

EDUCATION AND LABOUR MARKET PERFORMANCE IN ROMANIA. AN EMPIRICAL ANALYSIS OF THE URBAN-RURAL GAP

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Abstract

As education is the foundation of a prosperous and sustainable society and given the increasingly visible gap between urban and rural, the aim of the research undertaken in this paper is to present the level of education and labour market integration in Romania, in a comparative urban-rural approach. The dataset compiled for Romania is organized in two sub-panels, urban and rural, including indicators of the education system, but also fundamental credentials of the labour market, for the period 2000-2020. The research methodology is based on the application of two advanced econometric models, namely spatial models (lag and error) and Gaussian graphical models (GGMs). The results highlight the coordinates of the Romanian education system in the two areas of residence, urban-rural, but also the link between education and the labour market outcomes. Based on our findings, we propose adequate strategies to mitigate the gap between rural and urban and enhance the labour market performance.

Keywords

education; labour market; urban-rural; econometric modelling.

JEL Classification

C30; I25; I31; J21; R12.

Introduction

As education represents the foundation of a prosperous and sustainable society (Agbedahin, 2019), this should be one of Romania's priorities. The emphasis on education and training can play a strategic role in the process of economic development (Jukšs, 2021). Vocational education and training are very important among young people and adults, both in urban and, especially, rural areas (Zhang et al., 2018). Therefore, education and, implicitly, learning, in all possible forms, have an essential

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role for the rural environment, through which the citizens of the rural area to become more and more educated, regardless of age, to have an extended lifespan, to have as much many learning opportunities and access to all the information resources of contemporary society. Under these conditions, an education-based and knowledge-based economy can counteract urbanization trends, protect the natural and human resources of the rural environment, understand the new challenges of rural Europe and respond to them through new initiatives, flexibility and adaptability (Cooke, Leydesdorff, 2006).

Given the differences between urban and rural, the objective of our research is to present the level of education and labour market integration in Romania, in a comparative urban-rural approach. As such, the purpose of our research is to conduct a comprehensive econometric analysis to highlight the role of the education system and the implications of education on the long-term development of Romania, in a comparative urban-rural approach, focusing on the situation at the rural level.

The research is based on data sets collected from official sources on two panels, urban-rural, which should include indicators of the education system, but also indicators of integration into the labour market. The research methodology is based on the application of advanced and combined econometric models, in terms of the interdependence between education and labour market indicators, in a comparative approach at urban-rural level, as follows: spatial models (spatial lag and spatial error), based on the matrix inverse of distances, processed by Maximum Likelihood Estimator (MLE); and Gaussian graphical models (GGMs), processed by two estimation methods, namely Partial Correlations (Pcor) and Extended Bayesian Information Criterion with graphical least absolute shrinkage and selection operator (EBIClasso).

The novelty brought by this paper is based on the complex econometric analysis applied in Romania, for the two areas of residence, urban and rural, being the first of its kind so far. The research undertaken in this paper has both theoretical and practical implications, and the conclusions drawn from this study can be used as reference elements for the development of a set of specific educational policies and a comprehensive educational strategy that considers interdependencies, connections between the variables captured in the report and the positive/negative influences highlighted by the econometric analysis.

1. Literature review

Studies in the literature show a direct link between investment in education and economic, social, and human development, education being an important factor in ensuring sustainable development, because, through education, people understand and learn how to become more responsible for the environment and society (Dale, Newman, 2005; Dragoescu, 2015).

Thus, education for sustainable development tends to increase the interest of young people in acquiring the skills and competencies necessary for employment in the labour market, in accordance with its requirements, as well as assuming a sustainable way of

life with responsible and competent citizens (Garcia, van der Velden, 2008; Pastore, 2012).

The literature in the field of education in Romania reveals that it encounters major deficiencies, even if it is a necessary criterion for the good development of citizens and society (Dragoescu, 2015; Wodak, Fairclough, 2010). One of these shortcomings is highlighted by the poor funding of education (Drăcea et al., 2010). Problems that persist in acquiring basic skills in school and the low level of digital literacy of the majority of the population are a challenge for the integration into the labour market of future graduates in Romania (Kitchen et al., 2017; Walker, 2010).

With reference to higher education, Novo-Corti et al. (2018) show that public universities in Romania are much more involved than those in the private system in implementing programs, projects, debates, and courses on sustainable development, and the reactions of students are positive.

Regarding the rural environment in Romania, it can be characterized as having: a high potential for development that is not used efficiently, a declining population, aging and unevenly distributed, low levels of economic activity and low entrepreneurial initiative, a high rate of employment in agriculture, forestry and fisheries, high poverty and low quality of life, provision of poor basic social services, poorly educated children and underdeveloped population with limited access to education and training units and basic and social infrastructure deficient (Pavel, Moldovan, 2019).

The rural environment in Romania has very big problems, but the one that is causing all the other difficulties that the rural citizens face is poverty, Romania being one of the countries with the highest poverty rates in the European Union (European Commission, 2021). In rural areas, there is a growing number of poor, single-income families, sometimes only the allowance or social income. Children from these poor families have precarious living conditions, even leading to illness or malnutrition. All these shortcomings, as well as household responsibilities, do not allow children to go to school and have an education. Thus, a high degree of functional illiteracy is achieved among people belonging to the rural environment. Due to poverty, children are left with only 8 grades, and a large proportion of them are exposed to this problem, having reduced employment opportunities in the labour market (Feher, 2014; Precupetu et al., 2015; Raicov, Feher, 2018).

As such, the identification of the discrepancies between the rural and the urban environment remains a problem of fundamental importance in Romania, both in the social and economic field. Given that in the urban environment, we want to develop infrastructure, improve schools, hospitals, in rural areas we are witnessing efforts to maintain schools and dispensaries, improve roads, and increase the existence of new jobs. The urban society must provide its citizens with the best quality medical services and specialized education, invest in infrastructure to ensure development and prosperity at the national level. Thus, the rural environment needs coherent strategies to ensure the reduction of the gap with the urban environment.

2. Data and methodology

The data used in the empirical analysis were extracted for the period 2000-2020, being configured on two panels, with data related to the urban and rural areas of residence.

Specifically, the data used in the analysis are grouped into 2 categories, as follows:

- Indicators of the educational system: number of graduates (absolventi); number of school units (unit_scolare); the share of the school population in the total population (pond_pop_scolare); the share of teaching staff in the total school population (pond_pers_didactic); number of classrooms (sali_clasa); number of school laboratories (laborat_scolare); number of gyms (sali_gimn); number of school workshops (ateliere_scolare); the number of sports fields (terenuri_sport); the share of PCs in the total school population (pond_pcuri);
- Indicators of wellbeing and labour market: employment rate 15-64 years (rata_ocupare); unemployment rate (rata_somaj).

The indicators used in the empirical analysis, together with the measurement unit, the acronym of the variables and the data source, are presented in Table A1 of the Annex.

The descriptive statistics of the indicators are detailed in Table 1, for the data panel related to the urban environment, and Table 2, for the panel with data specific to the rural residence environment.

Table no. 1. Descriptive statistics - urban panel data

Variables	N	mean	standard deviation	minimum	maximum
unit_scolare	20	4652.85	948.0714	3870	6422
pond_pop_scolare	20	22.1898	1.779652	19.79628	24.4507
pond_pers_didactic	20	6.168738	0.1666257	5.872829	6.58269
sali_clasa	20	77511.95	7620.175	70561	88885
laborat_scolare	20	19510.55	1752.341	16019	21487
sali_gimn	20	2853.55	92.9581	2659	2938
ateliere_scolare	20	5538	1205.2	4148	7830
terenuri_sport	19	2855.474	238.1933	2305	3187
pond_pcuri	19	7.758597	3.350581	1.724597	11.78376
absolventi	19	500070.8	81728.04	392614	660726
rata_ocupare	20	59215	3.682287	53.7	67.1
rata_somaj	20	7875	2.213089	3.4	11.2

Source: own data processing in Stata 16

Table no. 2. Descriptive statistics - rural area panel data

Variables	N	mean	standard deviation	minimum	maximum
unit_scolare	20	6405.35	5414.051	3117	18059
pond_pop_scolare	20	12.55661	1.523687	9.981995	14.55403
pond_pers_didactic	20	7.223048	0.2680392	6.797065	7.740219
sali_clasa	20	54049.25	4736.964	45591	60434
laborat_scolare	20	5181.6	411.2734	4601	5661
sali_gimn	20	1875.55	89.22442	1665	2007
atieliere_scolare	20	998.3	423.5605	542	1721
terenuri_sport	19	2071.421	202.2961	1763	2390
pond_pcuri	19	6.244133	3.443945	0.5118911	10.26067
absolventi	19	120467.6	22289	90653	152534
rata_ocupare	20	64155	3.556976	60.2	73.8
rata_somaj	20	5.02	0.9174335	2.8	6.6

Source: own data processing in Stata 16

The processing of the two data panels and the econometric modelling were performed in Stata 16 and RStudio 3.6.3.

The research methodology is based on the application of the following econometric models: spatial models (lag and error); and Gaussian graphical models - GGMs.

Spatial models were configured and processed in two forms, namely spatial lag (autoregressive) and spatial error, to see if the observations are grouped or distributed randomly (Anselin, 2005). The models were estimated by the Maximum Likelihood Estimator (MLE) and are described in Equations 1 and 2, where the dependent variable is the number of graduates, and all other variables used are independent variables.

Spatial lag models:

$$y = \lambda W y + X \beta + u \quad (1)$$

Spatial lag models patterns:

$$y = X \beta + u, \quad u = \rho W u + v \quad (2)$$

Where: W is the inverse distance matrix (standardized); y represents the dependent variable (number of graduates); X captures the explanatory variables (independent); λ and ρ are scalars that estimate the dependence of y_i on the close neighbour y and the spatial correlations at the level of errors; u represents the term error (spatially correlated residual variables); v captures independent and identically distributed perturbations.

Spatial models are based on the construction of an inverse (standardized) distance matrix (W), having the following characteristics: period 2000-2020: size: 20×20 ; distance band: $0 < d \leq 16000$; friction parameter: 1; minimum distance: 5.0; distance to first quartile: 0.1; median distance: 0.2; distance to the third quartile: 0.3; maximum distance: 0.5; largest minimum distance threshold: 0.07; smallest threshold of the maximum distance: 0.28.

The original data has been transformed and the variables were stationary through logarithm.

The network analysis was performed by processing Gaussian Graphical Models (GGMs), which reveals an undirected network of partial correlation coefficients (both positive and negative), reflected graphically in terms of the links between variables (thickness of lines between network nodes), thus avoiding spurious correlations (Epskamp et al., 2018).

3. Results and discussions

3.1. Results of the spatial models (robust spatial lag and robust spatial error)

Considering the spatial differences identified in the compiled data and the analysis undertaken on the two levels, urban-rural, we developed and processed two types of spatial econometric models (robust spatial lag and robust spatial error), detailed on three groups of models, as follows: the 1st group including number of graduates as dependent variable, and employment rate, as representative variable of the labour market (Table 3); the 2nd group with number of graduates as dependent variable, and unemployment rate, as representative labour market credential (Table 4); and the 3rd group with employment and unemployment rates as dependent variables and proxies for labour market performance (Table 5).

Thus, the results emphasize the importance of the school population in increasing the number of graduates, the endowment of classrooms and school laboratories, including with IT equipment, but also with equipment and sports facilities (gyms and sports fields) in the statistically significant modelling (both positive and negative) of the number of graduates in urban and rural areas, with spillover effects on the labour market performance and economic development of Romania. Employment rate has induced negative impact on the number of graduates for the urban area (Table 3), in return for positive estimated coefficients of the unemployment rate (associated with negative implications) (Table 4), while for the rural one, the impact of labour market outcomes is not statistically significant.

Table no. 3. Results of the spatial lag robust models and spatial error robust models, dependent variable: absolvenți (graduates), labour market variable: employment rate (rata_ocupare)

	(1)	(2)	(3)	(4)
	Urban		Rural	
	log_absolventi	log_absolventi	log_absolventi	log_absolventi
	Spatial lag	Spatial error	Spatial lag	Spatial error
	robust	robust	robust	robust
log_unit_scolare	0.129 (0.196)	0.129 (0.199)	-0.150 (0.104)	-0.148 (0.100)
log_pond_pop_scolare	4.034*** (1.005)	4.000*** (1.129)	0.762* (0.995)	0.783 (0.992)

log_pers_didactic	0.511 (0.817)	0.485 (0.795)	-0.616 (0.962)	-0.606 (0.947)
log_sali_clasa	-0.0434* (0.165)	-0.0470* (0.158)	-0.352 (0.342)	-0.354 (0.338)
log_laborat_scolare	-0.637* (0.393)	-0.654* (0.448)	0.526* (0.715)	0.541 (0.675)
log_sali_gimm	1.986** (0.762)	1.967** (0.822)	0.471* (0.447)	0.459 (0.455)
log_ateliere_scolare	-1.207 (0.768)	-1.182 (0.967)	0.496 (0.457)	0.480 (0.460)
log_terenuri_sport	-0.0848 (0.176)	-0.0876 (0.181)	0.958 (0.503)	0.957 (0.492)
log_pond_PCuri	0.0738 (0.155)	0.0803 (0.185)	-0.0207 (0.158)	-0.0244 (0.152)
log_rata_ocupare	-1.416* (0.606)	-1.392* (0.762)	0.944 (0.931)	0.958 (0.904)
_cons	6.209 (6.627)	6.411 (6.796)	-6.440 (8.194)	-6.482 (7.677)
rho				
_cons	0.00242 (0.00279)		-0.00472 (0.00446)	
sigma				
_cons	0.0191*** (0.00278)	0.0191*** (0.00279)	0.0371*** (0.00496)	0.0370*** (0.00491)
lambda				
_cons		0.00467 (0.00903)		0.00836 (0.00938)

Note: standard errors are shown in parentheses, *, p < 0.05, **, p < 0.01, *** p < 0.001”.

Source: own research in Stata 16

Table no. 4. Results of the spatial lag robust models and spatial error robust models, dependent variable: absolvenți (graduates), labour market variable: unemployment rate (rata_somaj)

	(1)	(2)	(3)	(4)
	Urban		Rural	
	log_absolventi	log_absolventi	log_absolventi	log_absolventi
	Spatial lag	Spatial error	Spatial lag	Spatial error
	robust	robust	robust	robust
log_unit_scolare	0.327 (0.196)	0.326 (0.196)	-0.0973 (0.0861)	-0.104 (0.342)
log_pond_pop_scolare	3.142*** (0.502)	3.152*** (0.496)	0.456 (1.164)	-0.135 (15.18)
log_pers_didactic	-0.487 (0.514)	-0.482 (0.511)	-0.150 (0.775)	-0.483 (9.368)

log_sali_clasa	-0.189 (0.147)	-0.190 (0.144)	-0.245 (0.267)	-0.145 (2.437)
log_laborat_scolare	-0.553 (0.441)	-0.559 (0.461)	-0.0308 (0.638)	-0.247 (4.690)
log_sali_gimn	1.195 (0.629)	1.187* (0.582)	0.691 (0.440)	0.839 (2.467)
log_ateliere_scolare	-0.656 (0.486)	-0.658 (0.476)	0.653 (0.496)	0.961 (7.828)
log_terenuri_sport	-0.102 (0.181)	-0.101 (0.181)	0.629* (0.309)	0.602 (0.741)
log_pond_PCuri	0.169 (0.118)	0.170 (0.118)	0.0847 (0.160)	0.179 (2.132)
log_rata_somaj	0.0942* (0.0413)	0.0944* (0.0412)	-0.0320 (0.126)	0.0248 (1.208)
_cons	5.486 (7.871)	5.618 (7.519)	0.0998 (4.698)	-0.240 (.)
rho				
_cons	0.00141 (0.00137)		-0.00263 (0.00472)	
sigma				
_cons	0.0191*** (0.00240)	0.0191*** (0.00241)	0.0390*** (0.00702)	0.0394*** (0.00576)
lambda				
_cons		0.00317 (0.00540)		0.00765 (0.0291)

Note: standard errors are shown in parentheses, *, ** p < 0.05, *** p < 0.01, **** p < 0.001.

Source: own research in Stata 16

Particular attention should be paid to the endowment of classrooms and school laboratories, both for urban and rural areas, being the main variables for which unfavourable influences were obtained in terms of the impact on the number of graduates (negative coefficients), but also the employment and unemployment rates for the urban area.

It is observed that, overall, the influences of the variables on the number of graduates were stronger in urban than rural areas, requiring strategies adapted to the rural environment to support education, correlated with increased labour market outcomes and economic well-being.

Table no. 5. Results of the spatial lag robust models, dependent variables: employment rate (rata_ocupare) and unemployment rate (rata_somaj)

	(1)	(2)	(3)	(4)
	Urban		Rural	
	log_Rata_ocupare	log_Rata_somaj	log_Rata_ocupare	log_Rata_somaj
	Spatial lag robust	Spatial lag robust	Spatial lag robust	Spatial lag robust
log_absolventi	-0.247* (0.119)	2.063* (0.849)	0.105* (0.0890)	-0.200* (0.354)
log_unit_scolare	0.0649 (0.0770)	-1.879** (0.572)	0.0682* (0.0281)	-0.160 (0.149)
log_pond_pop_scolare	1.378*** (0.337)	-12.44*** (2.263)	-0.558* (0.231)	5.736*** (1.311)
log_pers_didactic	0.413 (0.355)	-1.965 (2.730)	0.414 (0.212)	2.610 (1.382)
log_sali_clasa	0.0552 (0.119)	0.653 (0.911)	0.153 (0.102)	-0.533 (0.358)
log_laborat_scolare	-0.166 (0.217)	0.188 (1.696)	-0.703*** (0.195)	3.927** (1.246)
log_sali_gimn	0.965** (0.312)	-1.855 (2.402)	0.240 (0.163)	-2.299* (1.052)
log_ateliere_scolare	-0.771*** (0.163)	6.775*** (1.258)	0.205 (0.116)	-3.094*** (0.694)
log_terenuri_sport	0.0527 (0.0793)	-0.540 (0.618)	-0.418*** (0.0925)	0.440 (0.537)
log_pond_PCuri	-0.0659 (0.0463)	0.273 (0.375)	0.143*** (0.0325)	-1.289*** (0.214)
_cons	1.461 (3.489)	-16.14 (28.78)	6.969*** (1.486)	-4.499 (6.821)
rho				
_cons	-0.00368 (0.00216)	0.000363 (0.000367)	0.00898*** (0.00228)	-0.00168*** (0.000306)
sigma				
_cons	0.0109*** (0.00178)	0.0900*** (0.0138)	0.0122*** (0.00202)	0.0679*** (0.0134)

Note: standard errors are shown in parentheses, *, *p < 0.05, **p < 0.01, ***p < 0.001”.

Source: own research in Stata 16

In terms of labour market outcomes, the empirical results entail that there is evidence to attest that an increase in the number of graduates does not always strengthen the labour market outcomes, particularly in the urban area, while in the rural area education majorly contributes to increased labour market performance (upward in the employment rate and decreases in the unemployment rate). There are also dissimilarities between

urban-rural also as regards the educational endowment and their interdependencies with labour market performance.

The results of spatial models should be considered subject to a limited level of statistical significance, given the relatively low number of observations used in econometric processing, which is a limitation of the empirical research undertaken. Thus, to increase the robustness of the estimates, but also in order to identify the interdependencies between all the specific variables used in the analysis, respectively the positive and negative correlations between them, the research approach is continued by the network analysis based on Gaussian graphical models.

3.2. Results of the Gaussian Graphical Models (GGMs)

Gaussian Graphical Models (GGMs) are configured and estimated by two methods, namely the partial correlation method (pcor) and the Bayesian method (EBICglasso), so that the results are as robust and economically relevant as possible. The GGMs models were processed at the level of the two data panels, urban and rural.

In the case of GGM models processed on urban data by the method of partial correlations (pcor) (Figure 1), the results show very strong positive links between graduates, share of school population, share of PCs, gyms, and sports fields. Partial inverse correlations are revealed between the unemployment rate, the share of teachers and school units, but also between graduates and the occupancy rate, respectively classrooms and school laboratories.

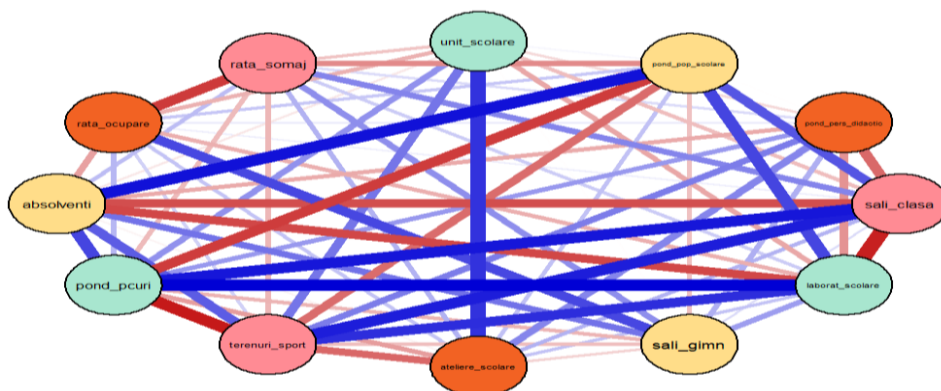


Figure 1. The results of Gaussian graphical models, method of partial correlations (pcor) - urban panel data

Source: own research in Stata 16

The EBICglasso method (Figure 1) reinforces the previous results and allows to capture the positive correlations between the occupancy rate, classrooms and gyms, the share of the school population, but also between schools, workshops, school laboratories and IT equipment (PCs). Reverse, unfavourable correlations are highlighted between the

number of graduates, classrooms and the share of teachers, but also between the unemployment rate and classrooms.

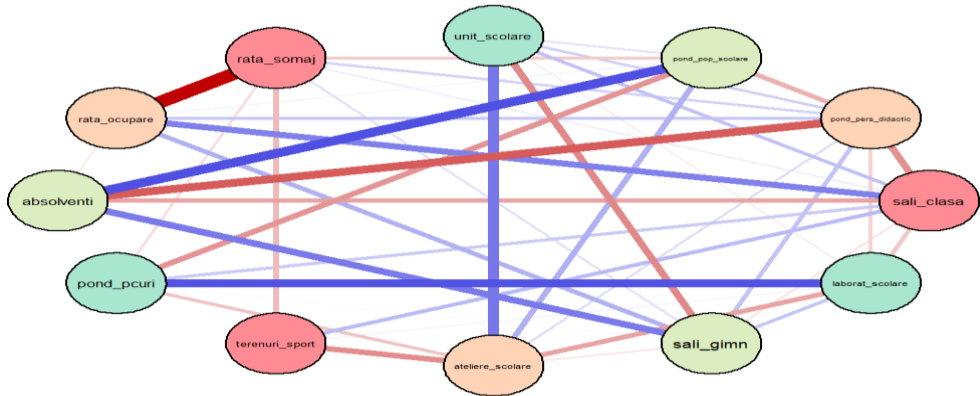


Figure 2. Gaussian graphical model results, EBICglasso method - urban panel data
 Source: own research in Stata 16

The results of the GGM models processed by the two methods (pcor and EBICglasso) in the case of the rural data panel are detailed in Figures 3 and 4. They emphasize strong positive links between the number of graduates and the share of the school population, respectively inverse correlations between graduates and the share of teachers, aspects that highlight the difficulties generated by the lack of highly qualified teachers in rural areas that negatively affect the number of graduates.

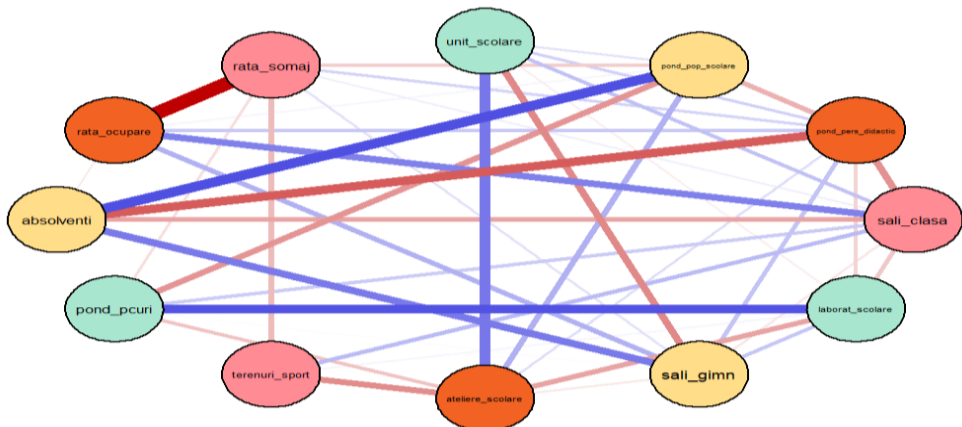


Figure 3. The results of Gaussian graphical models, method of partial correlations (pcor) - rural area panel data
 Source: own research in Stata 16

Considering the research undertaken, we can observe the coordinates of the Romanian education system on urban-rural areas of residence, but also the link between education and labour market.

By analysing the existing data, the state of disadvantage of the rural environment in relation to education is confirmed, both in terms of existing resources within households, schools, but also on the future results obtained by teachers and the school population. The rural environment should be a safe target for investment, but also for development programs related to infrastructure and the education system. There are many discrepancies between rural and urban areas, the rural environment being very disadvantaged, such as discrepancies in the number of schools, the number of graduates, the unemployment rate, the school population.

Thus, the research results illustrate the importance of human capital (school population and teaching staff), educational infrastructure (schools, classrooms, school laboratories, school workshops) and related equipment with both IT equipment (PCs) and sports equipment and related spaces, as factors influencing the number of graduates and drivers of labour market performance (highlighted by the employment and unemployment rates), in the perspective of adequate professional insertion in the labour market of young people after graduation, all these aspects having an impact significant impact on Romania's economic growth and long-term development (Pirvu, Tenea, 2021; Wang, 2018).

In this regard, we propose adequate solutions to improve the quality of education in rural areas, at least at the level of urban areas, which are beneficial for both economic well-being and the labour market, namely: the development of training or reintegration programs. in education and training of adults in rural areas; development of on-the-job training systems; creation and development of professional qualifications appropriate to the specific fields of the rural environment; anticipating labour market needs; incentives for businesses to hire young people or graduates of vocational schools; insertion bonus for graduates of rural vocational schools; bonus for the unemployed in rural areas who want to return to the labour market; creating an appropriate framework for employment among young people and adults in rural areas.

One of the limitations of the research is the low availability of data by area of residence, mainly in rural areas, over longer periods of time. Future research will address a wider range of educational coordinates as explanatory variables, but also their implications on the degree of economic development of Romania (surprised in terms of GDP per capita).

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APPENDIX

Table no. A1. Indicators used for analysis

Indicator	Measurement unit	Acronym	Data sources
School units	number	unit_scolare	Eurostat, INS
Share of school population/total average population of residence	% (calculated)	pond_pop_scolare	Eurostat, INS
Share of school population/total school population	% (calculated)	pond_pers_didactic	Eurostat, INS
Classrooms	number	sali_clasa	Eurostat, INS
School laboratories	number	laborat_scolare	Eurostat, INS
Gym rooms	number	sali_gimn	Eurostat, INS
School workshops	number	ateliere_scolare	Eurostat, INS
Sport fields	number	terenuri_sport	Eurostat, INS
Share of PCs/school population	% (calculated)	pond_pcuri	Eurostat, INS
Graduates	number of persons	absolventi	Eurostat, INS
Population participation in the labour force - Employment rate 15-64 years	%	rata_ocupare	Eurostat, INS
Population participation in the labour force - unemployment rate	%	rata_somaj	Eurostat, INS

Source: own contribution