asymmetric spatial dependency at the bank level, in the econometric analysis to come we change level of observation by averaging bank-level data over all small-sized to medium-sized banks headquartered in a district. This amounts to scaling down 543 local banks to 94 bank districts (that is, to the 94 home markets of the regional banks under study)[4]).

The connectiveness between the regional banks under study is captured by a spatial contiguity matrix W of dimension $94\,x\,94$ (mirroring the number of districts covered). In so doing, we define bank district j to be close or a neighbor to bank district i if the two bank districts share a common border line. If both bank districts j and bank district i meet this requirement element $w_{i,j}$ of the $94\,x\,94$-contiguity matrix W is set equal to one. If two bank districts under consideration miss this requirement we set $w_{i,j} = 0$. By convention the main diagonal of W has only zeros, that is $w_{i,i} = 0$, and the non-diagonal elements $w_{i,j}$ are transformed such that W has row-sums of unity. Standardizing contiguity matrix W that way allows for the convenience of creating new variables that feature the mean of observations from contiguous banks (this follows from multiplying matrix W by a vector of interest y).

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3) Since we were granted access to the balance sheet and income statement of all Austrian banks, we subjected the reported data at the company level to simple accounting-based consistency checks. If a bank failed this test (i.e., due to incomplete or inconsistent data reporting), it was excluded from the analysis. In order to check for remaining outliers, we consistently apply estimation techniques which are sensitive to outliers.

4) The Austrian banking market is highly segmented. Domestically, local and regional banks serve their local markets only. The latter happens to coincide with the district the respective local or regional banks are headquartered in.

In order to evaluate the differences in cross-border lending among various regional banks we classify the overall data set according to three regional sub-areas. That is, districts that are home to regional banks located along the border to the Czech Republic, the Slovak Republic, Hungary, and Slovenia are pooled to a homogenous regional entity. These geographical entities are represented by the time-invariant, binary variable $GREE$ (eastern border districts).

Legal and institutional convergence of East European countries to EU standards is captured by two binary time-variant variables. The dummy variable $EURO$ captures the period since the begin of the EU accession negotiations of 10 EU membership aspirants including the Czech Republic, the Slovak Republic, Hungary, and Slovenia, in 1999 and the variable HUV marks the period since 2004 when these very countries have finally acquired the status of a full EU member.

As to the bank-level variables used in this investigation, the variable to be explained is the degree of foreign lending activities of an individual bank. Thus, the left-hand-side variable in our regression analyses is defined by the ratio foreign assets in period t divided by total assets in period $t-1$ at the bank level, denoted $AAQ_{i,t}$, with $i = 1, 2, ..., 543$ and $t = 1996, 1997, ..., 2008$, respectively[5]). Depicting international bank lending based on this ratio has been predetermined by the fact that foreign lending activities of the banks investigated have only been made available to us in the given portmanteau form[6]).

To control for individual bank size, which is frequently associated with a bank's inclination to become international, we use total assets $SPAS_{i,t}$, measuring the i^{th} bank's total assets at time t (idiosyncratic variables in this study enter into the respective econometric models in log transformation; ditto for $SPAS_{i,t}$).

The ratio of bank lending over deposits, represented by $LDR_{i,t}$, reflects the degree to which a bank provides financial intermediation.

Control variable $EKQ_{i,t}$ is designed to capture the influence of bank capital on a bank's desire to engage in international activities. The consideration of bank capital

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[5]) Since this ratio is bounded by zero we converted the dependent variable into an unbounded variable via replacing the numerator through the absolute difference of foreign assets in t. Tests indicate that regression findings remain unaffected by this transformation, though findings lose somewhat in statistical value.

[6]) Due to legal data protection requirements Austrian Central Bank (OeNB) is only eligible to provide access to foreign lending data at the bank level when wrapped up in the sum of all foreign activities on the asset side. However, informal information provided by both bank managers and bank supervisory experts ensures us that the ratio of foreign assets over total assets at the bank level follows very closely the dynamics of foreign bank lending over total assets at the bank level. This particularly applies to the regionally operating banks that are at the center of this analysis.

as measured by core bank capital over total bank assets is motivated by the presumption that both capital-rich banks and capital-poor banks have their reasons to promote cross-border operations[7]).

The quality of a bank's personnel may also be a driving factor behind the tendency to lend cross-border. In the following, the skills level of a bank's employees, denoted $PM_{i,t}$, is represented by staff costs per employee. The presumption is that staff costs per head and professional skills level are positively related.

As a measure of management efficiency we use the traditional cost-income ratio, denoted $CIR_{i,t}$. The reading of this indicator is that lower values signal that bank management does a good job et vice versa.

For further data details, we refer the reader to the Appendix.

3.2 Model and Test

The model needed is supposed to reflect the competition of cross-border lending activities among neighboring banks and to allow for testing whether there is a linkage between spatial interaction and institutional convergence of Austria's eastern neighbors towards EU norms that has governed the banks' foreign lending behavior unequally across regions. In order to capture this spatial-institutional link we need a spatial model that allows for controlling for two different spatial regimes. In so doing, we adapt the design of the two-regime spatial autoregressive (SAR) model introduced in *Elhorst – Fréret* (2009). To be precise, we introduce a binary variable $d_{i,t}$ that equals one at time $t = 1999, 2000, ..., 2008$ (period from start of EU accession negotiations of eastern EU-membership aspirants to closing year of investigation) or at time $t = 2004, 2005, ..., 2008$ (period from start of eastern EU enlargement to closing year of investigation), respectively, when banks headquarter in an eastern border district of Austria, and equals zero if not. More formally, $d_{i,t}$ is set to 1 (to 0) when interaction variable $EURO\ x\ GREE$ or $HUV\ x\ GREE$ equals 1 (0). The interaction specification $EURO\ x\ GREE$ allows for testing whether already the EU accession negotiations stimulated foreign lending activities of Austrian regional banks located in the eastern border districts to such an extent that their behavior induced banks located in the interior districts to do the same by strongly following the strategy of their regional rivals. The model specification $HUV\ x\ GREE$ allows for testing this nexus in relation to the completion of eastern EU enlargement.

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[7]) We relate core capital to total assets rather than to risk-weighted assets, as suggested by the Basel Accords, since data on the latter have not been available for all regional banks under study.

The two-regime SAR model with spatial and time-specific effects introduced in *Elhorst – Fréret* (2009) and adapted to our setting then takes the following form:

$$(1) \qquad AAQ_{i,t} = b_0 + \rho_1 d_{i,t} \sum_{j=1}^{N} w_{i,j} AAQ_{i,t} + \rho_2 (1 - d_{i,t}) \sum_{j=1}^{N} w_{i,j} AAQ_{i,t} + \sum_{j=1}^{r} b_j Z_{ij,t} + \nu_t + \eta_i + \varepsilon_{i,t} \; .$$

The terms Z_{ij} stand for the logarithm of control variables $SPAS$, LDR, EKQ, PM, and CIR, respectively. The terms ν_t and η_i measure unobserved time-specific and bank district-specific effects, with time period $t = 1996, 1997, ..., 2008$ and bank district $i = 1, 2, ..., 94$. The token $\varepsilon_{i,t}$ is the classical disturbance term with $E[\varepsilon_{it}] = 0$ and $Var[\varepsilon_{it}] = \sigma_\varepsilon^2$, respectively.

Note vector η_i in model (1) reflects spatial effects represented through the 'geographic coordinates' of the regional banks under study[8]).

Further, coefficient ρ_1 reflects the degree of spatial-institutional interaction in cross-border lending related to regional banks, located in eastern border districts, since 1999 and/or 2004, respectively. Likewise, coefficient ρ_2 values the very same nexus as to regional banks with headquarter in interior districts or western border districts, respectively.

Consequently, if ρ_2 exceeds (falls below) ρ_1 in a statistical sense then this suggests that cross-border lending activities of banks located in interior and western districts be stronger positively affected by the foreign lending behavior of their rival banks than the banks located in districts along the eastern border of Austria (et vice versa). That is to say, foreign lending activities of Austrian regional banks located in the eastern border districts induced foreign lending behavior of banks located in the interior districts such that the latter strongly followed the strategy of the former (et vice versa).Whether this expectation is supported by the data will be tested in the next section.

3.3 Findings

The estimates for the two-regime SAR model (1) are reported in the Tables 1A and 1B, respectively. The specification chosen is strongly supported by standard diagnostic checks. The estimates for the idiosyncratic controls are mostly statistically significant and indicate that larger regional banks with low bank capital and low-

8) To be specific, for estimating versions of the two-regime spatial lag model (1) we use Matlab codes, made available by J. P. Elhorst on his website (http://www.regroningen.nl/elhorst/software.shtml).

quality personnel, but high loan-deposit ratio are more likely to venture lending abroad. In order to save space, we refrain from commenting the idiosyncratic control results in detail.

Most importantly, sign and significance of the estimates for the coefficients ρ_1 and ρ_2, respectively, strongly confirm the expectation that foreign lending activities of regional banks located farther away from the eastern border are more positively affected by their competitors' behavior than is the case with respect to the foreign lending behavior of regional banks operating closer to the eastern border. That is to say, foreign lending behavior of the former banks is very likely to have been induced by the behavior of the latter banks, given the geographic-institutional linkage under study. This implication is reflected by spatial-autoregressive coefficient ρ_2 significantly exceeding its companion coefficient ρ_1.

Table 1A: Two-Regime Pooled Model with Spatially Lagged Dependent Variable with Spatial and Time Period Fixed Effects

Dependent variable	$AAQ_{i,t}$
R^2	0.852
R^2 adjusted	0.837
Number of observations	1,222
Number of regions	94
Time period	1996 to 2008
Log-likelihood	-2,391.804
Regime dummy	$EURO_t \; x \; GREE_i$

Variable	Coefficient	t-statistic	p-value
$lspas_{i,t}$	4.823	6.542	0.000
$lldr_{i,t}$	2.103	3.146	0.002
$lekq_{i,t}$	-2.120	-5.785	0.000
$lpm_{i,t}$	-3.773	-3.344	0.001
$lcir_t$	1.210	1.329	0.184
$d \; x \; W \; x \; AAQ_{i,t}$	0.206	4.905	0.000
$(1-d) \; x \; W \; x \; AAQ_{i,t}$	0.373	4.561	0.000
Test: $\rho_1 - \rho_2$	-0.167	-1.755	0.086

Table 1B: Two-Regime Pooled Model with Spatially Lagged Dependent Variable with Spatial and Time Period Fixed Effects

Dependent variable	$AAQ_{i,t}$
R^2	0.852
R^2 adjusted	0.837
Number of observations	1,222
Number of regions	94
Time period	1996 to 2008
Log-likelihood	-2,391.161
Regime dummy	$HUV_t \; x \; GREE_i$

Variable	Coefficient	t-statistic	p-value
$lspas_{i,t}$	4.961	6.727	0.000
$lldr_{i,t}$	2.027	3.052	0.002
$lekq_{i,t}$	-2.147	-5.804	0.000
$lpm_{i,t}$	-3.692	-3.277	0.001
$lcir_{i,t}$	1.191	1.309	0.191
$d \; x \; W \; x \; AAQ_{i,t}$	0.214	5.487	0.000
$(1-d) \; x \; W \; x \; AAQ_{i,t}$	0.432	3.871	0.000
Test: $\rho_1 - \rho_2$	-0.218	-1.819	0.076

4. Conclusion

The paper provides evidence that foreign lending of Austrian small-sized to medium-sized banks has indeed been strongly positively affected by the swift alignment particularly of Austria's eastern neighboring countries (Czech Republic, Slovak Republic, Hungary, and Slovenia) to EU norms. This has triggered a spatial dependency of foreign lending competition among Austrian regional banks that can be captured by a spatial lag model that not only is capable of reflecting competitive dynamics in cross-border lending activities among neighboring banks but also allows for testing whether there is a linkage between spatial competition and institutional convergence of Austria's eastern neighbors towards EU norms.

References

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Appendix

Variables

$AAQ_{i,t}$	Foreign assets at time t as percent of total assets at time $t-1$ of bank district i
$GREE_i$	Time-invariant binary variable coding Austrian districts sharing the border line with the Czech Republic, the Slovak Republic, Hungary, and Slovenia
$EURO_t$	Time-variant binary variable coding the period since the start of EU accession talks of the Czech Republic, the Slovak Republic, Hungary, and Slovenia
HUV_t	Time-variant binary variable coding the period of EU membership of the Czech Republic, the Slovak Republic, Hungary, and Slovenia
$lspas_{i,t}$	Total assets in mio € of bank district i at time t deflated by GDP deflator, 2005=100, in logarithm
$lldr_{i,t}$	Loans in relation to deposits of bank district i at time t, in logarithm
$lekq_{i,t}$	Core capital as percent of total assets of bank district i at time t, in logarithm
$lpm_{i,t}$	Staff costs in €, deflated by GDP deflator, 2005=100, per employee borne by bank district i at time t, in logarithm
$lcir_{i,t}$	Costs in relation to income of bank district i at time t, in logarithm
W	$94\,x\,94$ contiguity matrix capturing the connectiveness between the 94 bank districts under study. Bank district j is defined as the average of all banks headquartered in district j. Bank district j is defined to be close or a neighbor to bank district i if the two bank districts share a common border line. If both bank districts j and i meet this requirement element $w_{i,j}$ of the $94x94$ contiguity matrix W is set equal to 1. If two bank districts under consideration miss this requirement we set $w_{i,j}=0$. By convention the main diagonal of W has only zeros, that is $w_{i,i}=0$, and the non-diagonal elements $w_{i,j}$ are transformed such that W has row-sums of unity.
$d_{i,t}$	$d_{i,t}$ is set to 1 when interaction variable $EURO_t\ x\ GREE_i$ (or $HUV_t\ x\ GREE_i$) equals 1. Otherwise $d_{i,t}$ is set to 0.

Table A1: Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
AAQ	3.694	4.214	0.000	27.820
SPAS	147.189	132.923	13.588	1,185.915
LDR	72.580	19.385	28.937	149.695
EKQ	7.541	2.216	3.682	16.884
CIR	0.689	0.063	0.457	1.034
PM	59,926	5,212	42,128	110,716

Number of observations	1,222
Number of bank districts	94
Time period	1996 to 2008