# Tendencies in the Regional Industry and Specialisation in Romania during the Transition Period*

**Tudorel Andrei**
*Ph.D. Professor*
**Liviu Bogdan Vlad**
*Ph.D. Lecturer*
**Monica Nedelcu**
*Ph.D. Senior Lecturer*
Academy of Economic Studies, Bucharest

***Abstract.*** *This article intends to present tendencies in the regional industry and specialisation in Romania during the transition period. The authors present the main tendencies in the analysis of concentration and specialisation and industry developments by electoral cycles as well. An econometric model for the analysis in time of concentration and specialisation in Romania during the transition period is also presented.*

**Key words:** *regional geography; regional development; regional specialisation; industry concentration; econometric models.*

* This article was written within the *PNII–National Complex Research Projects Programme*.

## 1. Tendencies in the analysis of concentration and specialisation

Regional specialisation and geographic concentration are important domains of economic research. The study that defined the new directions of the regional specialisation and concentration research is that of Krugman, P. (1991). Comparative studies of regions in the United States and in the European Union, such as Krugman (1991), revealed a higher degree of concentration in the processing industries in the US, as compared to Europe. *Unlike theoretical literature, the empirical analysis of the economic integration impact on industry regional specialisation and geographic concentration is at an incipient stage* Bode (2004).

The transition of the countries belonging to the former socialist block to the market economy and the enlargement of the European Union generated new research in the fields of regional specialisation and concentration, Hanson, G. H. (1996a, 1996b).

Regional specialisation can be defined as the distribution of a certain sector (industry) share *i* in the total economic activities (processing industries) in a certain region (county) *j* (Aiginger 1999b). A region *j* is considered to be specialised in a certain branch of industry *i*, if the respective branch has a high share among the population occupied in the processing industries in region *j* (Traistaru, 2002). This study will use the concept of specialisation as defined above.

The structure of the processing industry in a region *j* is highly specialised if a small number of industries hold a high share in the total processing industries. Specialisation can be measured using the occupied population, the production (the gross added value) or export data. One of the main difficulties in treating this topic quantitatively lies in ensuring data bases containing data series unaffected by various slope or level fractures. To that effect the Krugman, Herfindal, Gini indices, and others, can be used. The Andrei (2003) study presents such statistical measurements in Romania. The decision on choosing the most adequate measurements of regional specialisation and sectorial concentration depends to a large extent on the purpose of the research, considering though the available data and the specific properties of the respective measurements [(Bode E., Krieger – Boden K., Siedenburg F., Soltwedel R. (2004)].

Geographic concentration is defined as the distribution of the shares of a region (county) in a sector of the economic activity (industry) *i.* An industry *i* is highly concentrated if a large part of production is obtained in a small number of regions (counties) (Traistaru, 2000).

Regional specialisation and geographic concentration can be investigated at a sectorial level (economic activity sectors) and at an industrial level (the processing industry. Molle (1996), for instance, analyses sectorial specialisation for 96 NUTS1 and NUTS2 regions, using data from the period 1950-1990. The main findings of

the study are: the existence of a high convergence of the regions' production structure and a high degree of specialisation of periphery regions in 1990. Another study on regional specialisation is by Hallet (2002). The study uses the added value for 119 NUT1 and NUT2 regions for the period 1980-1995. Its findings indicate the decrease of specialisation, due to the tendency of the analysed regions production structures to move towards the European average. Cornett (2002) proposes the alternative concept of cohesion, based on an outline of the characteristics of inter-regional specialisation, measured by means of intra-industry, inter-state trade. From this perspective, the study analyses EU policy on its future enlargement and the impact of this process on its balance. Recently, Ezcurra *et al.* have examined regional production specialisation in the period 1977-1999. Their analysis for that period has confirmed the positive spatial auto-correlation in European regional specialisation, which had a decreasing tendency. The study emphasises the idea that the 1977-1999 convergence process in production specialisation will not continue indefinitely and, consequently, regional disparities will continue to be directly linked to the sectorial composition of the economic activity.

In Romania, several interesting studies have been carried out by Traistaru (2002), Andrei and Iacob (2003), Russu, Mitrut and Constantin (2006). Andrei (2003), for example, makes an econometric analysis of the time model regarding regional specialisation and geographic concentration at the NUTS II and NUTS III levels The study shows that, on average, during the period 1991-1999, regional specialisation fluctuated between -0.4% and 1.4% per year at the NUTS II level, while at the NUTS III level it increased by 0.5% per year. As for geographic concentration, at the NUTS II level, during the above-mentioned period, it was shown that it is not dependent on the time factor and it remains stable; also, using data for the NUTS III level, it was shown that it grew, on average, by 0.2% per year. The econometric analysis of the relation between regional specialisation and regional growth showed that, at the NUTS II level, during the period 1993-1998, the results of the estimation of the regional specialisation influence on economic growth were statistically insignificant for all specialisation indices. For all specialisation indices, per capita public expenditure had a significant, negative influence on economic growth. We obtained a significant, positive coefficient for the per capita GDP for all specialisation indices and for all model types, which means that there is a regional divergence of regional, per capita GDP. At the NUTS III level, for the period 1993-1998, the results of the estimation of the regional specialisation influence on economic growth were statistically significant only for the Gini and Krugman index, showing that there is a negative relationship between the two variables. The structural variables which had a considerable influence on economic

growth were the percentage of population in the working age groups (15 to 65), as well as the number of individual working people per 100,000 inhabitants.

A number of studies deal with the impact of the EU integration process and with the consequences of globalisation on global development. Thus, several studies have been published on regional disparities. Such studies have been made for countries like Bulgaria – Spiridonova (1995, 1999), Hungary – Nemes-Nagy (1994, 1998), Romania – Constantin (1997), etc. The main findings of these impact studies are that: (i) the globalisation and structural change process tends to favour Western and metropolitan regions, as well as regions with a strong industrial base (Petrakos, 1996); (ii) at a macrogeographic level, the transition process will lead to the increase of disparities at the European level, favouring the countries situated near the frontier between East and West (Petrakos, 1999); (iii) due to the economic integration process, the share of transportation costs in total production costs becomes less significant. In an empirical analysis, these transportation costs can be evaluated by the distance between the county capital city and the country capital city. The relocation of production has consequences on the pay structure at the regional level. Studies based on this theoretical approach have been carried out for Mexico. Thus, Hanson (1996b, 1997), using data on salaries in the Mexican processing industry, at a regional level, before and after liberalisation, verified the hypothesis that nominal salaries, as well as their structure at a regional level, decrease along with transportation costs to industrial centres (Mexico city and the regions on the United States border), approximated function of the distance to those locations.

A special place in the studies on activity specialisation and placing in development regions is held by the characteristics of the foreign investment localisation process, the regional influence on firm characteristics and the role of foreign investment in regional development. In Romania, a study was carried out to assess regional influences on newly established firms (Traistaru, 1999). Using the *new economic geography* approach, Altomonte and Resmini (1999) investigated the effect of direct foreign investment on regional specialisation modelling in the countries engaged in the integration process.

## 2. Industry evolution by electoral cycles

The industry has incurred serious losses during the transition period, because of the legacy bestowed upon it by the period of planned economy: excessive dimensions, lack of adaptation to the global market requirements, outworn technology and uneconomic territorial distribution. The transition period has brought about significant economic changes. Despite these efforts, though, after almost 20 years of transition, the Romanian economy displays the image of a country still affected by the inherited structural distortions.

The number of industrial employees decreased by 1,696,487 persons between 1991 and 2004. Thus, there were 3,188,055 persons employed in industry in 1991, while in 2004 there remained 1,491,568, which meant a fall of 53.2%. The highest annual drop occurred in 1992: a drop of 13.8% on the previous year. This decrease is followed by the 13% one in 1999. Considerable reductions of industrial staff also occurred in 1993 (-5.8% on the previous year), 1994 (-6.4%), 1995 (-9.5%), 1998 (-6.1%), 2000 (-6%), 2004 (-5.7%). During the period under investigation, increases in industrial staff occurred only in 2001 (1.9% on the previous year) and in 2002 (0.2% on 2001), but they were totally insignificant as compared with the decreases in previous periods.

The transition process in industry has caused a considerable decrease of industrial staff in all development regions. The most affected ones are those based predominantly on the extraction and heavy industries.

The table below presents staff reduction in relative figures during the above-mentioned period, in the eight economic regions. The most considerable reductions occurred in regions 1 and 8, amounting to approximately 60%. The smallest one was in region three, but it still was one of 40%.

Table 1 data shows that staff reduction, both in absolute and relative figures, was much more acute in the prevailing industry branches at the beginning of the 90's. The most significant decrease, of 79.7%, occurred in industry branch I10, which employed no less than 18.28 of the total industrial staff. In branch I2, which had the highest share, 19.8%, there was a drop of 43.2%. The smallest drop (14.2%) occurred in branch I4, which employed only 2.74 of industrial staff in 1991.

These results prove that Romania was insufficiently adapted to open market competion and that during the planned economy period industrial branches were over-dimensioned.

**Regional staff reduction between 1991 and 2004, by electoral cycles (%)**

**Table 1**

| | | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1991-2004 | $r$ | -59.81 | -50.84 | -56.06 | -53.13 | -39.17 | -44.94 | -53.78 | -60.48 | -53.21 |
| | $\bar{r}$ | -6.77 | -5.32 | -6.13 | -5.66 | -3.75 | -4.49 | -5.76 | -6.89 | -5.68 |
| 1991-1996 | $r$ | -33.98 | -31.89 | -28.47 | -35.47 | -33.39 | -31.20 | -29.79 | -38.49 | -32.64 |
| | $\bar{r}$ | -7.97 | -7.39 | -6.48 | -8.39 | -7.81 | -7.21 | -6.83 | -9.26 | -7.60 |
| 1997-2000 | $r$ | -23.57 | -21.88 | -29.93 | -22.57 | -12.51 | -18.81 | -23.11 | -27.89 | -23.22 |
| | $\bar{r}$ | -8.57 | -7.90 | -11.18 | -8.17 | -4.36 | -6.71 | -8.39 | -10.33 | -8.43 |
| 2001-2004 | $r$ | -18.01 | -4.52 | -6.15 | -0.04 | 4.55 | -1.72 | -11.14 | -4.74 | -6.19 |
| | $\bar{r}$ | -6.40 | -1.53 | -2.09 | -0.01 | 1.50 | -0.58 | -3.86 | -1.61 | -2.11 |

$r$ - change rate in each period, $\bar{r}$ - average annual change rate in each period

### 3. Econometric model for time analysis of specialisation and concentration

In order to follow the evolution of concentration and specialisation during the transition period, the following three regression models were considered. For the estimation of parameters the data from 1991-2004 were used. The development region GDP has been calculated and reported on by the National Statistics Institute only beginning with 1998. Consequently, in order to calculate the two categories of indicators, the regional GDP share in the national value is estimated through the region's share of occupied population in the national occupied population. For the analysis of aspects regarding the two characteristics we use three regression models defined for data of the panel type. We use the Hausman test to see whether there are significant differences between the models. Next, we will present the three models and the application rules of this statistical test.

The common-constant regression model for specialisation is defined by:

$$\log(\mathrm{SPECH}_j(t)) = b + a \times t + \varepsilon_{jt} \qquad (1)$$

where:

*j* is the index for the development region, with values from 1 to 8, and *t* is the time variable. $R^2_{CC}$ is the common-constant regression model coefficient.

The fixed-effect regression model is different from the former one because the independent term is different from a region to another:

$$\log(\mathrm{SPECH}_j(t)) = b_j + a \times t + \varepsilon_{jt} \qquad (2)$$

$R^2_{EF}$ is the fixed-effect regression model coefficient.

In order to test whether the two models are equivalent we use an F test, through which we verify whether the independent terms of the models are significantly different. The statistics of the test is defined on the basis of the relation below:

$$F = \frac{(R^2_{EF} - R^2_{CC})/(m-1)}{(1-R^2_{EF})/(T \times m - m - 2)} \rightarrow F(m-1, T \times m - m - 2) \qquad (3)$$

If the calculated statistic value is higher than a table value, then we can say that the fixed-effect model is more preferable than the common-constant one, because there are significant differences between the regions.

In the random-effect regression model the independent term is decomposed into a deterministic component and a random one. Therefore, we shall write that $b_j = b + u_j$. We shall define the random-effect regression model as:

$$\log(\mathrm{SPECH}_j(t)) = b + a \times t + (u_j + \varepsilon_{jt}) \qquad (4)$$

$R^2_{EA}$ is the random-effect regression model coefficient.

The Hausman test[1] is used to establish whether there are significant differences between the two models, the fixed-effect one and the random-effect one. This test is aimed at verifying the efficiency and the inconsistency of estimators in the two models. $\hat{a}_{EF}$ is the vector of the estimators in the first model, while $\hat{a}_{EA}$, the vector of the estimators for the random-effect model. The two hypotheses of the test are thus formulated:

$H_0$: the two estimators $\hat{a}_{CC}$ and $\hat{a}_{EF}$ are consistent, but is inefficient

$H_1$: $\hat{a}_{CC}$ is consistent and $\hat{a}_{EF}$ efficient, but is inconsistent.

The statistics of the test is defined on the basis of the relation below:

$$H = (\hat{a}_{EF} - \hat{a}_{CC})(\text{var}(\hat{a}_{EF}) - \text{var}(\hat{a}_{CC}))^{-1}(\hat{a}_{EF} - \hat{a}_{CC}) \rightarrow \chi^2 \quad (5)$$

If the statistic value is higher than a table value, then the null hypothesis is rejected and the second model is deemed much more appropriate.

The table below presents the characteristics of the three regression models defined for the regional specialisation variable.

**Characteristics of regressions for the analysis of regional specialisation**

**Table 2**

| | Common-effect model | Fixed-effect model | Random-effect model |
|---|---|---|---|
| **Independent term** | **-0.932526** (0.011200) | **-** | **-0.932526*** (0.017352) |
| **Slope coefficient (a)** | **0.002261***** (0.001315) | **0.002261**** (0.000975) | **0.002261**** (0.000970) |
| $b_1$ | - | -0.862331 | 0.065868 |
| $b_2$ | - | -0.876381 | 0.052684 |
| $b_3$ | - | -0.943424 | -0.010226 |
| $b_4$ | - | -0.979146 | -0.043746 |
| $b_5$ | - | -0.936210 | -0.003457 |
| $b_6$ | - | -0.942096 | -0.008980 |
| $b_7$ | - | -0.960310 | -0.026071 |
| $b_8$ | - | -0.960310 | -0.026071 |
| $R^2$ | 0.26167 | 0.499337 | 0.470172 |
| n | 112 | 112 | 112 |

**Note:** *, **, *** are siginificantly different from zero, i.e. for 1%, 5% and 10%.

The three regression models are defined in a similar manner for the analysis of the industry concentration level function of the number of employees $\text{CONCH}_i(t)$, $i = 1,...,n$, $t = \overline{1991,2004}$. The results of the estimations are presented in the table below.

**Characteristics of regressions for the analysis of industry concentration**

**Table 3**

| | Common-effect model | Fixed-effect model | Random-effect model |
|---|---|---|---|
| **Independent term** | **-0.804780*** (0.008455) | **-** | **-0.804780*** (0.014725) |
| **Slope coefficient (a)** | **0.000411** (0.000993) | **$583 \times 10^{-6}$** ($248 \times 10^{-6}$) | **0.000411** (0.000478) |
| $I_1$ | - | -0.893617 | -0.085951 |
| $I_2$ | - | -0.858003 | -0.050986 |
| $I_3$ | - | -0.754253 | 0.050874 |
| $I_4$ | - | -0.775510 | 0.030004 |
| $I_5$ | - | -0.756739 | 0.048434 |
| $I_6$ | - | -0.783539 | 0.022122 |
| $I_7$ | - | -0.831053 | -0.024527 |
| $I_8$ | - | -0.826975 | -0.020522 |
| $I_9$ | - | -0.862617 | -0.055516 |
| $I_{10}$ | - | -0.818067 | -0.011778 |
| $I_{11}$ | - | -0.717189 | 0.087263 |
| $I_{12}$ | - | -0.795825 | 0.010060 |
| $I_{13}$ | - | -0.805539 | 0.000523 |
| $R^2$ | 0.9 | 0.782501 | 0.768259 |
| n | 112 | 112 | 112 |

**Note:** *, **, *** are siginificantly different from zero, i.e. for 1%, 5% and 10%.

In order to choose between the three models for regional specialisation analysis we use the two tests presented above:

(i) For the first two models we use the F statistics; in this case, the statistic value is 13.77. From the F statistics table the value of 2.72 is calculated for a significance threshold of 5%. Thus, the null hypothesis is rejected and the fixed-effect model is accepted for the analysis of regional specialisation;

(ii) In order to choose between the fixed-effects model and the variable-effects ones, we calculate the statistics of the the Hausman test; in this case, we obtain the value of 42,579.11.

After the application of the two tests, it results that the most appropriate model for the analysis of regional specialisation if the random-effect one. We therefore state the following conclusions: (i) at the beginning of the transition period there is no significant specialisation of the economic development regions; (ii) during the analysed period there was a specialisation effect only in regions 1 and 2. In the other regions it occurred a reduction of this phenomenon. The data in Table 4 show that there was no concentration change rule for Romanian industry branches during the transition period.

## Note

(1) We recommend, for a detailed presentation of this test: Hausman, J., Specific Tests in Econometrics, Econometrica, 46, 1978.

## References


Aiginger, K. et al., „Specialization and (Geographic) concentration of European Manufacturing", *Enterprise DG Working Paper No 1.* Background Paper for The competitiveness of European Industry: 1999 Report (1999a), Brussels

Aiginger, K., „Do Industrial Structures Converge? A Survey on the Empirical Literature on Specialization and Concentration of Industries", *WIFO-Working papers,* (1999b)

Aiginger, K., „Trends in the Specialization of Countries and the Regional Concentration of Industries. A Survey on Empirical Literature", *WIFO-Working Papers,* (1999c)

Amiti, M., „New Trade Theories and Industrial Location in the EU: A Survey of Evidence", *Oxford Review of Economic Policy* 14 (2), 1998, pp. 45-53

Andrei, T. (2003). *Statistică și econometrie*, Editura Economică, București

Barro, R.X., Sala-I-Martin. X., „Convergence", *Journal of Political Economy*, 100 (2), 1992, pp. 223-251

Cornett, A. (2002). *Regional Cohesion in an Enlarged European Union*, in J.R. Cuadrado-Roura, M. Parellada (Eds), *Regional Convergence in the European Union. Facts, Prospects and Policies*, Springer-Verlag, Berlin

Ezcurra, R., Pascual, P., Rapun. M., „Regional Specialization in the European Union", *Regional Studies*, 40 (6), 2006, pp. 601-616

Frankel, J.A., Rose, A.K. „The endogeneity of the optimum currency area criteria", *Economic Journal*, 108, No. 449, 1998, pp. 1009-1025

Fujita, M., Krugman, P., Venables, A. (1999). *The Spatial Economy*, MIT Press, Cambridge

Fujita, M., Thisse, J.F. (2002). *Economics of Agglomeration*, Cambridge University Press, Cambridge

Hallet, M. (2002). *Regional Specialisation and Concentration in the EU*, in Cuadrado-Roura, J. R., Parellada, M. (Eds), *Regional Convergence in the European Union. Facts, Prospects and Policies*, Springer-Verlag, Berlin

Hanson, G.H., „Economic integration intra-industry trade and frontier regions", *European Economic Review*, 40, 1996a, pp. 941-949

Hanson, G.H., „Localization economies. Vertical organization and trade", *American Economic Review,* 87, 1996b, pp. 1266-1278

Hanson, G.H., „Increasing returns trade and the regional structure of wages", *Economic Journal,* 107. 1997, pp. 113-133

Hanson, G.H., „Market potential increasing returns and geographic concentration", *Working Paper No. 6429*, National Bureau of Economic Research, 1998

Hausman, J., „Specific Tests in Econometrics", *Econometrica*, 46, 1978, pp. 1251-1271

Heckscher, E., „The Effect of Foreign Trade on Distribution of Income", *Economisk Tidskrift*, 21, 1919, pp. 1-32

Kim. S., „Expansion of markets and the geographic distribution of economic activities: the trends in US regional manufacturing structure. 1860-1987", *Quarterly Journal of Economics*, 70, 1995, pp. 881-908

Kriegen-Boden, C. (2002). EMU and the Industrial Specialisation of European Regions, in Cuadrado-Roura, J. R., Parellada, M. (Eds). *Regional Convergence in the European Union. Facts, Prospects and Policies*, Springer-Verlag, Berlin

Kriegen-Boden, C., Morgenroth, E., Petrakos, G. (2008). *The Impact of European Integration on Regional Structural Change and Cohesion,* Routledge

Krugman, P. (1991). *Geography and Trade*, MIT Press, Cambridge

Krugman, P., „What's new about the new economic geography?", *Oxford Review of Economic Policy*, 14, 1998, pp. 7-17

Longhi, S., Nijkamp, P., Traistaru, I., „Economic Integration and Regional Structural Change in a Wider Europe:Evidence from New and Accession Countries", *Journal for Institutional Innovation Development and Transition*, Volume 8, 2004, pp. 48-55

McCann, P. (2001). *Regional and Urban Economics*, Oxford University Press, Oxford

Molle, W. (1996). The Regional Economic Structure of the European Union: an Analysis of Long-Term Developments, in K. Peschel (ed.) *Regional Growth and Regional Policy within the Framework of European Integration*, Physica-Verlag, Heidelberg, pp. 66-86

Negrescu, D., „Un deceniu de privatizare în România", în *Tranziție economică în România. Trecut, prezent și viitor,* Ruhl, C., Dăianu, D. (1999), The World Bank și Centrul Roman de Politici Economice, București, 1999, pp. 520-543

Ohlin, B. (1933). *Interregional and International Trade*, Harvard University Press, Cambridge

Cocean, P. (2002). *Geografie regională*, Cluj-Napoca: Presa Universitară Clujeană

Pons-Novel, J., Tirado-Fabregat, D.A., „Specialization and Asymmetries in Macroeconomic Fluctuations: Evidence for European Regions", *Regional Studies*, 40(7), 2006, pp. 695-706

Traistaru, I., „Regional patterns of private enterprise development in Romania", *Working paper,* Center for European Integration Studies, University of Bonn, 1999

Traistaru, I., Iara, A., Pauna, C.B., „Regional structural change and growth în România", *42nd Congress of the European Regional Science Association, Dortmund, 27th -31st August 2002*

Traistaru, I., Nijkamp, P., Longhi, S., „Regional specialisation and location of industrial activity in accession countries", *42nd Congress of the European Regional Science Association, Dortmund, 27th -31st August 2002*

Traistaru, I., Nijkamp, P., Resmini, L. (2003). *The Emerging Economic Geography in EU Accession Countries,* Ashgate Publishing, Ltd.

Sala-I-Martin, X., „The classical approach to convergence analysis", *The Economic Journal*, 106, 1996, pp. 1019-1036

Verbeek, M. (2000). *A Guide to Modern Econometrics*, John Wiley & Sons. Ltd.