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Specialization and growth in Italy: what spatial econometric analysis tells us

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Specialization and growth in Italy: what spatial econometric analysis tells us.

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Abstract

This paper investigates the determinants of Italian regional specialization in the period 1995-2006. In particular, it tests and evaluates the presence of spatial autocorrelation in sectoral specialization patterns by the use of spatial econometrics tools.

Results show positive effects of neighbouring regions specialization for advanced industry and services sectors and hence a progressive synchronization of economic cycles. By contrast, sectors traditionally considered backward, evidence the presence of a core-periphery structure. The introduction of spatial effects in the general regression model increases the number of significant explicative variables. In accordance with the findings from New Economic Geography openness and market access positively affect regional specialization in most of the considered sectors.

JEL classification: C13, C21, R11, R12

Key words: specialization, regional growth, spatial econometric.

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1 Aim and literature review

The relationship between productive specialization and economic growth has been widely analysed both from the theoretical and empirical point of view. From a theoretical point of view, the neo-classical model of trade and growth suggests that, under the hypotheses of perfect competition and constant returns to scale, economic integration enforce convergence of per capita income and growth rates. By contrast, more recent models from endogenous growth theory (Romer*,* 1986, 1990; Lucas, 1988; Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991, Aghion and Howitt*,* 1992) and New Economic Geography (Krugman, 1991a, 1991b; Krugman and Venables, 1995; Ottaviano and Puga, 1997; Fujita, Krugman and Venables, 1999), based on imperfect competition and increasing returns to scale[1], argue that the reduction of trade barriers could foster income disparities. However, the impact of openness on growth and disparities depends on the degree of integration and technology *spillovers*. In particular, it has been shown that agglomeration, following integration, and growth processes reinforce each other and increase regional disparities (Martin and Ottaviano*,* 1999, 2001; Baldwin and Forslid*,* 2000; Baldwin *et al.* 2001; Fujita and Thisse, 2002a, 2002b; Baldwin *et al.* 2003).

The more recent New Economic Geography models, accounting for long run consequences of integration and combining the theoretical elements of localization and international trade, suggest that the integration process might also stimulate greater regional specialization, making regions more vulnerable to random demand shifts and shocks. By contrast, it has been argued (Helg *et al.* 1995; Frenkel and Rose, 1996) that integration, through trade intensification, may result in a higher similarity of productive structures, hence a progressive synchronization of economic cycles.

In the presence of scale economies, technological externalities and imperfect market competition, the reduction in exchange costs, resulting from economic integration, drive the firms to localize themselves in regions with higher market access. In this way, they can share a specialized labour force and knowledge as well as generate vertical linkages within their production processes, leading to considerable cost advantages. In the long run, therefore, progressive relocation of productive activities to areas with higher market potential may generate regional differentials in growth and factor accumulation with a core-periphery structure outcome.

Agglomeration forces, however, may have a different impact depending on the business sector where they arise. Generally, spatial concentration in core areas is more evident for firms with high returns to scale (Midlefart-Knarvik *et al.,* 2000) while typically backward business activities

[1] Increasing returns are allowed by the accumulation of factors like local human capital, skills and technological innovation.

concentrate in the periphery or in regions with lower wages. In European countries, interest in production reorganization has increased, due to accelerating monetary and economic integration, since the beginning of the 1990s.

As regards the determinants of regional specialization, three different theoretical strands may be identified. The first is given by an extension of the resource-endowment theory (Ohlin, 1993) and argues that differences in comparative advantage lead to the evolution of regional specialization. The new trade theory ("Economic Geography") emphasizes costs and demand linkages as key agglomeration forces (Krugman, 1991). Finally, the strand originating from the external-economies theory (Marshall, 1920) highlights the *spillover* effects from clusters of industries.

Given this theoretical scenario, the aim of our paper is to investigate the determinants of Italian regional specialization (NUTS2 level). In particular, our interest is to test and evaluate the presence of spatial autocorrelation in sectoral specialization patterns by the use of spatial econometrics tools. A positive autocorrelation would stimulate more similar patterns while a negative result would generate wider differences and, hence, a core-periphery outcome. As far as we know, this analysis has not yet been implemented for Italian regions.

The paper is organized as follows. The second section describes the methodology of the empirical analysis. The third presents the model, data and results. Section four draws some conclusions and suggests areas for future research.

2 Methodology

Our empirical study is conducted through descriptive and econometric analyses. First the regional specialization dynamic is assessed through transition matrices (*TM*) of Specialization Indexes (SP_{ij}), which give the probability of a region changing its specialization, and Shorrocks Mobility Indexes (*SMI*). Regional specialization is measured by the Balassa Index based on regional sector employees:

$$SP_{ij} = \frac{E_{ij}}{\sum_{j=1}^{n} E_{ij}} \Bigg/ \frac{\sum_{i=1}^{m} E_{ij}}{\sum_{j=1}^{n}\sum_{i=1}^{m} E_{ij}}$$

where E_{ij} indicates the number of employees in region *i* and sector *j*.

Mobility across sectors is measured by the following Shorrock index:

$$SMI = [n - tr(TM)]/(n-1)$$

where n is the number of classes. *SMI* varies from *0*, corresponding to the absence of mobility, to *n/(n-1)*, indicating the highest mobility.

The investigation of the determinants of Italian regional specialization is implemented with the following fixed effect panel data model:

$$SP_{it}^{j} = \beta x_{it} + \varepsilon_{it} \qquad (1)$$

where $\boldsymbol{x_{it}}$ is a row vector of observation on the explicative variables and ε_{it} an independently and identically distributed error term with zero mean and variance σ^2.

In order to test for the presence of spatial dependence effects, we then perform the robust Lagrange-Multiplier tests (LM tests) for spatial interaction on OLS estimates of a pooled model of eq. 1. The null hypothesis of these tests is the absence of spatial dependence. The alternative hypotheses are as follows:

- spatial lag dependence (LM*lag*), when the dependent variable is influenced by the dependent variable observed in the neighbouring regions;
- spatial errors dependence (LM*err*), when error terms may be correlated across space.

This specification strategy, as suggested in Florax *et al.* (2003), is based on the fact that since the test statistic increases and probability decreases, the probability of the chosen model being the most appropriate increases. These tests enable us to choose the proper spatial panel econometric model for each sector (Anselin, 1988), that is a Spatial Autoregressive model (SAR) in the presence of spatial lag dependence, and a Spatial Error Model (SEM), for spatial error dependence.

For our purposes, the SAR model is specified as follows (eq.2):

$$Sp_{it}^{j} = \delta \sum_{k=1}^{N} w_{ik} SP_{it}^{j} + \beta x_{it} + \mu_i + \varepsilon_{it} \qquad (2)$$

The SEM specification is:

$$Sp_{it}^{j} = \beta x_{it} + \mu_i + \phi_{it} \qquad (3) \qquad\qquad \varphi_{it} = \rho \sum_{k=1}^{N} w_{ik} \varphi_{it} + \varepsilon_{it} \qquad (4)$$

W being the row standardized distance weighting matrix, where the single element w_{ij} is the inverse of the kilometric distance between neighbouring regions, and μ_i the regional specific effects.

We first run a spatial pooled model following LM test results and then, as suggested by the outcome of the Hausmann test for all sectors, time–fixed effect panel data models. We do not control for spatial fixed effects because of the small variation in dependent variables over time (Elhorst, 2009). To estimate time-fixed effects we run both the SAR and SEM models as performance of LM tests in this case has not yet been investigated (Elhorst, 2009). For both of them we use the Maximum Likelihood estimator as suggested by the empirical literature (Anselin, 1988, Elhorst, 2009) due to the inconsistency of OLS estimates in the presence of spatial interaction effects.

Given the possibility of endogeneity of one or more of the explicative variables we also estimate the GMM System model. This transformation developed by Arellano and Bover (1995) and Blundell and Bond (1998) seems to perform better when series are persistent and the number of time series is relatively small. This estimator, known as "System GMM", is the solution of a system that combines the regression in difference with a regression in levels where instruments are the lagged difference of the corresponding variables.

3 Empirical analysis

3.1 Empirical model and data

Following the literature suggestions, we assess the determinants of Italian regional specialization in the period 1995-2006 by estimating a general regression model as shown in eq.5:

$$Sp_{it}^{j} = \beta_1 Open_{it} + \beta_2 Inv_{it} + \beta_3 Hum_{it} + \beta_4 Scae_{it} + \beta_5 MP_{it} + \beta_6 Gdppc_{it} + \beta_7 R\&D_{it} + \beta_8 Pop_{it} + \varepsilon_{it} \quad (5)$$

The specialization indexes relate to the production sectors listed in the appendix. The explicative variables are as follows:

- ***Open****=(Imports+Exports)/GDP*, as economic openness affects the comparative advantage dynamic and hence the patterns of regional specialization;
- ***Inv****= Investment/GDP*, as a measure of physical capital;
- ***Hum=*** *Population with high school and university degrees/Population*, as a measure of human capital;
- ***Scae****= added value in the 5 most important sectors/ total added value*, as measure of scale economies, another major source of regional comparative advantage (Brun and Renard, 2001; Liang and Xu, 2004);
- ***MP***$=\Sigma_j(Gdppc_j/d_{ij})$, where *d* is the distance between regions *i* and *j*, in order to account for market access (Harris, 1954; Combes and Overman, 2003);
- ***Gdpp****c=per capita GDP*, as a measure of the impact of economic development;
- ***R&D*** *= R&D expenses/GDP*, as a measure of research intensity;
- ***Pop=*** *regional population*, as an indicator of region size.

We do not use all the explicative variables for all the branches. For testing the presence of spatial interaction effects, we modify eq. 5 by introducing either a spatial autoregressive or a spatial error component.

In order to account for endogeneity problems we also run an Arellano-Bover GMM System for the spatial autoregressive model (Arellano and Bover, 1995). Of all the explicative variables, the spatially lagged dependent variable, Open, Hum, Scae, Gdppc and R&D may be considered as endogenous.

3.2 Results

Descriptive analysis

Descriptive analysis of average aggregate specialization values shows that regions are mainly specialized in the services sector followed by agriculture and industry (table 1). For each sector we built the transition matrix of the corresponding Balassa specialization index[2]. Given these results we calculated the Shorrock indexes as a measure of regional specialization mobility. The indexes evidence that agriculture presents the highest persistency while regions initially more specialized in industrial sectors show the highest probability of changing their production structures. Among manufacturing sub-sectors, leather shows the highest and chemicals the lowest persistency (table 1).

Panel estimation

Results of the fixed effect general model (eq. 5), when significant, show that *openness* has a positive impact on specialization in the following sectors: industry, strictly industry, manufacturing, textile, paper, wood and food products and in trade services (table 2). *Physical capital* endowments (investment) have a positive effect on industry, strictly industry, manufacturing, textile and mineral products, while they have a negative impact on trade and tourism. *Human capital* always has a positive effect on: industry, strictly industry, manufacturing, textile, mineral, chemical, leather, wood and food products. *Scale economies* prove to have a negative effect on industry, strictly industry, textile, mineral, metal, chemical, leather, wood products and money & finance and a positive effect on transport services. *Market potential* has a positive impact only on textile products and tourism services. *Per capita GDP* is not significant except for tourism (negative effect). *R&D* has a positive effect on strictly industry, manufacturing, machinery, chemical, metal and paper products. *Region size* always has a negative impact on specialization in industry, strictly industry, manufacturing, mineral, wood and food products and trade services. An explanation of the latter result may be the fact that larger regions usually have a more heterogeneous population and vary in physical factors (Ulmann and Dacey, 1960). No effect of the overall explicative variables is found for services and building, real estate and money & finance.

Spatial panel estimation

[2] Transition matrices tables are available upon request.

In order to test for the presence of spatial dependence we perform the robust LM*lag* and LM*err* panel tests developed by Elhorst (2009) for pooled models. The test results (table 3) show that services, metal, leather, paper and food products together with trade and money & finance have no spatial effects. For the remaining sectors we estimate a SAR model for sectors with lag dependence and a SEM model for those with error dependence. When both tests are significant we chose the estimates from the model with the more significant of the two tests.

As shown in tables 4-9, positive spatial autoregressive effects, which indicates a positive effect of neighbouring specialization and hence similar patterns, are found in strictly industry, manufacturing, machinery and tourism. A positive spatial error autocorrelation, that is a spatial autocorrelation among determinants of specialization omitted from the model, is found for chemicals and transport, while for agriculture, wood and real estate the relation is negative. A negative effect, as mentioned above, indicates the presence of a core-periphery structure. In general, the introduction of spatial effects in the panel estimation increases the number of the significant explicative variables with respect to the general model.

Pooled models show that *openness* has a positive impact on regional specialization in industry, strictly industry, manufacturing, machinery, minerals and textiles SAR models as well as in agriculture, chemicals and wood SEM models. A negative effect, on the contrary, is presented in the error correlation model for services and transport.

Investment positively affects tourism and textiles SAR models and negatively industry, strictly industry, manufacturing and machinery SAR as well as real estate, wood and transport SEM models.

Human capital positively affects industry, strictly industry, manufacturing, textile and mineral SAR models and chemical SEM models. A negative effect is shown on the machinery SAR model.

Scale economies have a negative impact on industry, strictly industry, manufacturing, textiles, minerals, food and building in SAR models and on chemicals and wood SEM models. A positive effect, on the contrary, is given in the transport SEM model.

Market potential is positively related to industry, strictly industry, manufacturing, textile, mineral, machinery and tourism SAR models as well as to the agriculture SEM model. A negative impact is given in the SAR model for building and in SEM models for chemical and real estate.

Development level (*Gdppc*) is negatively related to specialization in industry, strictly industry, manufacturing, textiles, minerals and machinery SAR models as well as in wood, transport and real estate SEM models. A positive impact is found for building and tourism SAR models and for the chemicals SEM model.

Research intensity has a negative impact on industry, strictly industry, manufacturing and textiles SAR models and on the wood SEM model, while it has a positive effect on the machinery SAR model and transport and real estate SEM models.

The *size* of regions matters negatively for industry, strictly industry, mineral, machinery, tourism and building SAR models and transport and wood SEM models. A positive and different result, with respect to the general model estimates, is shown for the textiles SAR model and agriculture, chemical and real estate SEM models. The latter effect can be explained, in the context of New Economic Geography (Fujita *et al*., 1999; Fujita and Thisse, 2002) as a consequence of agglomeration economies (Ezcurra *et al*., 2006).

Estimation of Time Fixed Spatial panel models (tables 4-9) yields a positive spatial effect on industry, strictly industry, manufacturing, machinery, transport and tourism. Negative effects, on the contrary, are given in agriculture, food, leather, chemicals, metals, paper, wood, trade, monetary and finance and real estates. A further result is given by the signs of the significant explicative variables which are equal both in SAR and SEM models.

Openness has a positive impact on industry, strictly industry, manufacturing, machinery, metal, leather, textile, chemical, paper, wood and trade. A negative effect is presented in the services, transport and real estate. The effect on the agriculture sector is not clear-cut.

Investment positively affects agriculture, services, textiles, chemicals, and tourism and negatively affects industry, strictly industry, manufacturing, food, metals, wood, machinery and real estate.

Human capital effect is positive in chemicals, leather, paper, services, monetary and finance and real estate and negative in industry, strictly industry, manufacturing, food, metals, wood and machinery

A positive effect of *Scale economies* is found for metals, services, transport and money & finance. The opposite holds for industry, strictly industry, manufacturing, textiles, minerals, food, leather, chemicals, paper, wood and building.

Market potential is positively related to industry, strictly industry, manufacturing, food, textile, mineral, paper, wood, machinery, transport and Tourism and negatively related to chemical, building, services, trade, money & finance and real estate. Again, in this case the effect on agriculture is not clear-cut.

Income effect is positive in agriculture, chemicals, paper, services, tourism and transport, negative in industry, strictly Industry, manufacturing, textiles, minerals, food, leather, metals, wood, machinery, trade and real estate.

Research has a positive impact on machinery, services, money & finance and real estate and a negative impact on textiles, leather, chemicals and transport.

Population matters negatively for industry, strictly industry, manufacturing, food, metals, wood, machinery, transport, tourism and building. A positive effect is shown for agriculture, textiles, paper, trade, money & finance and real estate.

Accounting for endogeneity, the Arellano-Bover GMM System, enables us to find significant positive spatial effects for a larger number of sectors (table 10), namely for: industry, strictly industry, manufacturing, metals, paper, machinery, services, trade, tourism, transport and real estate. Explicative variables effects do not differ greatly with respect to spatial panel time fixed effect outcomes and are available on request.

4 Conclusions

The objective of this paper was to investigate the determinants of Italian regional specialization in the period 1995-2006, assessing the contribution of spatial interdependence. Spatial interdependence may be positive, indicating the existence of similarity in specialization patterns, or negative, in the case of core-periphery structures. Of course, different results may have different implications for economic integration. The first outcome is that the influence of neighbouring regions specialization increases when time fixed effects and endogeneity are accounted for. In particular, positive effects are found for advanced industry and services sectors, showing a greater diffusion of production activities among regions and hence a progressive synchronization of economic cycles. By contrast, sectors traditionally considered backward, namely agriculture, food, wood, minerals, textiles, leather and building, evidence the presence of a core-periphery structure. These sectors are more vulnerable to demand shifts and shock and therefore more exposed to risks of the international competition.

As regards other determinants of regional specialization, our analysis shows that the introduction of spatial effects in the general regression model increases the number of significant explicative variables. The overall results of econometric analyses show that openness and market access positively affect regional specialization in most of the considered sectors. This outcome is in accordance with the findings from New Economic Geography. Physical and human capital have no clear-cut effect on specialization in the various models estimated. This may well be due to the unavailability of sectoral data for these factors. Income level and scale economies show an increasing positive effect when spatial interaction is accounted for.

What we expect for the Italian specialization pattern is that an analysis based on provincial data might yield more pronounced results in terms of spatial interaction, due to the greater presence of knowledge *spillovers* in production sub-sectors at provincial level. This aspect would be suitable for further analysis.

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Appendix

Productive branches

- **Agricultural-forestry and fishery products (Agri)**
- **Industry (Ind)**
- Strictly industrial activities (Indstr)
- **Manufactured products (manu)**
- Non-metallic minerals and mineral products (min)
- Food-beverages-tobacco (food)
- Textiles and clothing (text)
- Leather goods (leath)
- Chemical products (chem)
- Metal products (met)
- Paper products (paper)
- Wood and rubber (wood)
- Machinery-equipment and electrical goods (machi)
- **Building and construction (buil)**
- **Services (serv)**
- Retail and wholesale trade (trade)
- Tourism services (tour)
- Transport and communication services (trasp)
- Monetary and financial intermediation (mone)
- Real estate activities (rest)

Table 1. Descriptive analysis results

Sectors/Branches	Shorrocks index	Mean	Standard dev.
Agriculture	0.20	1.3	0.75
Industry	0.32	0.938	0.234
Strictly Industry	0.27	0.89	0.327
Manufacturing	0.21	0.882	0.345
Mineral products	0.26	1.039	0.487
Food & Beverage .	0.34	1.068	0.286
Textile	0.21	0.826	0.573
Leather products	0.07	0.972	1.821
Chemical products	0.38	0.739	0.407
Metal products	0.18	0.865	0.401
Paper products	0.29	0.798	0.386
Wood products	0.31	0.957	0.518
Machinery products	0.13	0.82	0.424
Building	0.39	1.105	0.225
Services	0.30	1.05	0.16
Trade services	0.96	0.976	0.087
Tourism services	0.27	1.123	0.486
Transport	0.87	0.975	0.208
Monetary & Finance	0.35	0.909	0.165
Real estate	0.37	0.908	0.177

Table 2. Fixed effect general model results

	Agric.	Industry	Services	Strictly industry	Manuf.	Paper products	Chem. products	Miner. products	Leather products	Mach.
Open	-.0078***	.00163*	-.0003	.0029***	.003***	.0027*	.001	.0094	.00591	.0018
Inv	.106	.141**	-.036	.145**	.153**	-.0957	-.078	.868*	-1.34	-.05
Hum		.343**	.014	.44**	.476***	.279	.605*	5.32***	3.7***	.257
Scae		-.223*	.044	-.333**	-.32**	.398	-1.05***	-2.64**	-4.15***	-.23
MP	-.258	-.18	.010	-.191	-.192	.368	.39	-1.53	1.06	-.313
Gdppc	-.0057	.0079	-.002	.0051	.0051	-.0153	-.0167	-.032	-.0321	.004
R&D		.0162	.003	.0314*	.031*	.0522*	.0515*	-.13	.0819	.077***
Pop	1.4e-07	-8.5e-08**	7.5e-09	-7.9e-08**	-9.9e-08***	-2.4e-07***	.0557	-6.1e-07*	2.1e-07	7.5e-08

Legend :*p<0.05;**p<0.01;***p<0.001

Table 3. Fixed effect general model results

	Metal products	Trade	Tourism	Money & Finance	Real Estate	Transport	Building	Wood	Food	Textile
Open	-.38e-05	.0014*	-.194*	-.00038	-.0006	-3.7e-05		.0041***	.00348**	.00362**
Inv	.051	-.0865*		-.00731	-.0651	.003	-.0961	.0237	.002	.29***
Hum	.121			.022	-.204			.513**	.92***	.591**
Scae	-.296*			.173		.291**	.184	-.409*	-.229	-.766***
MP	.139	.108	.678**	-.174	-.0911	-.144	-.14	.0069	-.329	.461**
Gdppc	-.002	-.00309	-.0285**	.0027	.00614	.0008	.00019	.0051	.00227	-.009
R&D	.053***			-.0045	-.008	.02	4.2e-08	.0243	.0213	.032
Pop	2.3e-08	-4.5e-08*	-3.5e-08	-3.2e-08	4.6e-08	-5.1e-08	.184	-1.4e-07**	-1.7e-07***	-6.2e-08

Legend :*p<0.05;**p<0.01;***p<0.001

Table 4. Pooled model: robust LM tests results

	Robust LMlag		**Robust LMerr**	
	Value	**p**	**Value**	**p**
Agriculture	8.06	0.005	**4.57**	0.032
Industry	**9.83**	0.02	0.83	0.36
Strictly Industry	**72.46**	0.000	45.13	0.000
Manufacturing	**15.41**	0.000	0.21	0.64
Mineral products	**43.24**	0.000	41.10	0.000
Food & Beverage .	**9.34**	0.002	0.65	0.41
Textile	**2.99**	0.08	1.85	0.17
Leather products	0.15	0.69	1.99	0.157
Chemical products	21.12	0.000	**21.13**	0.000
Metal products	1.02	0.311	0.52	0.46
Paper products	0.12	0.76	1.38	0.23
Wood products	9.39	0.002	**23.4**8	0.000
Machinery products	**30.87**	0.000	6.07	0.014
Building	**7.81**	0.05	7.75	0.05
Services	0.12	0.71	1.09	0.29
Trade services	0.001	0.97	0.12	0.71
Tourism services	**18.47**	0.000	17.69	0.000
Transport	0.21	0.64	**3.66**	0.05
Monetary & Finance	1.54	0.21	0.15	0.69
Real estate	4.42	0.35	**4.44**	0.035

Table 5. Spatial panel data models results

	Agriculture			Industry			Services	
	Pooled	Time fixed effect		Pooled	Time fixed effect		Time fixed effect	
	SEM	SAR	SEM	SAR	SAR	SEM	SAR	SEM
Open	.010***	-.019***	.012***	.011***	.010***	.009***	-.002***	-.002***
Inv	-0.148	1.093***	.135	-.195**	-.421***	-.439***	.244***	.260***
Hum				.297**	-1.250***	-1.348***	.933***	.920***
Scae				-1.621***	-1.914***	-1.846***	1.032***	1.036***
MP	.554***	-1.238***	.54***	.248***	.335***	.347***	-.110***	-.109***
Gdppc	.002***	.009***	.003***	-.004***	-.006***	-.006***	.003***	.003***
R&D				-0.077***	-0.015	-.026	.040***	.040***
Pop	.023***	-.011	.021***	-.013***	-.013***	-.011***	.001	.001
δ		-.625***		.267***	.227***		.020	
ρ	-.473***		-.866***			.230**		-.050
R^2adjusted	.839	.724	.862	.892	.914	.909	.735	.736

Legend :*p<0.05;**p<0.01;***p<0.001

Table 6. Spatial panel data models results

	Strictly industry			Manufacturing			Paper products	
	Pooled	Time fixed effect		Pooled	Time fixed effect		Time fixed effect	
	SAR	SAR	SEM	SAR	SAR	SEM	SAR	SEM
Open	.016***	.015***	.014***	.016***	.015***	.015***	.012***	.012***
Inv	-.317***	-.530***	-.580***	-.358***	-.578***	-.632***	.020	.188
Hum	.400*	-1.03***	-.085***	.490**	-.986**	-1.034**	2.149***	1.248**
Scae	-2.113***	-2.39***	-2.296***	-2.25***	-2.552***	-2.44***	-1.17***	-1.15***
MP	.315***	.393***	.408***	.341***	.421***	0.435***	.403***	.387***
Gdppc	-.007***	-.009***	-.008***	-.007***	-.009***	-.009***	.004***	.005***
R&D	-.045*	.012	-.008	-.049*	.010	-.012	.042	.057
Pop	-.011***	-.012***	-.009**	-.010**	-.010**	-.008**	.034***	.032***
δ	.289***	.261***		.289***	.264***		-.151**	
ρ			0.256***			.250***		-0.71***
R^2adjusted	.894	.905	.897	.890	.900	.892	.850	.869

Legend :*p<0.05;**p<0.01;***p<0.001

Table 7.. Spatial panel data models results

	Chemical products			Mineral products			Leather products	
	Pooled	Time fixed effect		Pooled	Time fixed effect		Time fixed effect	
	SEM	SAR	SEM	.06**	SAR	SEM	SAR	SEM
Open	.015***	.021***	.021***	.378	.003	.005*	.025**	0.005
Inv	.056	.692***	.804***	3.803***	.079	.020	-.610	-0.102
Hum	4.337***	9.726***	9.919***	- 4.317***	1.412	1.935	.236	3.580***
Scae	-1.98***	-.748*	-.880**	.277**	-4.73***	-4.83***	- 15.155***	-3.883***
MP	-.505***	-.752***	-.788***	-.006**	.418***	.382***	1.529***	0.980
Gdppc	.004**	.011***	.012***	-.082	-.009***	-.009***	-.039***	-0.034
R&D	.016	-.238***	-.232***	-.026*	.021	-.025	-.866**	0.083
Pop	.102***	.100***	.099***	-.189*	-.027*	-.025*	.067	-0.144
Δ		-.157*			-.231*		-.401***	
P	.299***		-.252**	.408		.016		-0.134
R^2adjusted	.591	0.685	.690	.06**	0.369	.355	.343	0.990

Legend :*p<0.05;**p<0.01;***p<0.001

Table 8. Spatial panel data models results

	Machinery and electrical goods			Metal products		Trade		Tourism		
	Pooled	Time fixed effect		Time fixed effect		Time fixed effect		Pooled	Time fixed effect	
	SAR	SAR	SEM	SAR	SEM	SAR	SEM	SAR	SAR	SEM
Open	.01***	.01***	.01***	.01***	.01***	.02***	.001			
Inv	-.85***	-1.32***	-1.01***	-1.64***	-1.61***	.9	.28***	.53**	.75***	1.05***
Hum	-1.86***	-5.76***	-6.23***	-4.62***	-3.29***					
Scae	-.10	-.70**	-.44	.28	.94***					
MP	.388***	.60***	.54***	.59***	.59***	-.08***	-.1***	.26***	.26***	.25**
Gdppc	-.007***	-.01***	-.01***	-.01***	-.01***	-.001	.01***	.02***	.02***	.02**
R&D	.18***	.34***	.30***							
Pop	-.03***	-.03***	-.02***	-.03***	-.04***	.01***	.02***	-.07***	-.06***	-.07
δ	.42***	0.43***		-0.01		-.28***		.12*	.10	
ρ			.56**		-.19*		-.19***			.365***
R^2adj.	.77	.80	.80	.74	.76	.18	.32	.654	.646	.664

Legend :*p<0.05;**p<0.01;***p<0.001

Table 9.. Spatial panel data models results

	Money & Finance		Real Estate			Transport			Building		
	Time fixed effect		Pooled	Time fixed effect		Pooled	Time fixed effect		Pooled	Time fixed effect	
	SAR	SEM	SEM	SAR	SEM	SEM	SAR	SEM	SAR	SAR	SEM
Open	.00004	.01***	-.03***	-.01***	-.01***	-.002**	-.002**	-.002***			
Inv	-.09	-.06	-.35***	-.12***	-.25***	-.27**	-.06	-.114	.23	.19	.19
Hum	1.32***	.58***	.06	.53*	1.19***						
Scae	1.47***	1.37***				2.97***	3.45***	3.367***	-.57**	-.66**	-.64**
MP	-.06***	-.09***	-.05***	-.1***	-.14***	.02	.05	.068*	-.2***	-.21***	-.19***
Gdppc	.00	-.003	-.01***	-.01***	-.01**	-.002**	-.001	-.001	.01***	.01***	.01***
R&D	.09***	.08***	.19***	.19***	.14***	.09***	.08***	.090***			
Pop	.02***	.02***	.04***	.04***	.04***	-.01***	-.02***	-.019***	-.04***	-.03***	-.04***
δ	-.27***			-.21***			.21***		.07	.07	
ρ		-.97***	-.67***		-.96***	.32***		.008			-.09
R^2adj.	.85	089	.81	.78	.83	.63	.67	.65	.35	.33	.33

Legend :*p<0.05;**p<0.01;***p<0.001

Table 10. Spatial panel data models results

	Wood			Food		Textile		
	Pooled	Time fixed effect		Time fixed effect		Pooled	Time fixed effect	
	SEM	SAR	SEM	SAR	SEM	SAR	SAR	SEM
Open	.031***	.025***	.03***	-.001	-.002	.014***	.014***	.014**
Inv	-.46**	-.77*	-.92***	-1.38***	-1.58***	1.03***	.917***	1.038***
Hum	.31	-2.64*	-2.92***	-2.47***	-3.20***	1.94***	1.31	1.27
Scae	-2.18***	-2.59***	-2.96***	-2.22***	-1.73***	-4.99***	-5.23***	-5.34***
MP	.14*	.25**	.36***	.375***	.437***	.579***	.608***	.575***
Gdppc	-.003**	-.005**	-.008***	-.007***	-.009***	-.012***	-.013***	-.013***
R&D	-.199***	-.07	-.063	-.02	-.039	-.163**	-.134*	-.121
Pop	-.061***	-.05***	-.061***	-.026***	-.035***	.045***	.045***	.046***
δ		-.294		-.474***		-1.07	-.113	
ρ	-.784***		-.98***		-.694***			-.118
R^2adj.	.722	.655	.77	.387	.449	.712	.703	.704

Legend :*p<0.05;**p<0.01;***p<0.001

Table 11 Arellano-Bover GMM-Sys spatial autoregressive parameters

Sectors/Branches	δ AB-SYS
Agriculture	-1.88*
Industry	.888***
Strictly Industry	1.59***
Manufacturing	1.56***
Mineral products	-.101
Food & Beverage .	-3.32**
Textile	-.176***
Leather products	-.56***
Chemical products	.478
Metal products	1.43***
Paper products	.528**
Wood products	-1.43**
Machinery products	.76*
Building	-.368
Services	.898***
Trade services	4.27*
Tourism services	.309***
Transport	.315**
Monetary & Finance	2.04
Real estate	2.84***

Legend :*p<0.05;**p<0.01;***p<0.001