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Spatial Analysis of Rural Development Measures
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CSA Slovenia	
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Contents

List of tables

List of figures

1 Introduction

The report aims to develop an econometric spatial modelling approach to examine three different types of Rural Development measures carried out within the Rural Development Programme of the Republic of Slovenia in the period 2007-2010:

- Axis 1: Modernisation of agricultural holdings (measure 121)
- Axis 2: Agri-environmental payments (measure 214)
- Axis 3: Diversification into non-agricultural activities (measure 311).

RDP monitoring data, which is the main data source of the analysis, does not include the impact data. Econometric analysis will thus be limited only to the analysis of the measure uptake, i.e. participation models. The sole exception is measure 121, where we attempt to estimate an impact model from secondary statistical data.

2 Background information of the analysed RDP measures in the case study region

2.1 RDP Slovenia 2007-2013

In the programming period 2007-2013, Slovenia has been considered as one NUTS 2 region[1], therefore the actual RDP embraces the whole country territory. According to the Eurostat nomenclature, the prevailing part of the country territory is characterised as predominantly rural areas. Development gap between these areas and the rest of the country (characterised as intermediate areas) is increasing, which is a result of various factors, such as: difficult (natural and structural) conditions for farming, remoteness, poorly developed infrastructure, economic downturn accompanied by shrinking off-farm employment opportunities, negative demographic trends etc., all being obvious drivers influencing rural development in Slovenia.

In territorial sense, the process of CAP RD programming, consultation, and implementation is taking place only at the national level. This inevitably affects the institutional setup of rural development policy in the country. The key institution responsible for addressing rural development problems is the Ministry of Agriculture, Forestry and Food (MAFF), which can also be considered as central institutional player in the RDP design in Slovenia. In the design process, MAFF was responsible for drafting, preparation and public consultation on RDP, and for submission and negotiation of the document with the European Commission. Tasks of MAFF also include establishment and maintenance of the monitoring system, whereas the responsibilities concerning implementation of RDP measures are carries out by the Paying Agency, an institution affiliated with MAFF. Furthermore, several ministries and other governmental institutions are represented in the RDP Monitoring Committee, however, only few of these have exercised their right to actively participate in the design of RDP. Besides the above mentioned stakeholders, non-governmental institutions played a rather important

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[1]Since 2007, the country is divided into 2 macro-regions. Significance of these two regions is merely statistical, they do not exercise any administrative power.

role, especially Chamber of Agriculture and Forestry. To some extent, this holds also for other NGOs, such as the Chamber of Agricultural and Food Enterprises, various agricultural, rural and environmental NGOs and research and higher education institutions.

It has to be pointed out that since Slovenia has fairly centralised governance system, there are no trajectories to accommodate regional and local development interest directly. Consequently regional interests were taken aboard only indirectly, thought the consultation with the Government Office for Local Government and Regional Policy.

One of the weaknesses that Slovenia shares with other Member States joining the EU in 2004 and 2007, respectively, is a short track-record in implementation of the common EU agricultural and rural development policies. This is often a result in non-efficient planning of the rural development measures (eg. Inadequate eligibility and/or selection criteria, deficient financial planning). Consequentially, the implementation criterion has been changing frequently.

2.2 Modernisation of agricultural holdings

Low labour productivity is to a great extent a result of unfavourable agricultural holding size

structure and low specialisation level and frequently by out-dated fixed assets. The improvement of the competitiveness of agriculture is closely related to the investments in fixed assets on agricultural holdings providing better utilisation of production factors and better labour productivity. Particularly on smaller holdings the compliance of the facilities with the requirements of the newly introduced standard on animal welfare is problematic. Additionally, in Slovenia great dependence on natural conditions has been registered, which additionally diminishes the competitiveness of the agricultural sector. In future, the adaptation to the new climate conditions shall play a key role in further development of agricultural sector. The measure is aimed at increasing the competitiveness of the agricultural sector, this shall not cause environmental pollution, biodiversity deterioration, habitat loss or decreased natural and landscape diversity. In implementing the investments the provisions emerging from Natura 2000 shall be considered at all times. Agricultural holdings located in the Natura 2000 sites or in water protection areas linked to Directive 2000/60/EC shall be granted a higher aid share, which shall contribute that in these areas farming and consequently biodiversity arising from traditional use shall be preserved.

2.2.1 Specific objectives

The support for modernisation of agricultural holdings is aimed at enhancing the restructuring and increasing the management efficiency by:

- introducing new products, technologies and production improvements;
- qualifying agricultural holdings for meeting newly introduced minimum standards of the community , for improving the environmental protection, hygiene and safety at work;
- stabilising the income on agricultural holdings,

And thus contribute to increased investment capacity or labour productivity in agriculture.

2.2.2 Main specificities of measure design compared to EU measure description

- tenders are sector-specific (eg. pig breeding, fruit production, arable production), or target group specific (eg. investments carried out by young farmers)
- two-step procedure for selection of the projects: (i) scoring of applications, applications below the minimum threshold are rejected; (ii) approval of projects according to the 'first come first served' criteria[2];
- different administrative requirements for 'large' and 'small' investments (threshold set at 50,000 EUR of total eligible project costs[3]), indicative reservation of funds for so called 'small investments';
- different co-financing rates according to the type of investment (eg. lower co-financing rate for the purchase of agricultural machinery), location of investment (higher co-financing in LFAs), or characteristics of the beneficiary (eg. Higher co-financing for young farmers).

2.2.3 Description of the management structure - procedures for selection of applications

Application claims for measures under axes 1 and 3 are prepared by beneficiaries (often helped by professional advice of extension office. Detailed administrative checks are carried out prior to approving an application to determine whether it was filed on time, was complete and whether the conditions for approving the payment were met. The checks are documented on detailed standardised check lists. The applicants whose forms arrived on time, are complete and in line with the provisions of an individual public tender have preferential treatment.

The amount of aid is calculated after the administrative and on-site checks are completed by the controlling service. The finance section transfers the recorded amounts of aid to a joint order for payment which is then sent to the Ministry of Finance. The finance section also checks whether the list of payments corresponds to the list of beneficiaries entitled to monthly payments. The payment is made directly to the beneficiary's bank account.

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[2]In 2011, the selection process has closed to a 'closed' tender system. The applications, arriving within the award period are scored; project applications with the highest scores are awarded with co-financing.

[3]VAT is therefore excluded.

2.2.4 Some basic data, output indicators, result indicators

- Number of calls: 15 public tenders (by the end of 31.12.2011)
- Money spent: 72,00 % of planned resources for the measure 121 (by the end of 31.12.2010)

Table 1: RDP Slovenia - output indicators for measure 121 (investments in agricultural holdings)

Indicators	Starting point in 2007	Value in 2009	Target value in 2013	% of target achieved
Number of farm holdings that received investment support	0	1.338	2.622	51,03 %
Total volume of investment (€)	0	141.751	183.900	77,08 %

Source: Mid-term Evaluation of RDP Slovenia

Table 2: RDP Slovenia - result indicators for measure 121 (investments in agricultural holdings)

Indicators	Starting point in 2007	Value in 2009	Target value in 2013	% of target achieved
Increase in GVA/AWU (000 €)	0	0,53	1,3	40,77
Number of agricultural holdings introducing new products and/or techniques	0	652	542	120,30
Number of agricultural holdings adapted to the newly introduced minimum Community standards	0	187	1.225	15,27

Source: Mid-term Evaluation of RDP Slovenia

2.3 Agri-environmental payments

Agri-environmental payments support the supply of environmental public goods in agriculture, by means of remunerating farmers for sustainable farming methods, contribute towards the reduction of environmental pollution, the conservation of biodiversity and specific values of Slovenian countryside, such as traditional farming methods and the conservation of cultural heritage and typical Slovenian landscapes related thereto. Payments contributing towards the sustainable development of rural areas and the provision of public goods, which are also a reflection of society demands for environmental services, are granted to agricultural holdings for farming methods ensuring the protection and improvement of the environment, landscape, natural resources and genetic diversity as well as public health. Agri-environmental payments are aimed at conducting environment friendly farming methods emphasising the multifunctional role of agricultural production reflecting in the public function of maintaining the landscape and biodiversity as well as preserving the settlement of Slovenian countryside by taking into account ecological, social and spatial settlement patterns in the rural areas. Payments are granted for socially relevant activities, e.g. conservation of settlement, cultural landscape and environment, which are not directly measurable from the marketing viewpoint. Payments are disbursed per hectare of utilised agricultural land, in some cases per animal, and are intended for partial compensation of costs for additionally invested

effort due to the environmental and landscape protection requirements as well as for the preservation of traditional farming methods.

2.3.1 Specific objectives

Agri-environmental payments are aimed at:

- The reduction of negative impacts of agriculture on the environment,
- the conservation of natural conditions, biodiversity, soil fertility and traditional cultural landscape,
- The maintenance of protection areas

2.3.2 Main specificities of measure design compared to EU measure description

- Promote extensive production
- Conservation of environmentally sensitive areas
- Conservation of landscape and historical features of agricultural land
- Carry out agricultural activities in accordance with the rules of good agricultural practices
- Contractual commitment for 5 years

2.3.3 Activities

To accomplish the objectives set, the following sub-measures, divided into three groups, shall be implemented within the framework of agri-environmental payments:

Group I - reduction of negative impacts of agriculture on the environment:

- preservation of crop rotation
- greening of arable land
- integrated vine production
- integrated fruit production
- integrated vine production
- integrated horticulture
- organic farming

Group II conservation of natural conditions, biodiversity, soil fertility and traditional cultural landscape:

- mountain pastures
- steep slopes mowing
- humpy meadows mowing
- meadow orchards
- rearing of autochthonous and traditional domestic breeds
- production of autochthonous and traditional agricultural plant varieties
- sustainable rearing of domestic animals
- extensive grassland maintenance

Group III - maintenance of protection areas:

- animal husbandry in central areas of appearance of large carnivores
- preservation of special grassland habitats
- preservation of grassland habitats of butterflies
- preservation of litter meadows
- bird conservation in humid extensive meadows in Natura 2000 sites
- permanent green cover in water protection areas

2.3.4 Description of the management structure - procedures for selection of applications

The measures ″compensatory payments in less-favoured areas″ and ″agri-environmental payments″ require the beneficiaries to file the claims on an application form which is also used for submitting claims for the CAP Pillar I direct payments. The Department for Environmental Programme and Less-Favoured Areas for Agriculture as part of the Direct Payments Section at the Agency (hereinafter: Department for Environmental Programme and Less Favoured Areas for Agriculture) processes the single applications in line with Regulations 796/2004 and 885/2006. Detailed administrative checks are carried out prior to approving an application to determine its completeness and whether the conditions for approving the payment are met. Administrative checks and supervision of obligations that span several years are recorded with the aid of special software.

The Agency set up a complete IACS system with software administrative checks for processing the single applications for compensatory payments in less-favoured areas for agriculture; for agrienvironmental payments; and for agricultural subsidies. These checks include:

- Cross-linked checks of reported crops and animals,
- Cross-linked checks with databases to ascertain whether aid would be justified.

The software support for implementing the agricultural policy measures (IACS) is checked in detail before data is transferred from the applications and the amount of aid is calculated. The checks are documented on special control sheets during the testing. The amount of aid is calculated after the administrative and on-site checks are completed by the controlling service. The finance section transfers the recorded amounts of aid to a joint order for payment which is then sent to the Ministry of Finance. The finance section also checks whether the joint payments correspond to the list of approved claims by beneficiaries. The payment is made directly to the beneficiary's bank account

2.3.5 Some basic data, output indicators, result indicators

Money spent: 38,00 % of planned resources for the measure 214 (by the end of 31.12.2010)

Table 3: RDP Slovenia - output indicators for measure 214 (agri-environmental measures)

Indicators	Starting point in 2006	2007	2008	2009	Target value (2013)	% of target achieved
Number of agricultural holdings participating in AE measures	22.400	26.563	26.081	20.824	26.700	78.03
Total area under agri-environment support (ha)	361.000	351.040	348.150	312.571	368.000	84.94
Net number of hectares, where at least one AE submeasure is implemented	199.500	253.272	249.999	215.196	205.000	104,97
Total number of contracts	48.200	49.394	47.600	38.534	52.400	73,54
Total number of contracts (Related to genetic resources)	3.100	4.239	3.921	3.349	4.400	76,11
Number of agricultural holdings engaged in submeasure organic farming	1.650	1.975	1.995	1.976	5.000	39,52

Source: Mid-term Evaluation of RDP Slovenia

Table 4: RDP Slovenia - result indicators for measure 214 (investments in agricultural holdings)

Indicators *Area under successful land management contributing to improvement of:*	Starting point in 2006	2007	2008	2009	Target value (2013)	% of target achieved
Biodiversity (ha)	355.700	69.599	67.744	57.593	376.600	15,29
Water quality (ha)	131.300	253.272	249.999	215.196	132.200	162.78
Mitigating climate change (ha)	/	253.272	249.999	215.196	65.000	331.07
Soil quality (ha)	82.800	62.605	62.725	66.382	96.000	69.15
Areas within Natura 2000 sites on which AE submeasures are implemented	57.200	66.573	65.587	55.977	62.000	90,29

Source: Mid-term Evaluation of RDP Slovenia

2.4 Diversification into non-agricultural activities

Farms and the resources on them offer opportunities for new forms of making income and employment. By diversifying economic activities on farms the utilisation of human resources in particular is improved as well as the improvement of the economic situation of agricultural holdings and indirectly of the entire countryside is ensured. Considering the physical (ha of UAA, LU) and economic indicators (Standard Output, SO[4]) the farm structure in Slovenia is very unfavourable. In comparison to other European countries Slovenia is among the countries in the EU with the lowest average farm size. At the same time the labour input on Slovenian farms, measured in the PMWU coefficient is at the level of the EU average. Hence, compared to the EU average Slovenian farms use too much labour force. Due to the smallness of the farms their labour potential remains unutilised. Farm size and on-farm labour force make them uncompetitive. Furthermore, in future intense conditions in the labour market may be expected and thus the importance of self-employment shall increase. The development of new, non-agricultural on-farm activities opens numerous opportunities for self-employment and thus for the optimisation of labour force and new sources of income for farm households.

2.4.1 Main specificities of measure design compared to EU measure description

- Improve the economic status of members of household
- Development of new, non-agricultural activities on the farm
- Self-employment
- For settlements which do not have the status of the city in the Republic of Slovenia

2.4.2 Eligible areas of support

Support under this measure is territorially restricted to beneficiaries, which have registered office and perform the activity outside the settlements with the status of a town according to the Decision of the National Assembly of the RS.[5]

The following activities are eligible for support within the measure 311 in Slovenia:

- Production activities related to traditional on-farm skills;
- Production activities related to the processing of products outside Annex I to the treaty and other non-agricultural products on farms
- Production of energy from renewable resources for on-farm sale

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[4] Previously: Standard Gross Margin, ESU

[5] According to the above listed document, altogether 67 settlements in Slovenia are designated as urban. These settlements represent only a fraction of the country territory. As a rule, these settlements represent only a part of the area of a municipality, which is the basic territorial unit of our analyses. This criterion will thus be neglected in the spatial analysis of the measure 311.

- Sales activities related to on-farm production activities (specialised stores for sale of products from own production and the surrounding farms)
- On-farm service activities (tourism, childcare, care of older people, care of persons with special needs)

The beneficiaries must meet all conditions for performing certain activities in accordance with the applicable legislation and submit a business plan which must contain economic parameters of the investment. In case of social-protection services in the countryside a special programme must be submitted. If at the application submission a beneficiary does not fulfil the requirements set referring to appropriate vocational skills and qualifications, he must fulfil these requirements before the investment conclusion. Based on the submitted business plan or programme the beneficiary may obtain support for training, provided it is relevant for the performance of the activity supported and the application is accompanied by education or training plan. Mere training without the investment is not an eligible cost. Training must be verifiable by a proof on concluded training and may not be a part of the regular education system. For support to investments in renewable resources of energy for sale projects may apply the estimated value of which does not exceed EUR 480,000. The operator of subsidiary occupation or the majority owner of an enterprise must be a member of farm household and must have permanent address at the address of the farm. As eligible costs are acknowledged all costs related to building construction, purchase of new machinery and equipment, purchase of ICT equipment and the costs of obtaining appropriate skills as well as general costs directly related to the preparation and implementation of projects. For an application to be approved the beneficiaries must, in accordance with the criteria, exceed the minimum number of points, which shall be laid down in public tender.

Target group are legal and natural persons which are at the application submission registered as individual independent entrepreneur, company, cooperative, or a farm engaged in subsidiary occupation, and do not exceed the criteria on micro enterprises specified in the Commission Recommendation 2003/361/EC (less than 10 employees and less than EUR 2,000,000 turnover annually). Operator of the subsidiary occupation on farm or legitimate representative of the independent entrepreneur, cooperative or company must be a member of the farm household in accordance with Article 35 of Regulation 1974/2006 laying down detailed rules for the application of Regulation (EC) No 1698/2005

2.4.3 Some basic data, output indicators, result indicators

- Number of calls: 6 public tenders (by the end of 31.12.2011)
- Money spent: 54,00 % of planned resources for the measure 311 (by the end of 31.12.2010)

Table 5: RDP Slovenia - output indicators for measure 311 (Diversification into non-agricultural activities)

Indicators	Starting point	Value in 2009	Target value in 2013	% of target achieved
Number of beneficiaries	0	77	360	21,29
Number of supported tourism related projects	0	30	200	15,00
Number of participants who successfully completed training	0	/	50	/
Total Volume of Investment (€)	0	13.623.127	52.000.000	26,20

Table 6: RDP Slovenia - result indicators for measure 311 (Diversification into non-agricultural activities)

Indicators	Starting point	Value in 2009	Target value in 2013	% of target achieved
Total number of jobs created in supported projects	0	3,5	750	0,49
Increase in non-agricultural GVA in supported businesses	0	7.333,56	2.000	366,68
Additional number of tourists (index)	100	55,02	120	45,85
Number of inhabitants in rural areas enjoying the improved basic services in rural areas	0	/	20.000	/

Source: Mid-term Evaluation of RDP Slovenia

17

3 Materials and methods

3.1 Data

3.1.1 Independent variables: sources, availability and grouping

The data are taken from three different databases. The first dataset consists of the monitoring datasets of the three analysed RDP measures. Data from the first group (RDP data) have been collected from approved applications for measure 121. These data were supplied by Agency for Agricultural Markets and Rural Development, which is responsible for collection of monitoring data. Database contains information on all supported agricultural households, which means that the data are collected on individual level. We have aggregated the individual applications at municipality level and over time – the data are from 2008, 2009 and 2010.

The RDP monitoring database has been augmented by two other groups of secondary data: general socio-economic data[6] and Agricultural census 2010 data[7]. Both These two groups of secondary data were already collected at municipality level.

In order to organise the above listed data as independent variables in our econometric estimations in a robust and meaningful manner, they were organised into four groups:

- Agricultural structures
- Socio-economic conditions
- Geographical conditions
- Measure-specific variables.

Explanatory variables for the econometric analysis have been organised as presented in the following five tables (Tables 8 to 12). In selection of independent variables, secondary statistical data are prevailing, measure-specific independent variables being the sole exception.

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[6]Source: Statistical office of the Republic of Slovenia, Statistical Yearbook 2011: http://www.stat.si/letopis/LetopisPrvaStran.aspx?lang=en (last acceded 7th August 2012).

[7]Source: Statistical office of the Republic of Slovenia, Agricultural Census 2010 Database: http://pxweb.stat.si/pxweb/Database/Agriculture_2010/Agriculture_2010.asp (last acceded 7th August 2012).

Table 7: Candidates for independent variables, Group I (agricultural structures)

Variable description	Name	Unit	Year	Source
Land productivity proxy (Standard Output per hectare UAA*)	AA	€/ha	2010	Ag.Census 2010
Labour productivity proxy (Standard output per Annual Work Unit)	AAA	€/AWU	2010	Ag.Census 2010
Average economic size of agricultural holdings	CD3	€	2010	Ag.Census 2010
Average AWU on farm	CD5	AWU	2010	Ag.Census 2010
Average size of family on HH	CD7	No.	2010	Ag.Census 2010
% of farms with livestock breeding	CD11	%	2010	Ag.Census 2010
Average LSU, only on farm with livestock breeding	CD12	LSU*	2010	Ag.Census 2010
Stocking density (LSU per UAA in ha)	CD13	LSU/ha	2010	Ag.Census 2010
Purpose of agricultural production: farms with predominant subsistence production	CD14	%	2010	Ag.Census 2010
Purpose of agricultural production: farms with predominant market production	CD15	%	2010	Ag.Census 2010
Purpose of agricultural production, % of sale	CD16	%	2010	Ag.Census 2010
Average UAA per farm	CD17	ha	2010	Ag.Census 2010
UAA, % of small farms (0<2 ha)	CD22	%	2010	Ag.Census 2010
UAA, % of medium farms (2<5 ha)	CD23	%	2010	Ag.Census 2010
UAA, % of medium-large farms (5<10 ha)	CD24	%	2010	Ag.Census 2010
UAA, % of large farms (>10 ha)	CD25	%	2010	Ag.Census 2010
% of farms with their own machinery	CD27	%	2010	Ag.Census 2010
Age of farm holder (18<35), %	CD32	%	2010	Ag.Census 2010
Age of farm holder (35<45), %	CD33	%	2010	Ag.Census 2010
Age of farm holder (45<65), %	CD34	%	2010	Ag.Census 2010
Age of farm holder (>65), %	CD35	%	2010	Ag.Census 2010
Share of farm holdings engaged in plant production	CDR_D	%	2010	Ag.Census 2010
Share of farm holdings engaged in mixed agricultural production	CDT8_D	%	2010	Ag.Census 2010
Share of farm holdings engaged in livestock production	CDZ_D	%	2010	Ag.Census 2010

** Utilised Agricultural Area

* equivalent of 500kg of live weight

Table 8: Candidates for independent variables, Group II (socio-economic conditions)

Variable description	Name	Unit	Year	Source
Population density	NS11	Inh./km^2	2011	SORS (2012)*
Average age of the population by municipalities	NS22	-	2011	SORS (2012)
Ageing index by municipalities	NS33	-	2011	SORS (2012)
Natural increase by municipalities	NS44	%	2010	SORS (2012)
Education, % of primary school or less	NSI1	%	2011	SORS (2012)
Education, % of secondary school	NSI2	%	2011	SORS (2012)
Education, % of higher education	NSI3	%	2011	SORS (2012)
Persons in employment	NTRG1	%	2011	SORS (2012)
Self-employed farmers	NTRG2	%	2011	SORS (2012)
Registered unemployment rate	NTRG3	%	2011	SORS (2012)
Average monthly net earnings	NTRG4	€/capita	2011	SORS (2012)
Net earnings per hour worked	NTRG5	€/hour	2011	SORS (2012)

* SI-STAT Data portal, http://pxweb.stat.si/pxweb/dialog/statfile1.asp (7th August 2012)

Table 9: Candidates for independent variables, Group III (geographical conditions)

Variable description	Name	Unit	Year	Source
Share of LFA in total agricultural area	OMD_D	%	2011	SEA (2012)*
% of UAA located in water protection zones	VVO_D	%	2010	SEA (2012)
% of UAA located in Natura 2000 areas	NAT_D	%	2010	SEA (2012)

* Slovenian Environment Agency, internal database

Table 10: Candidates for independent variables, Group IVa (measure-specific variables, 121)

Variable description	Name	Unit	Year	Source
EARDF expenditure per agricultural holding	b4	€	2011	AAMRD[1]
Gender of beneficiaries, % of female	f2	%	2011	AAMRD
Status of beneficiaries, % of companies and public institutions	g2	%	2011	AAMRD
No. of supported FT farmers per farm (h2/cd1)	h11		2011	AAMRD
Share of beneficiaries with young farmer status	i1	%	2011	AAMRD
Share of beneficiaries participating in agri-environment schemes	j1	%	2011	AAMRD
Supported areas as share of total UAA	l11	%	2011	AAMRD
Share of supported farms engaged in organic production	m1	%	2011	AAMRD
Share of supported farms engaged in integrated production	m2	%	2011	AAMRD
Share of supported farms engaged in conventional production	m3	%	2011	AAMRD
Specific investment objectives, % of modernization	n1	%	2011	AAMRD
Specific investment objectives, % of income stabilization	n2	%	2011	AAMRD
Specific investment objectives, % of introduction of new products	n3	%	2011	AAMRD
Type of investment, % of mechanization	o1	%	2011	AAMRD
Type of investment, % of buildings	o2	%	2011	AAMRD
Type of investment, % of other investments	o3	%	2011	AAMRD

[1] Agency for Agricultural Markets and Rural Development, internal database

Table 11: Candidates for independent variables, Group IVb (measure-specific variables, 214)

Variable description	Name	Unit	Year	Source
Payment rights (CAP Pillar I), average/farms participating in A-E measures	p	No./farm	2009	AAMRD[2]
Payment rights (CAP Pillar I), average/all farms	p1	No./farm	2009	IACS
Payment rights (CAP Pillar I), average/hectare	pph	€/ha	2009	IACS
Payment rights arable land (CAP Pillar I), average/farms participating in A-E measures	pn	No./farm	2009	IACS
Payment rights grassland (CAP Pillar I), farms participating A-E	pt	€/ha	2009	IACS
Payment rights grassland (CAP Pillar I), all farms	pt1	€/ha	2009	IACS
Direct payments per farm (all farms)	ps1	€/farm	2009	IACS
Direct payments, Grand Sum	ps2	€	2009	IACS
Direct payments per farm (farms participating A-E)	sp	€/farm	2009	IACS
Average land area participating in A-E measures - all (farms participating A-E)	nk	ha	2009	IACS
Average land area participating in A-E measures – arable land (farms participating A-E)	nn	ha	2009	IACS
Average land area participating in A-E measures - grassland (farms participating A-E)	nt	ha	2009	IACS

[2] Agency for Agricultural Markets and Rural Development, internal database

3.1.2 Uptake and participation indicators

In accordance with the agreement from the Bologna meeting (July 2012), designation of dependent variables for participation models should be comparable for all CSA. This was also guidance for designation of dependent variables in participation models for measures 121, 214 and 311 in Slovenia.

Dependent variables are listed and briefly described in the table below (Table 13).

Table 12: Dependent variables for participation models (measures 121,214 and 311)

Variable description	Name	Unit	Year	Source
EAFRD investment support per hectare UAA	y1_121	€/ha	2007-2011	MAE (2012)*
Share of agricultural holdings benefiting from EAFRD investment support	y2_121	%	2007-2011	MAE (2012)
Share of UAA participating in at least one A-E measure	y1_all	%	2011	AAMRD (2012)**
Share of UAA participating in A-E schemes for organic production	y1_ek	%	2011	AAMRD (2012)
Share of UAA participating in A-E schemes for arable land	y1_njiv	%	2011	AAMRD (2012)
Share of UAA participating in A-E schemes for grassland	y1_trav	%	2011	AAMRD (2012)
Share of agricultural holdings participating in at least one A-E measure	y2_all	%	2011	AAMRD (2012)
Share of agricultural holdings participating in A-E schemes for organic production	y2_ek	%	2011	AAMRD (2012)
Share of agricultural holdings participating in A-E schemes for arable land	y2_njiv	%	2011	AAMRD (2012)
Share of agricultural holdings participating in A-E schemes for grassland	y2_trav	%	2011	AAMRD (2012)
EAFRD payments (all schemes) per hectare UAA	y3_all	€/ha	2011	AAMRD (2012)
EAFRD payments (A-E schemes for organic production) per hectare UAA	y3_ek	€/ha	2011	AAMRD (2012)
EAFRD payments (A-E schemes for arable land) per hectare UAA	y3_njiv	€/ha	2011	AAMRD (2012)
EAFRD payments (A-E schemes for grassland) per hectare UAA	y3_trav	€/ha	2011	AAMRD (2012)
Percentage of all supported projects	y1_311	%	2011	MAE (2012a)***
Percentage of total EAFRD appropriations	y2_311	%	2011	MAE (2012a)

*Ministry of Environment and Agriculture; RDP monitoring tables for measure 121

** Agency for Agricultural Markets and Rural Development; subset of IACS database for

*Ministry of Environment and Agriculture; RDP monitoring tables for measure 311

3.1.3 Impact indicators

Relevant data for impact indicators for RDP Slovenia are captured at the level, which makes them representative only at the programme level (ie. whole country). This problem is expressed particularly in the case of measures 214 and 311.

In case of the measure 214, the Programme Authority (Ministry of Agriculture and Environment) has established a monitoring network with measuring points on locations of a particular environmental focus (eg. groundwater basins, specific wildlife habitats). Various alternatives attempted by other project teams (particularly INRA, UNIBO) were taken into consideration. However, as most of these approaches would require individual data and data on acreage of different crops/cultures, these approaches are not feasible for us. Our database on measure 214 has been aggregated at the municipality level by the RDP Paying Agency and does not contain data on crop production.

As for the measure 121, labour productivity would be the most suitable impact indicator, but unfortunately it is not monitored at the municipal level. Also the monitoring data is not usable, as there are too many missing reported economic indicators from the beneficiaries' accounting data. Looking for possible alternatives, the Agricultural Census 2010 data offers two possibilities: first alternative is expressed as economic size (in SO) per utilized agricultural area (UAA), and second as economic size (in SO[8]) per annual working hour (AWU[9]). Both sets of data are available at the municipality level.

Theoretically, similar approach could be taken in the case of measure 311. Here, the problem linked with absence of reporting is even more expressed; the monitoring data contains no feedback information on economic impacts of individual projects. Also use of secondary statistical data appears to be not feasible. National accounts statistics data is recorded up to the NUTS 3 level. Besides, possible impact indicators such as labour productivity/worker in non-farm sector (prescribed by CMEF) are much too vague.

3.2 Model estimation

3.2.1 Approach towards model estimation: steps common to all models

As described in greater detail in Section 3.1, the data that could potentially serve as explanatory variables in our econometric analysis were gathered from various sources and

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[8] The standard output (SO) of an agricultural product (crop or livestock) is the average monetary value of the agricultural output at farm-gate price, in euro per hectare or per head of livestock. There is a regional SO coefficient for each product, as an average value over a reference period (5 years). The sum of all the SO per hectare of crop and per head of livestock in a farm is a measure of its overall economic size, expressed in euro

[9] AWU is based on the relationship between the number of hours worked on an agricultural holding in a year and the extent of work done by one fully employed person in one year (1.800 hours). The calculation of AWU takes into account the total annual labour input on farm. In addition to work done by the holder, other family members and people regularly employed on the farm, hired labour is also covered.

presented at the municipality level (NUTS 5). As a starting point in the selection of explanatory variables, we have excluded the variables that do not correlate to any of the dependent variables. Multicollinearity which increases the standard errors of the coefficients and leads to misleading results was checked using the test Variance inflation factors (VIF).

The variables that satisfied the significance and multicollinearity checks were then tested in several versions of econometric models. To determine the most suitable explanatory variables, we checked each of them individually. Selection was based on three criteria:

- theoretical relevance of included variables (if feasible, the models contain variables from each thematic group: agricultural structures, socio-economic conditions, geographical conditions and measure-specific attributes);
- significance of variables (see correlation matrix in Chapter 6, Tables 34 to 43);
- the regression equation that explains the most variance (highest R^2)

Once we have chosen dependent and corresponding independent variables, we estimated the econometric models using standard OLS procedure.

Next step of the analysis consisted of spatial exploration. Here, we first selected the appropriate weight matrix. Among various alternatives, we have chosen the Queen Contiguity (first order) approach. This matrix defines the relationship among different locations, or in other words defines the spatial neighbourhood for every location (value 1 if two municipalities that share a common boundary, otherwise 0). Matrix (in our case 210 x 210) has been row standardized.

Exploratory Spatial Data Analysis (ESDA) was our first step to check weather spatial patterns exist. With the principles of ESDA we performed LISA significance map, LISA cluster map and MORAN I statistic. With this analysis we can see how the spatial patterns of two variables interact (positive spatial correlation could be defined as high-high or low-low). In most of the cases, ESDA revealed spatial patterns in our data, which gave rise to the decision to re-estimate the (a-spatial) models by including spatial weight matrices into standard OLS, and thus estimating spatial econometric models.

LM tests have been applied to determine which spatial model fits better to the analysed our data (spatial lag or spatial error). As a final step, we compared standard OLS models with spatial models and of course interpreted the results.

Sofar, participation models have been carried out for two analysed measures: measure 121 (Modernization of agricultural holdings) and 214 (Agri-environmental measures). For measure 311, spatial analysis was carried out, whereas the models will be developed in a later stage, if this proves to be feasible.[10]

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[10] See additional explanation in Section 3.2.4.

3.2.2   121 - Modernisation of agricultural holdings (participation models)

In the analysed period (2007-2010), 2.230 applications were approved within the measure 121. In spatial terms, agricultural households in 193 municipalities (out of 210 in total) benefited from investment support (see Figure below).
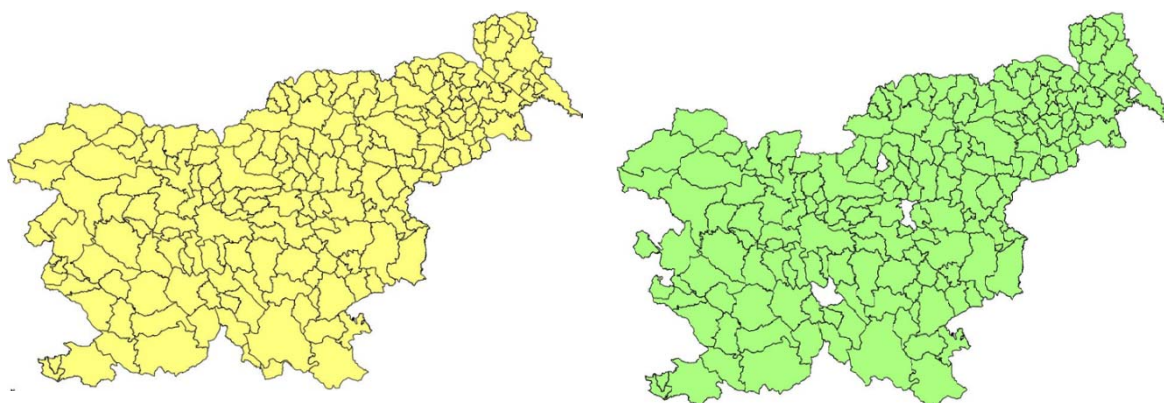
Figure 1: Municipalities (NUTS 5) in Slovenia (on the left); municipalities in Slovenia benefiting from measure 121 (on the right)

As agreed in Bologna meeting (July 2012), participation models for measure 121 are designed to explain two dependent variables:

- EAFRD investment support per hectare UAA (y1_121)
- Share of agricultural holdings benefiting from EAFRD investment support (y2_121)

With respect to the selection criteria (see section 3.2.1), variability is explained by six independent variables referring to agricultural structures, one independent variable explaining geographical conditions and five measure-specific independent variables. Interestingly, none of the indicators describing general socio-economic conditions on municipality level satisfied the selection criteria concerning correlation with dependent variables (see Table 36, Annex).

3.2.3   214 - Agri-environmental measures (participation models)

IACS database with information on the implementation of measure 214 consists of:

- detailed (individual) information on implementation of all 22 agri-environmental (A-E) sub-measures within the Rural Development Plan, and
- Aggregated net values for various groups of A-E submeasures, including net values for all A-E measures.[11]

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[11] This is important in order to control for double counting of beneficiaries (parcels/areas/holdings) participating in several A-E submeasures.

Apart from the A-E data, the IACS database also contains a number of other policy-relevant data (basic structural data, payment rights, LFA support).

Econometric analysis of participation in the measure 214 starts with the net figures for the whole group of 22 measures. In the analysed period, 20.773 agricultural holdings have applied in at least one A-E sub-measure on the area of 213.701 hectares.

This is followed by an in-depth analysis of three other groups of A-E submeasures:

> (i) Organic production (sub-measure with the same name),
>
> (ii) A-E sub-measures designed for Arable land (3 sub-measures: Integrated crop production, Greening of arable land and Preservation of crop rotation), and
>
> (iii) A-E sub-measures designed for Grassland (4 sub-measures: Humpy meadows mowing, Mountain pastures grazing, Steep slopes mowing, inclination 35-50%, and over 50%)

1,976 agricultural holdings have participated in A-E support for organic farming, 5,389 holdings in A-E support for arable land group and 6,358 holdings in A-E support for grassland.

The table below presents the figures about implementation of selected groups of agri-environmental sub-measures analysed in CSA Slovenia.

Table 13:Implementation of analysed groups of agri-environmental measures

Sub measures	No. of contracts in 2009*	Area (ha) in 2009*
Sub-measures relating to organic agriculture		
Organic farming	1.976	28.088
Sub-measures relating to arable land		
Integrated crop production	1.813	45.475
Greening of arable land	4.960	61.942
Preservation of crop rotation	2.111	18.909
Sub-measures relating to grassland management		
Humpy meadows mowing	36	29
Mountain pastures with herdsman	120	5.105
Mountain pastures without herdsman	16	583
Steep slopes mowing, inclination 35-50%	5.868	15.054
Steep slopes mowing, inclination over 50%	3.433	5.797
Agri-environmental measures, total		
Grand Total (net)	20.773	213.701

*Submeasures within the same group can not be combined on the same plot, presented figures are thus additive.

Source: RDP Annual report 2011

Due to the unavailability of indicators measuring spatial and environmental impacts of A-E measures at the sub-national level, spatial econometric analysis is restricted to the participation models. Three indicators have been selected as dependent variables in the econometric analysis:

- Share of UAA participating in analysed A-E sub-measures (y1);
- Share of agricultural holdings participating in analysed A-E sub-measures (y2);
- EAFRD payments per hectare of utilised agricultural area (UAA) (y3).

3.2.4 Diversification into non-agricultural activities (participation models)

Measure 311 is characterised by a relatively low uptake. In the analysed period, 199 applications have been approved in 95 municipalities. More than half of supported investments (51%) relate to rural tourist infrastructure, followed by investment in exploitation of renewable energy sources (28%).

Several problems relate to the econometric analysis of measure 311. Two major restrictions relate to dependent variables. On one hand, the frequency of supported investments is low whereas on the other hand, supported projects are varying, both in terms of volume and in terms of contents. Another restriction has to do with the monitoring database of Measure 311, which forms the basis for our analysis. It contains only project-specific data, whereas no data

is available about the socio-economic and structural characteristics of the benefiting agricultural holdings. Econometric analysis would thus rely only on secondary statistical data, which we deem not sufficient.

At the moment, the analysis of measure 311 is restricted to the spatial analysis of participation indicators. This was indicated also at the Bologna project meeting (July 2012). Nevertheless, in the following weeks, we are planning to improve the dataset and carry out the participation models for measure 311. Similarly to CSA France and Scotland, due to a large amount of non-benefiting municipalities, we are taking into consideration development of two-stage Heckman specification models.

3.2.5 Modernisation of agricultural holdings (impact models)

As indicated in the SPARD Toulouse meeting (april 2012), our ambition is to augment the participation analysis with at least some impact modelling. In this respect, analysing impacts of farm investment support (measure 121) on factor productivity in agriculture appears to be the most promising approach.

As a starting point, we have attempted to analyse linkages between RDP expenditure on measure 121 and (land and labour) productivity. Land and labour productivity proxies have been calculated from the agricultural Census 2010 data. Economic performance is measured by the Standard Output (SO) indicators, estimating farm revenues in Euros. Annual Work Unit (AWU) has been used as standard unit of labour input. Thus, the following two dependent variables have been used as dependent variables:

- Standard output per hectare UAA [€/ha]
- Standard output per Annual Work Unit [€/AWU]

Further work is planned in order to improve impact modelling of measure 121. Effort will be made to estimate more accurate and dynamic productivity indicators directly from the IACS database. As IACS database contains detailed information about the crops and livestock status, it is possible to calculate standard output (SO) figures for each individual farm applying for direct payments. In fact, this has already been carried out for the IACS 2011 database. We now plan to repeat this operation on the IACS 2007 database. We would therefore be able to acquire data about the change of standard output in the analysed period. Same can be relatively easily done for calculation of changes in land and labour productivity. In terms of time span, these data will be more consistent with the time span of our analysis (2007-2011). Furthermore, the planned improvements would enable us to conduct a dynamic analysis.

4 Results

4.1 Modernisation of agricultural holdings: participation models

4.1.1 Spatial analysis

LISA cluster map and Moran scatter plot for the first dependent variable - density of investment support [€/ha] is presented in the figure below. The Moran I coefficient of 0.1813 indicates a weak spatial autocorrelation, but still we have some clusters, mainly low-low values.

Figure 2: LISA Cluster Map and Moran I for measure 121; Y1 = density of investment support [€/ha]
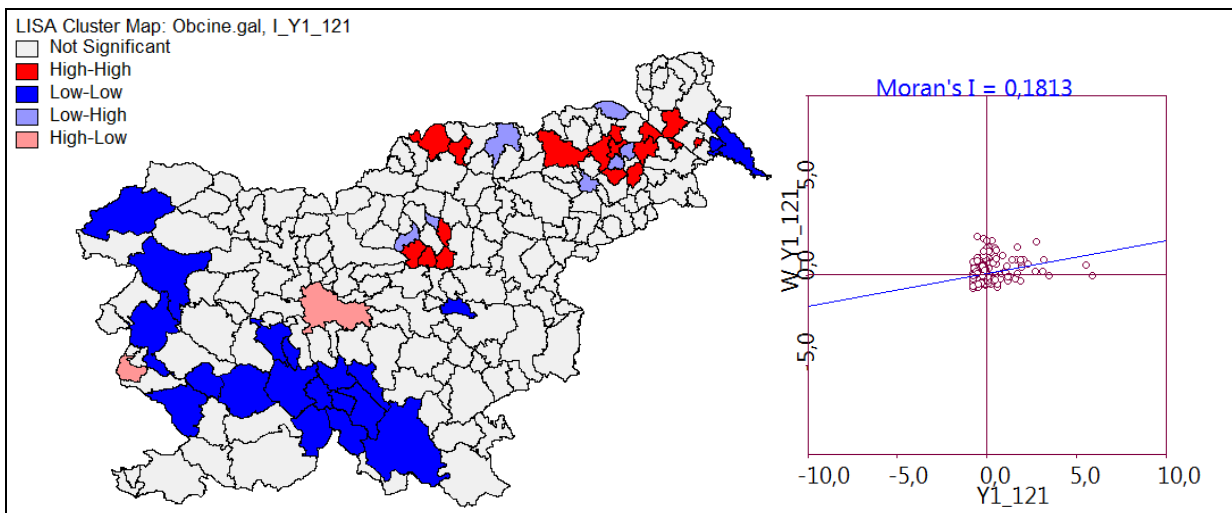
ESDA has been carried out also for the second dependent variable - participation rate [% of benefiting farms]. Here, the Moran I coefficient of 0.3273 is greater than in the first dependent variable but still indicates the relative weak autocorrelation. As it can be depicted from Figure 3, we have some clusters of high-high and low-low values.

Figure 3: LISA Cluster Map and Moran I for measure 121; Y2 = participation rate [% of benefiting farms]
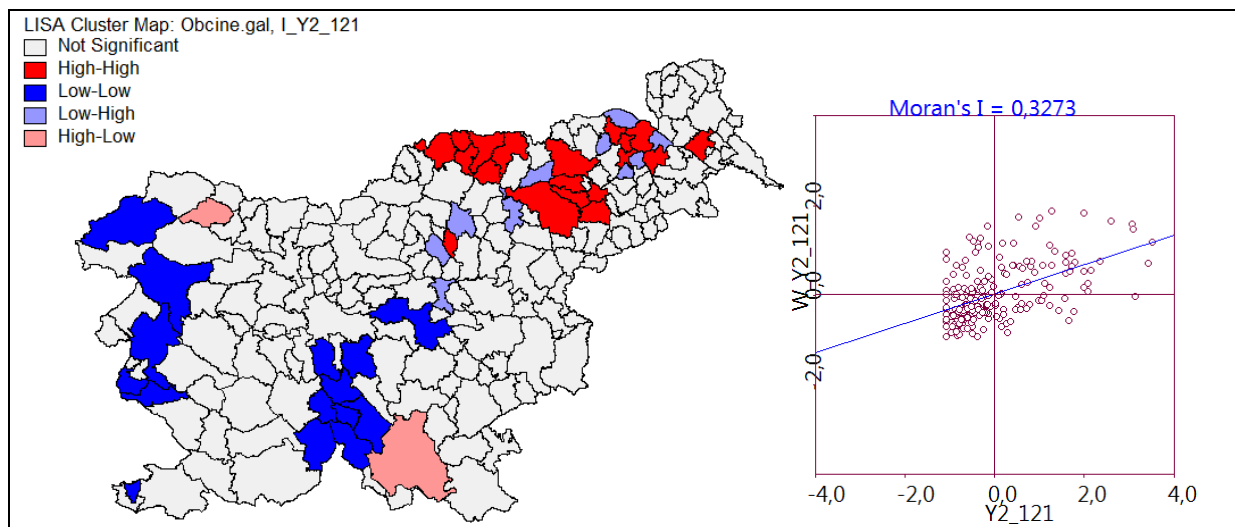
4.1.2 Model results

Table 14 presents the results of the participation models for measure 121.

Table 14: Results of the participation models for measure 121

	121, Y1 a-spatial	121, Y1 spatial	121, Y2 a-spatial	121, Y2 spatial
I. AAA	5,88*			
CD5	52,94			
CD13			1,91***	1,91*
CD16	-0,06		0,05**	0,05**
CD17			0,18*	0,18*
CD25			-0,01	-0,01
III. NAT_D	-0,72*		-0,01*	-0,01
IV. L11	5,14***			
M3			0,01·	0,01
N1			0,03*	0,03**
N2	1,29**			
O2	2,04***			
Intercept	-99,88*		-2,24**	-2,63***
Adjusted R^2	0,55		0,35	
R^2	0,57		0,37	0,46
Rho				0,39***

Given the insight on the spatial dependencies, we first check the standard OLS results for dependence using the standard Moran and LM test. The value of Moran I 0.1813 of y1 already at the beginning indicates a weak spatial autocorrelation between the neighbouring municipalities in the sample. The spatial dependence is further explored by LM test which suggests that there is no spatial dependence in model. As spatial econometric approach is not

suitable for analysing the intensity of investment support [€/ha UAA, y1], we have finished the analysis with the standard OLS model.

Model results suggest that the intensity of investment support rises with farm size and farm labour productivity. Rising share of complex investments (containing construction, income stability) also increases the intensity of investment support. Volume of investments decreases with rising share of environmentally vulnerable areas (Natura 2000).

As for the second model, simple tests of the lag and error are significant, indicating presence of spatial dependence. The robust tests help us understand what type of spatial dependence may be at work. The robust lag test is still significant, but the robust measure for error becomes insignificant. We can conclude that spatial lag model is better. The coefficient parameter (Rho) of spatial dependence (0,39) has positive effect and it is highly significant. When we compare OLS model with spatial lag model the significance of variables remains similar and we have some improvement in R^2 (from 37% to 46%). We can conclude that the participation rate [% of benefiting farms, y2] in one municipality is affected by participation rate in neighbouring municipalities.

Similarly than in the first model, also the frequency of supported investments increases with rising farm size and intensity of agricultural production (in this case illustrated by stocking density). Frequency of supported investment grows also by increasing share of marketed agricultural production and by increasing share of investments geared towards technological improvements (modernization).

4.2 Agri-environmental measures: participation models (all A-E measures)

4.2.1 Spatial analysis

A LISA cluster map and Moran scatter plot of y1_all - density of A-E implementation [% of participating UAA] are presented below (Figure 4). A Moran I coefficient of 0.4238 indicates some positive spatial clustering effects. We have some big clusters of high-high and low-low relationships.

Figure 4: LISA Cluster Map and Moran I for measure 214 (all submeasures); Y1 = density of A-E implementation [% of participating UAA]
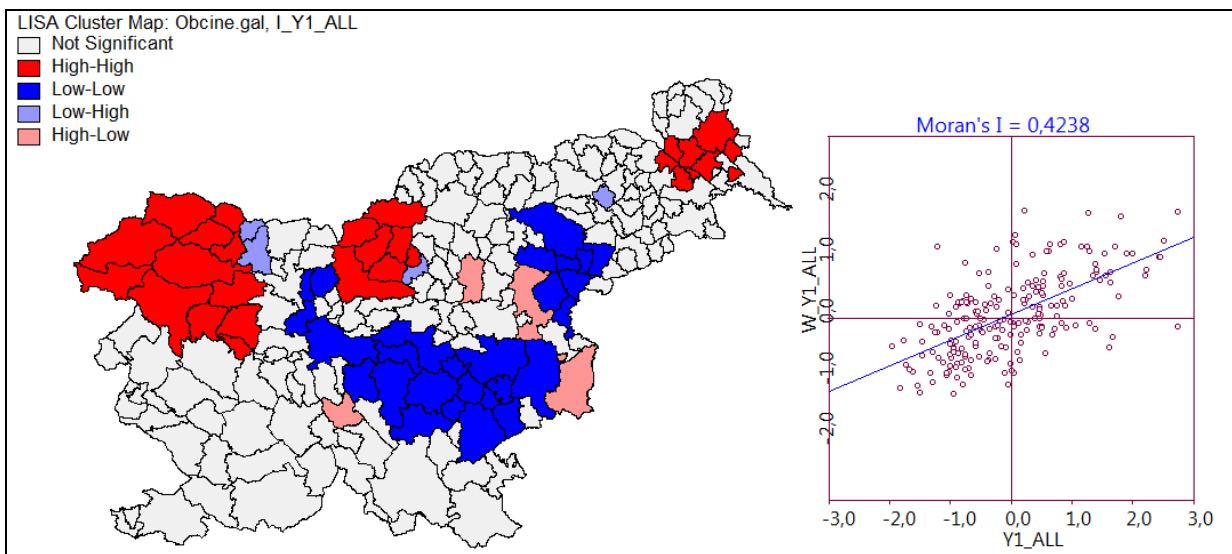
Results of ESDA for y2_all - participation rate [% of participating farms] reveal similar high-high and low-low neighbourhood effects. The spatial distribution appears rather heterogeneous (Moran I coefficient of 0,4616)

Figure 5: LISA Cluster Map and Moran I for measure 214 (all submeasures); Y2 = participation rate [% of participating farms]
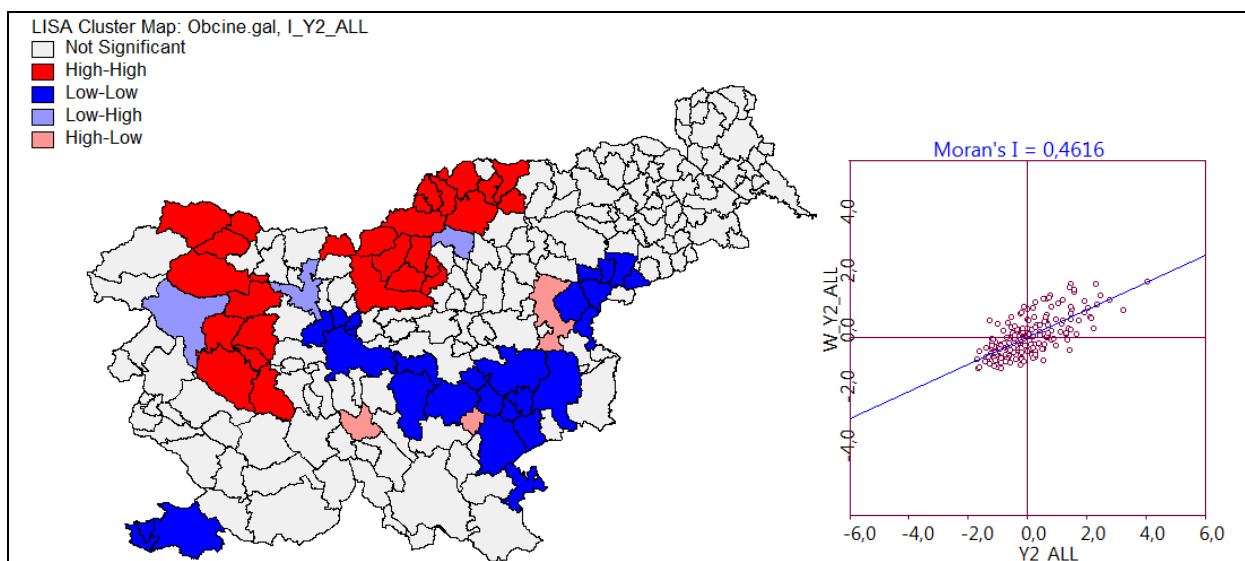
LISA cluster map for the third dependent variable y3_all- intensity of support [€/ha], one can perceive one big cluster of low-low values and one smaller cluster of high-high values. With a Moran I coefficient of 0.4526, the spatial pattern is characterized by high spatial autocorrelation.

Figure 6: LISA Cluster Map and Moran I for measure 214 (all submeasures); Y3 = intensity of support [€/ha]
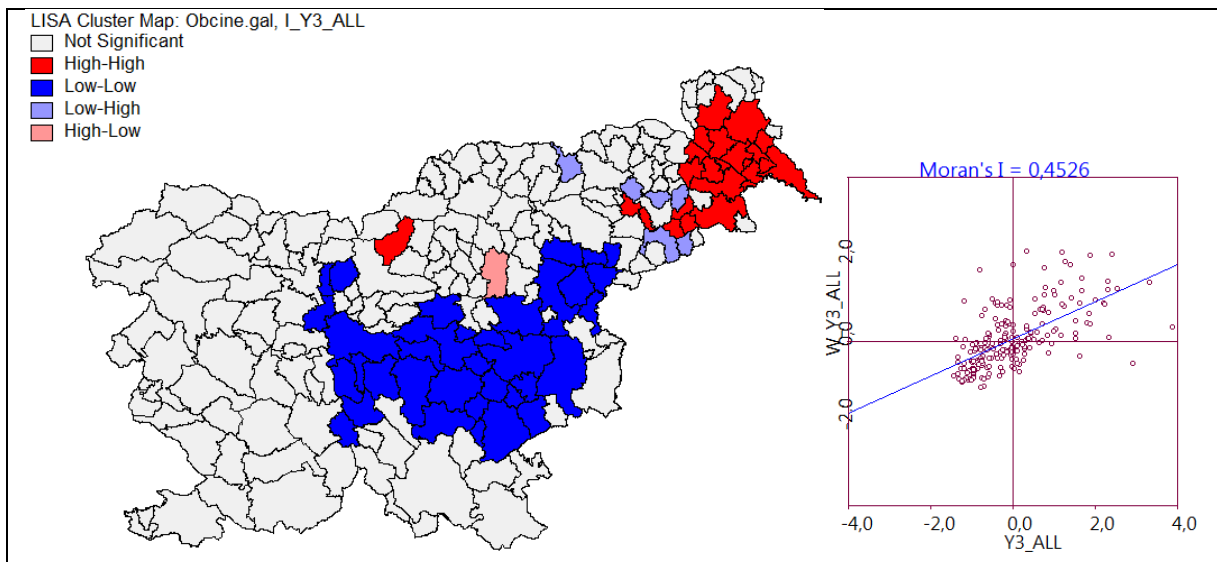
4.2.2 Model results

Results of the simple tests of spatial lag and spatial error, and robust tests of spatial lag reveal that spatial lag model is preferable in all three models.

Table 15: Results of the participation models for measure 214, all measures

		214 all, Y1 aspatial	121, Y1 spatial	214 all, Y2 aspatial	214 all, Y2 spatial	214 all, Y3 aspatial	214 all, Y3 spatial
I.	CD13					-57,55***	-48,18***
	CD16			0,19***	0,13*	1,34***	1,05***
	CD17	-2,32***	-2,05***			5,22***	5,89***
	CD24					-1,13*	-0,89*
	CD25			-0,19*	-0,11		
II.	NS22					7,71***	4,65**
III.	OMD_D					-0,11	-0,07
IV.	nk	0,19*	0,24**				
	pph					0,13*	0,02
	pt1	0,03***	0,03***	0,04***	0,03***		
	y3_all	0,26***	0,23***	0,08***	0,08***		
	Intercept	21,22***	11,59***	3,37*	0,32***	-261,17**	-160,87***
	Adjusted R^2	0,83		0,75		0,45	
	R^2	0,83	0,86	0,75	0,77	0,47	0,57
	Rho		0,25***		0,22***		0,44***

From table given above the coefficient parameter (Rho) of spatial dependence has positive effect and is highly significant in all three models. Also, in all three cases we have improvement in R^2. If we compare OLS models and spatial lag models for y2_all and y3_all, some of the variables in spatial models are no longer significant.

Rather surprisingly, results of the first model reveal a negative relationship between average farm size and percentage of land under agri-environmental schemes. On the other hand, percentage of land under agri-environmental schemes increase with growing payment rights (CAP Pillar I) on participating farms, and with the actual sum of environmental payments per hectare.

The second model reveals a positive relationship between the market orientation of farms and the share of agricultural holdings participating in agri-environmental measures. Furthermore, results confirm the findings of the first model that payment rights and the sum of environmental payments increase the participation rates.

The third model analyses various factors with influence on the intensity of environmental payments. Expectedly, environmental payments decrease with growing intensity of farming practices (illustrated by stocking density). On the other hand, similarly to the previous two models, areas with higher share of market-oriented and higher average size of farms record higher environmental payments. Results also reveal a positive relationship between the average age of population (possibly illustrating remoteness of an area) and the sum of environmental payments.

4.3 Agri-environmental measures: participation models (support for organic farms)

4.3.1 Spatial analysis

Density of A-E implementation for organic farming [% of participating UAA, y1_ek] is characterized by a highly clustered spatial distribution (Moran I coefficient is 0.4396). We have four smaller clusters of high-high values and two clusters of low-low values (see figure below).

Figure 7: LISA Cluster Map and Moran I for measure 214 (organic farms); Y1 = density of A-E implementation [% of participating UAA]
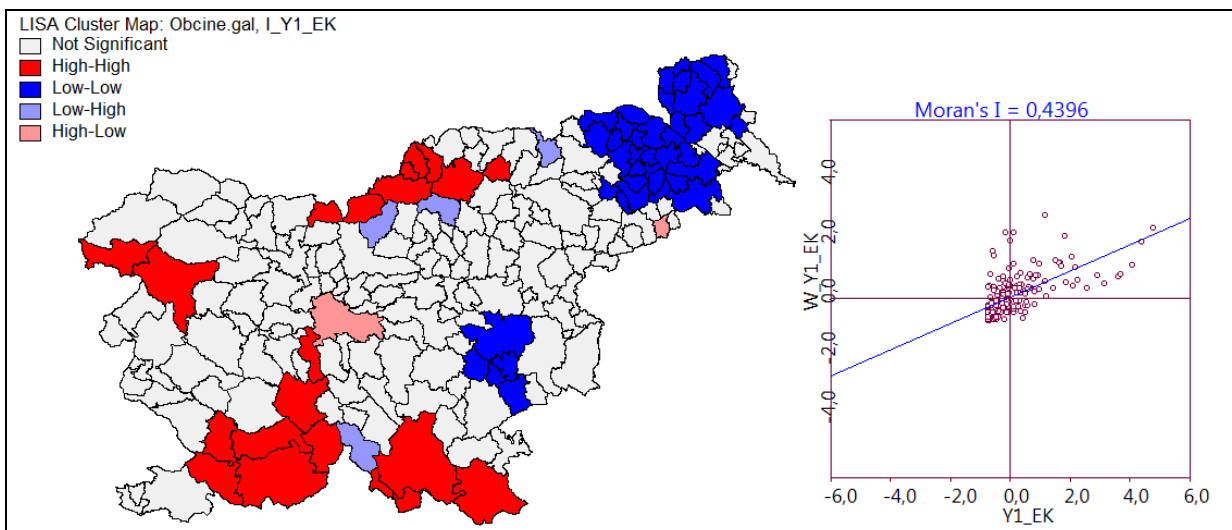
Participation rate for organic farming [% of participating farms, y2_ek] shows significant clusters (Moran I coefficient is 0.4876). We have one big cluster of high-high and one big cluster of low-low values (see Figure 8).

Figure 8: LISA Cluster Map and Moran I for measure 214 (organic farms); Y2 = participation rate [% of participating farms]
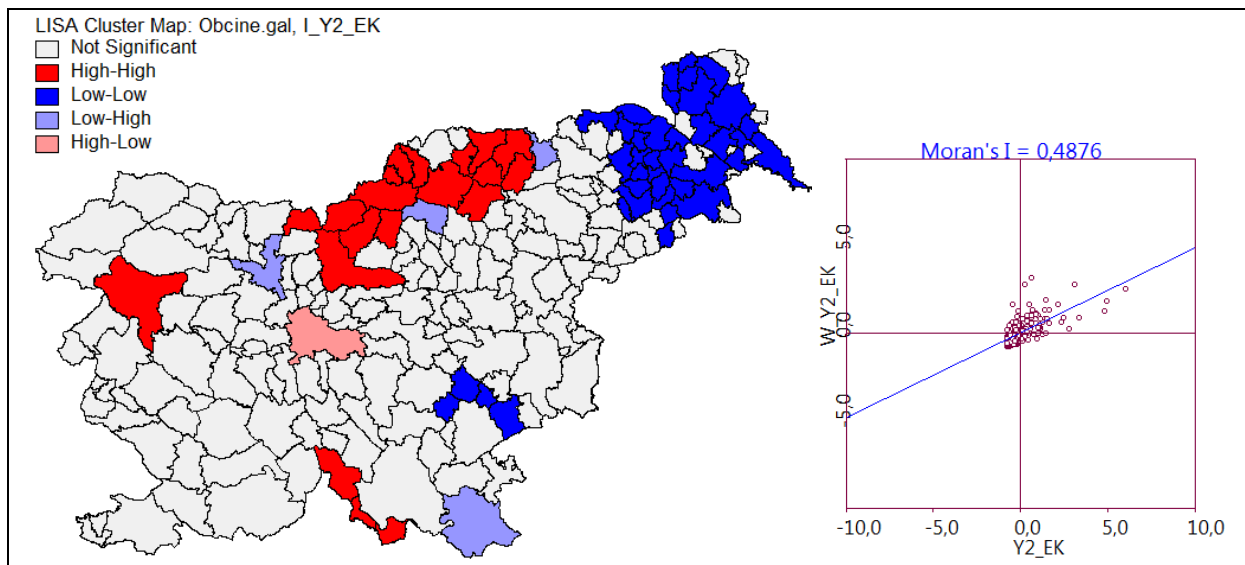
The Moran I coefficient of 0.4406 for y3_ek - intensity of support [€/ha] indicates an average level of spatial autocorrelation. We have more clusters with high-high values (see figure 9).

Figure 9: LISA Cluster Map and Moran I for measure 214 (organic farms); Y3 = intensity of support [€/ha]
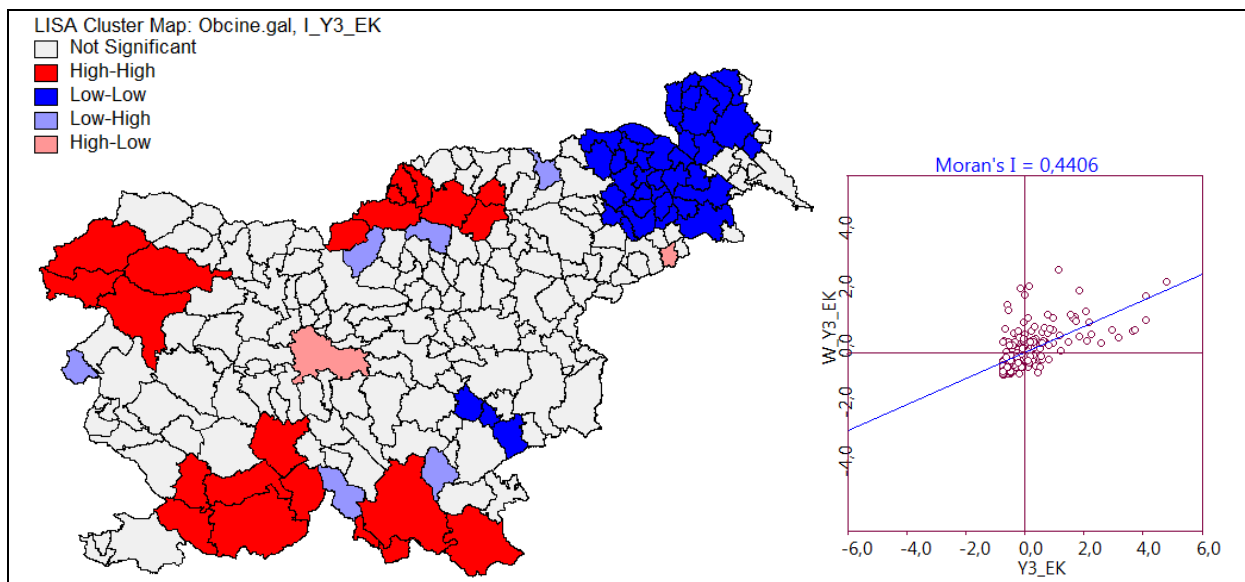
4.3.2 Model results

Table below presents the results of participation models for farms participating in A-E support for organic farms.

Table 16: Results of the participation models for measure 214: support for organic farms

		y1_ek a-spatial	y1_ek spatial	y2_ek a-spatial	y2_ek spatial	y3_ek a-spatial	y3_ek spatial
I.	AA	-1,22	-1,33.	-0,45	-0,52.	-4,54	-4,95
	CD17			-0,27**	-0,30**		
	CD22			0,06*	0,04		
	CD25			0,18***	0,17***		
	CDR_D			-0,04**	-0,03*		
II.	NAT_D	0,05**	0,05*			0,19**	0,18*
	OMD_D	-0,03.	-0,04.	0,00	0,00	-0,12.	-0,15
IVb	pph	-0,07***	-0,07***	-0,03***	-0,03***	-0,26***	-0,25***
	pt1			0,00***	0,00***		
	y3_all			0,03***	0,03***		
Intercept		27,07***	27,19***	5,21***	6,47***	100,93***	101,30***
a-R2		0,37		0,69		0,37	
R2		0,38	0,50	0,71	0,73	0,39	0,50
Rho							
Lambda			0,50***		0,37***		0,49***

For all three models, simple tests of the lag and error are significant, indicating presence of spatial dependence. The robust tests help us understand what type of spatial dependence may be at work. The robust measure for error is still significant, but the robust lag test becomes insignificant, which means that when lagged dependent variable is present the error dependence disappears. The coefficient of spatially correlated errors (LAMBDA) is positive and highly significant in all three cases. When we compare OLS with spatial error model, significance of the model coefficients remains the same. We have also improvement in R^2, but unfortunately we can not confirm that density of A-E implementation, participation rate and intensity of support for organic farming in one municipality are affected by neighbouring municipalities. Density of A-E implementation, participation rate and intensity of support for organic farming in one municipality are affected by unknown effect.

Apart from spatial clustering, only two factors contribute significantly to the first model, which explains the share of municipality area under organic farming. There is a positive relationship between the share of area under organic farming and the share of ecologically vulnerable areas (denoted by Natura 2000 sites). This result can be interpreted as positive in terms of spatial targeting of organic farming. The second significant factor refers to the CAP Pillar I payment rights; result of the first model suggests that areas with high payment rights appear to have a lower representation of areas under organic farming. As the payment rights for arable land in Slovenia surpass the payment rights for grassland, the result can be

interpreted that areas with a high representation of extensive, grassland-based livestock production opt for organic farming more frequently.

The second model, which attempts to identify factors affecting participation rate of farms in organic farming, brings somewhat contradictory results concerning farm size. Negative coefficient for average farm size suggests that participation in organic farming falls with the average farm size, suggesting that small farms decide for organic farming more often (this is confirmed by a positive coefficient for small scale farming (up to 2 hectares) in the aspatial model). On the other hand, the sign is positive also for the group representing the largest farms. Interpretation of this result is speculative, but might represent previously mentioned relatively large, extensive grassland-based livestock farms. Results of the second model (negative coefficient for arable farming and CAP Pillar I payment rights) additionally confirm higher participation of livestock farms in organic farming, which was found already in the first model. Positive coefficient for the volume of agri-environmental payments can be interpreted to additionally confirm spatial clustering. Many factors can contribute towards this situation. It can be due to favourable (production/natural) attributes for participation in agri-environmental measures. Differences in participation rates can occur also by varying interest (or acquaintance?) of areas in agri-environmental measures. A possible explanation can also be in varying level of professional support (eg. associations of organic farmers, extension services).

The third model, which explains the variability of payments for organic farming between different areas, brings no additional dimensions to the explanation. In terms of significant model coefficients (Natura 2000 sites, and CAP Pillar I payment rights), it is identical to the first model.

4.4 Agri-environmental measures: participation models (A-E sub-measures on arable land)

4.4.1 Spatial analysis

With a Moran I coefficient of 0.7246, the spatial pattern of the variable values is characterized by high spatial autocorrelation. High values are found in north-eastern Slovenia, we also have one big cluster of low values in the western part of Slovenia.

Figure 10: LISA Cluster Map and Moran I for measure 214 (sub-measures for arable land); Y1 = density of A-E implementation [% of participating UAA]
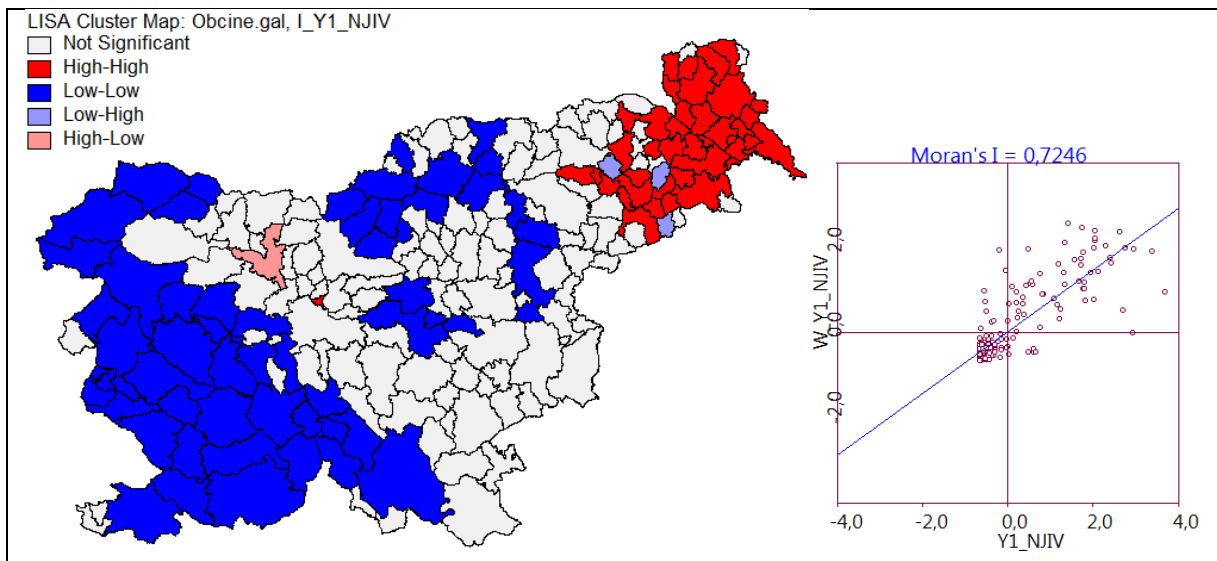
Similar observations hold when observing the ESDA results for dependent variable indicating participation rates in A-E sub-measures designed for arable land [% of participating farms]. The participation rate is characterized by a highly clustered spatial distribution (Figure 11). Moran I coefficient is 0.7070. We can see one big cluster of low values in the western part of Slovenia, and a cluster of high values in the north-east. This largely corresponds to the natural characterictics, as the share of arable areas in total agricultural area is by far the largest in North-Eastern Slovenia.

Figure 11: LISA Cluster Map and Moran I for measure 214 (sub-measures for arable land); Y2 = participation rate [% of participating farms]
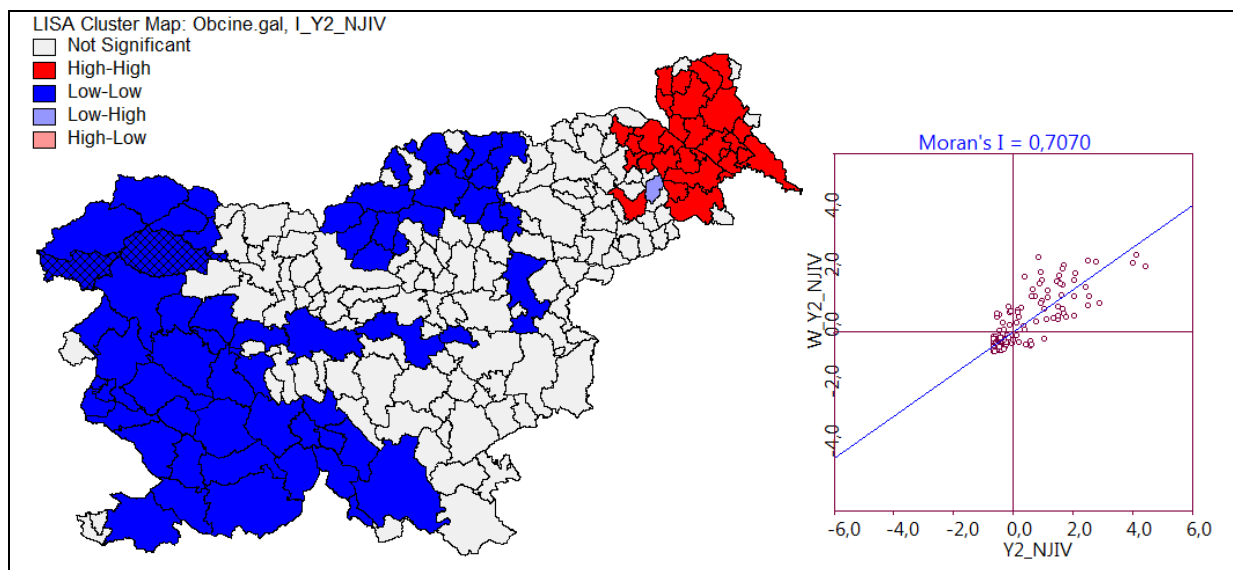
From LISA cluster map for y3_njiv- intensity of support for arable sub-measures[€/ha] we see one big cluster of low-low values and one smaller cluster of high-high values (Figure 12). With a Moran I coefficient of 0.6847, the spatial pattern is characterized by high spatial autocorrelation.

Figure 12: LISA Cluster Map and Moran I for measure 214 (sub-measures for arable land); Y3 = intensity of support [€/ha]
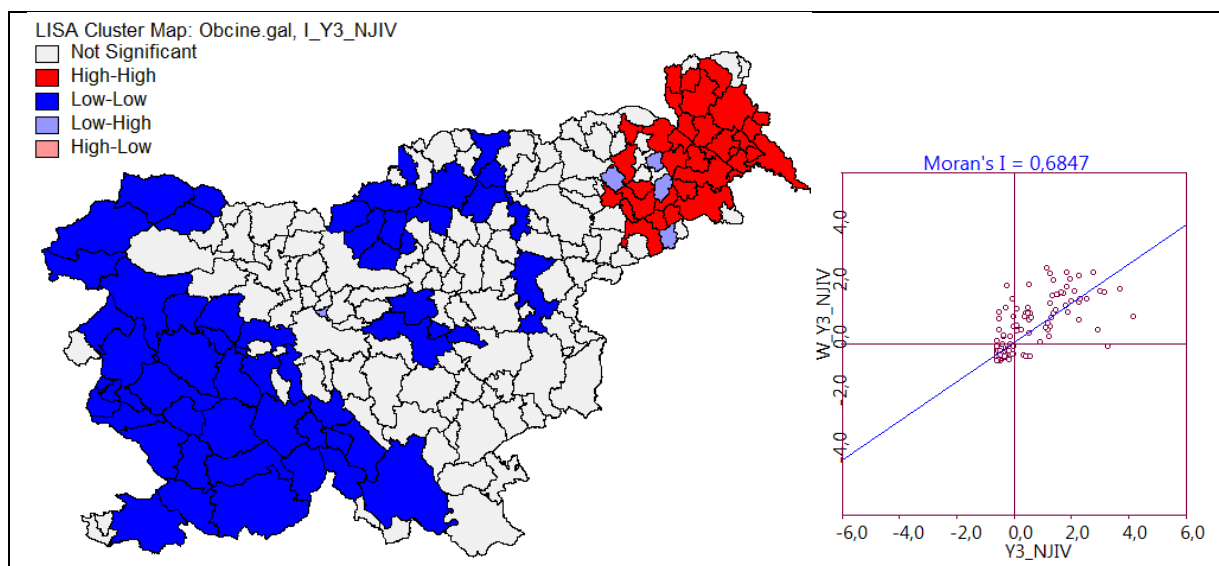
4.4.2 Model results

Table 17: Results of the participation models for measure 214: A-E submeasures on arable land

		y1_njiv a-spatial	y1_njiv spatial	y2_njiv a-spatial	y2_njiv spati	y3_njiv a-spatial	y3_njiv spatial
I.	AAA	0,88***	0,75***	0,99**	0,91***	3,34**	2,47*
	CD3	-0,69***	-0,56***	-0,92***	-0,75***	-1,04	-0,30
	CD16	-0,14*	-0,10*	0,05	0,08	0,10	0,16
	CD24	0,30***	0,27***				
	CDR_D	-0,08*	-0,07*				
	CDZ_D			0,10**	0,09**		
	NTRG2			0,61***	0,34**		
	NTRG3	0,51**	0,29*	0,71**	0,29	4,58***	3,23***
III	OMD_D	-0,05**	-0,05**	-0,07*	-0,06*	-0,34**	-0,28**
IVa	nn	0,22***	0,21***				
	pph	0,15***	0,11***	0,16***	0,11***	0,32***	0,16*
	pt	-0,01***	-0,01***			-0,02**	-0,01**
	y3_all	0,14***	0,13***	0,09***	0,06***		
Intercept		-32,27***	-26,06***	-50,22***	-36,16***	-77,81***	-48,18*
a-R2		0,91		0,77		0.6662	
R2		0,90	0,92	0,78	0,83	0,68	0,72
Rho			0,22***		0,42***		0,36***

LM tests suggest that both spatial model are significant (lag and error) but robust test suggest that spatial lag model is better in all three models. In comparison with standard OLS models, spatial lag models show similar results. R^2 in spatial model is higher and also the improvement is significant. In that case we can confirm that density of A-E implementation, participation rate and intensity of support for arable sub-measures in one municipality are affected by implementation, participation rate and intensity of support for arable sub-measures in neighbouring municipalities. As the observed group of (arable) agri-environmental sub-measures depends greatly from the structure of agricultural land, spatial clustering is obvious.

Although the three estimated models analyse different aspects of participation (participation rate as a percentage of agricultural land in the first and as a percentage of farms in the second, and intensity of support [€/ha] in the third model), model coefficients are to a large extent mutually consistent. Results reveal a positive relationship between farm economic size

(models 1 and 2), full-time farming (model 2) and agricultural labour productivity (all three models) on one side and participation in arable agri-environmental sub-measures on the other. These results indicate that full-time, larger and more productive farms opt for these sub-measures more frequently. This is partly relativized by a negative coefficient (at the edge of statistical significance) for the impact of the percentage of sales in the first model. The first model highlights that participation in arable A-E sub-measures is higher in areas with higher representation of (small-to-middle-size) group of farms from 5 to 10 hectares. Furthermore, results of the first two models suggest that the uptake is higher in the areas with a higher percentage of livestock farming.

All three models show a positive relationship between the unemployment rate and participation in arable A-E submeasures. This result might only reflect the fact that agriculture tends to be stronger represented in areas facing general economic difficulties (eg. Lack of non-farm jobs).

Somewhat surprising are positive coefficients for the share of areas located in LFAs, especially as this result to some extent contradicts to the equally positive coefficient for the share of arable land (model 1).

In contrast to organic farming participation models, model coefficients for pament rights are positive. This is understandable, as payment rights are currently (as already mentioned) about three times higher as payment rights on grassland.

4.5 Agri-environmental measures: participation models (A-E submeasures on grassland)

4.5.1 Spatial analysis

Figure 13 presents ESDA results for density of implementation of A-E sub-measures in grassland areas (Figure 13). The Moran I coefficient of density of A-E implementation for grassland sub-measures is 0.6159, which means that the spatial pattern is characterized by high spatial autocorrelation.

Figure 13: LISA Cluster Map and Moran I for measure 214 (sub-measures for grassland); Y1 = density of A-E implementation [% of participating UAA]
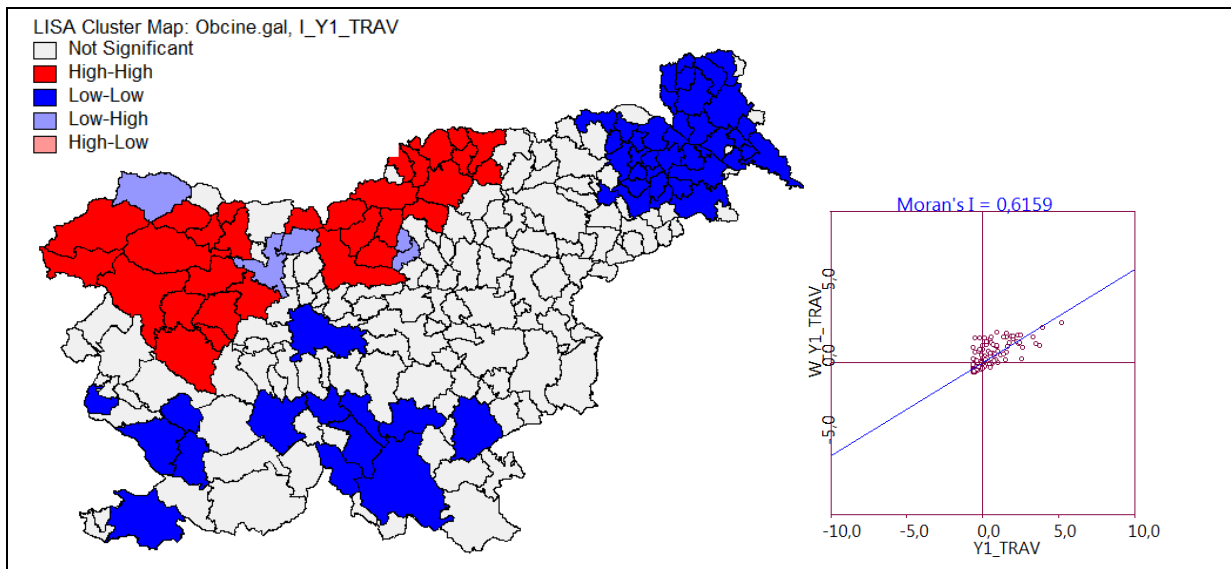
LISA cluster map and Moran scatter plot of y2_trav- participation rate for grassland sub-measures show similar results. A Moran I coefficient of 0.6991 indicates positive spatial clustering effects. We have some two big clusters of high-high values in North and North-West Alpine district of Slovenia, where grassland largely prevails in land use. Low-low clustered are located in north-eastern Slovenia (with larger share of arable land), and in South (Mediterranean part) and South-East of the country, where permanent crops and horticulture are represented to a higher extent.

Figure 14: LISA Cluster Map and Moran I for measure 214 (sub-measures for grassland); Y2 = participation rate [% of participating farms]
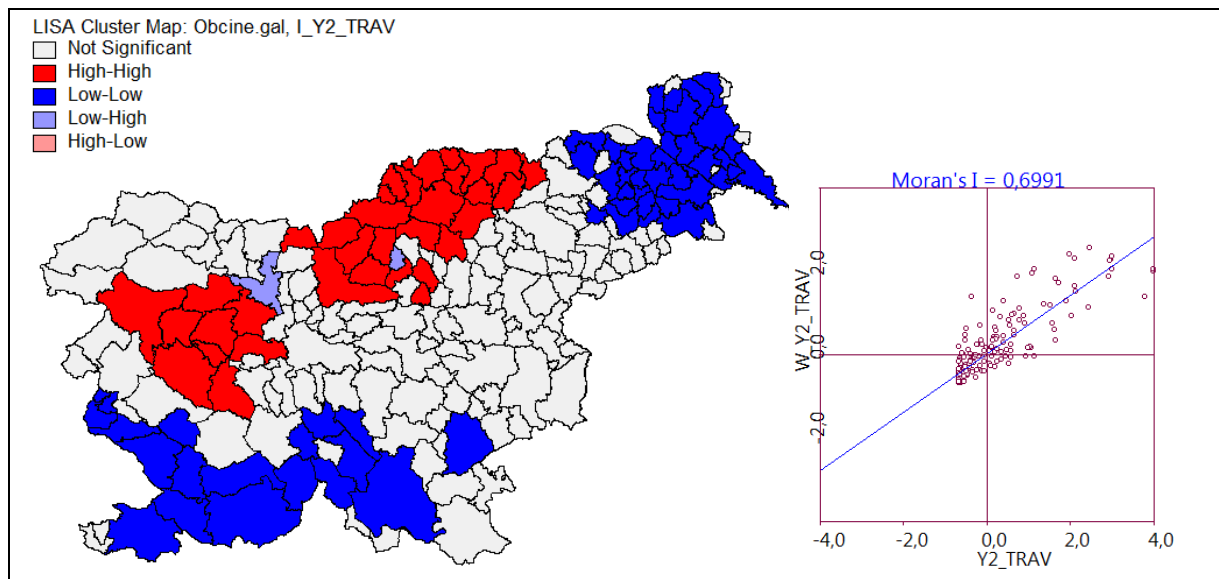
ESDA for y3_trav - intensity of implementation of A-E measures designed for grassland again draws a similar picture (Figure 15). A Moran I coefficient of 0.6262 indicates positive spatial clustering effects. We have some clusters of high-high and low-low values.

Figure 15: LISA Cluster Map and Moran I for measure 214 (sub-measures for grassland); Y3 = intensity of support [€/ha]
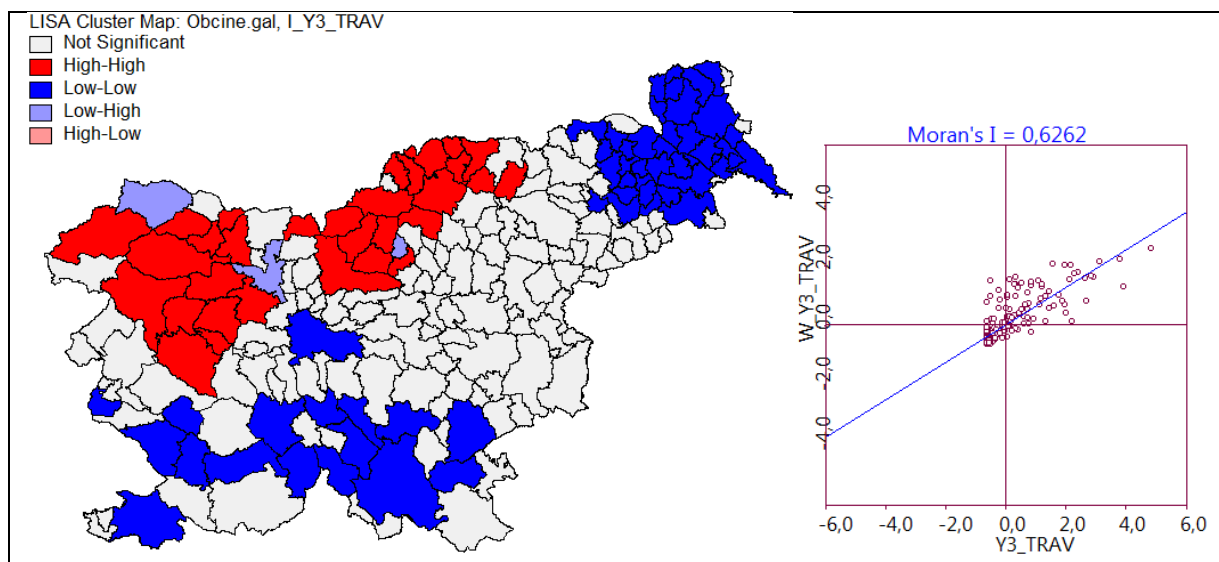
4.5.2 Model results

Table 18: Results of the participation models for measure 214: A-E submeasures on grassland

	y1_trav a-spatial	y1_trav spatial	y2_trav a-spatial	y2_trav spatial	y3_trav a-spatial	y3_trav spatial
CD5			7,81	0,40		
CD24			0,32*	0,20.		
CD35			-1,07**	-0,37	-0,46*	-0,14
CDR_D	-0,27***	-0,12***	-0,32***	-0,08	-0,17***	-0,05.
OMD_D	0,05*	0,04*	0,06	0,03	0,02	0,02
nt	0,68***	0,42***				
pph	-0,03**	-0,02*	-0,08**	-0,03*	-0,04**	-0,02.
pt	0,00*	0,00*	0,00.	0,00*		
y3_all	0,07***	0,05***				
Intercept	14,00**	4,90	51,74**	17,65	29,20***	8,79.
a-R2	0,50		0,40		0,33	
R2	0,51	0,68	0,42	0,75	0,34	0,65
Rho		0,61***		0,79***		0,73

In all three models, spatial lag fit the best. Compared to (a-spatial) OLS models, differences are not big when we look the explanatory variables but the improvement of R^2 is substantial. For example, from 42 % to 75 % (y2_trav) or from 34 % to 75 % (y3_trav). We can also confirm that space is important when we are dealing with density of A-E implementation, participation rate and intensity of support for arable sub-measures. One municipality is affected by surrounding municipalities.

The group of A-E sub-measures on grassland gathers rather diverse activities, which is reflected also in the model results, which – apart from spatial targeting and obvious relationships – do not bring much of an additional insight. There is a weak positive relationship (model 2) between the share of small-to-middle-size-farms, and participation in A-E measures on grassland. A weak positive relationship also exists between participation in these measures and the share of land located in LFA. The results of models 2 and 3 further suggest that the possibility to participate in these measures decreases with the age of farm holders. Results of all three models strongly confirm the obvious fact that this group of A-E submeasures is not attractive for farms specialised in plant production, nor for those with prevailing arable land (inferred from negative coefficients for CAP Pillar I payment rights), but is attractive for farms engaged in grassland-based agricultural (mainly livestock) production.

4.6 Diversification into non-agricultural activities - participation model

4.6.1 Spatial analysis

Figure 16: LISA Cluster Map and Moran I for measure 311; Y1 = supported projects as % of all (output indicator – measure uptake)
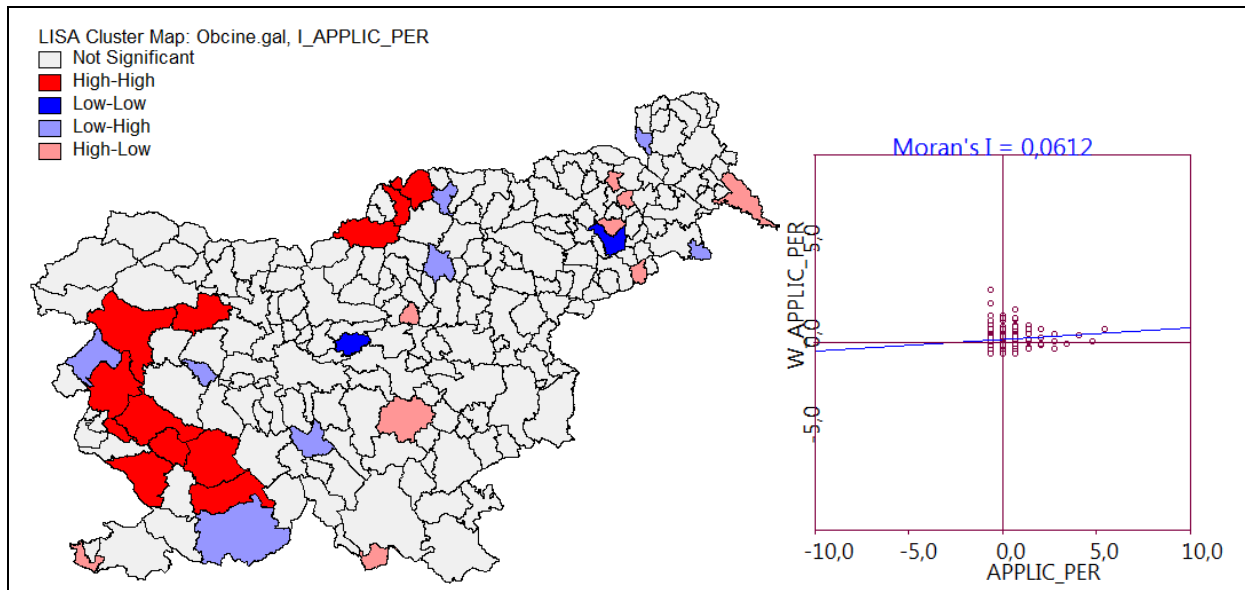
Figure 17: LISA Cluster Map and Moran I for measure 311; Y1 = eligible funding as % of EARDF appropriations for measure 311 (output indicator – measure uptake)
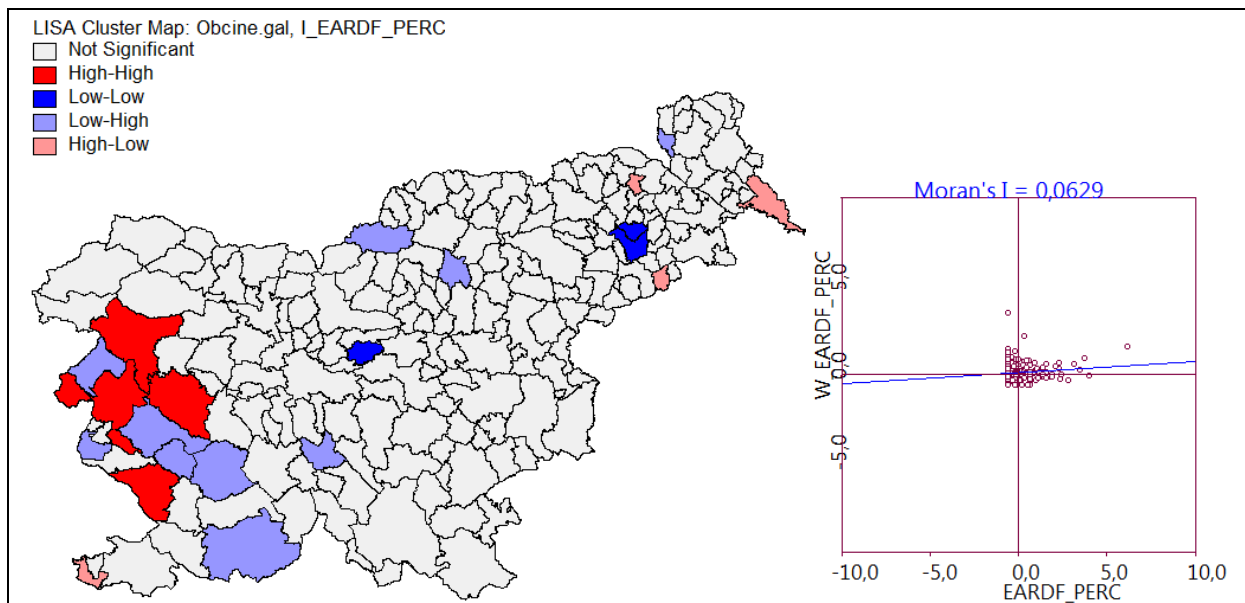
Expectedly, LISA cluster map and Moran's I statistic (0.06) for both variables denoting uptake of measure 311 indicates a weak spatial autocorrelation. Nevertheless, some clusters are perceivable, especially high high and low-high clusters in the Mediterranean (SW) part of Slovenia.

4.7 Modernisation of agricultural holdings: impact models

4.7.1 Spatial analysis

Results of ESDA for land productivity indicator are presented in Figure 18. Moran I coefficient of 0.4350 reveals indicates some spatial clustering effects. We have a large cluster

of low-low relationships in S and SW Slovenia, and some high-high clusters in coastal, Central and NE Slovenia.

Figure 18: LISA Cluster Map and Moran I for measure 121; Y1 = Standard output per hectare of UAA [€/ha] (impact indicator – land productivity)
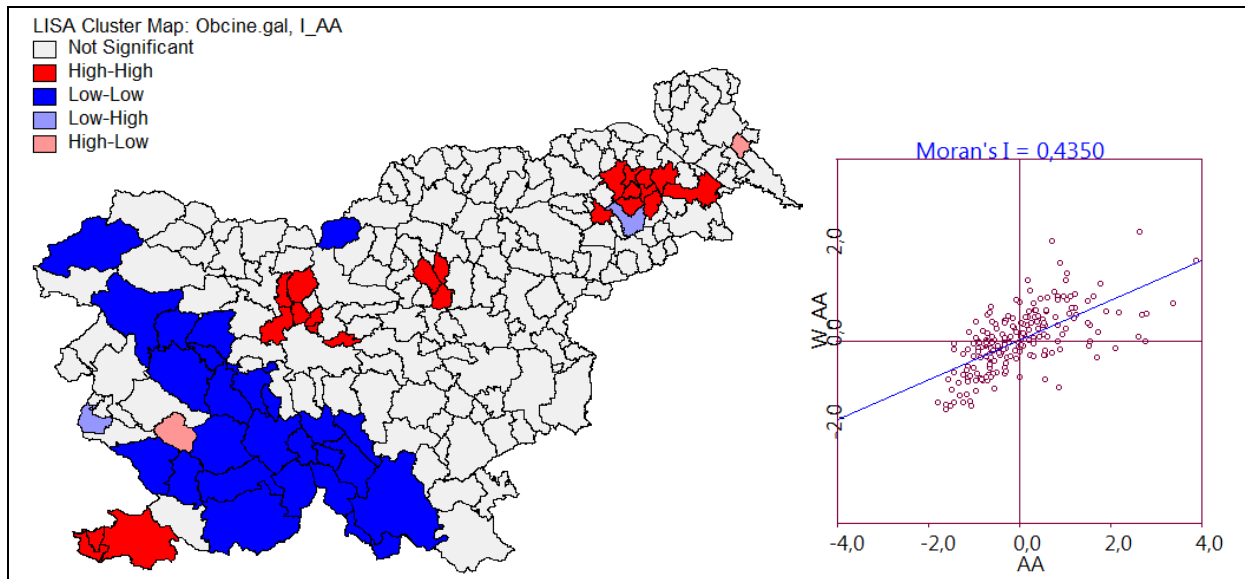
Spatial clustering is less evident when observing the results of ESDA on labour productivity (Moran's I 0.2435). In comparison to the land productivity ESDA results, spatial clusters are less perceivable, with the exception of a (stronger) high-high cluster in NE Slovenia.

Figure 19: LISA Cluster Map and Moran I for measure 121; Y1 = Standard output per hectare of UAA [€/ha] (impact indicator – land productivity)
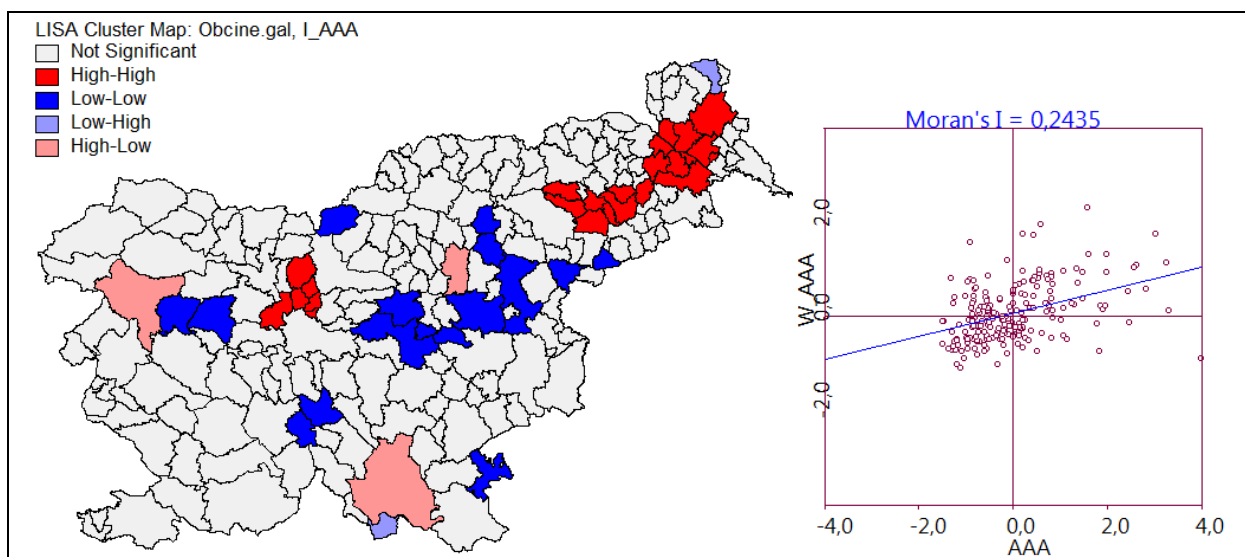
4.7.2 Model results

As described in section 3.2.5, we estimated two impact models on measure 121. In the first case (land productivity model), we estimated a non spatial, classical log-linear model. The results are presented in Table 19.

Table 19: Results of the impact models for measure 121 (model 1: land productivity)

Economic size (as SO in 1000 eur) / UAA in ha (log)	Aspatial model		Spatial lag model	
	coefficient	p-value	coefficient	p-value
RDP spending per farm (in €), from measure 121	1,2814	0,0166	1,2143	0,0127
Num. of insurances on the farm, sum per municipality	0,0031	0,0005	0,0029	0,0002
LFA, % of mountain area	-0,0008	0,0405	-0,0004	0,2841
LSU before investment, sum per municipality	-2,2017	0,0103	-1,4236	0,0727
Type of production, % of integrated	0,0029	0,0000	0,0027	0,0000
Type of investments , % of mechanization	-0,0017	0,0002	-0,0019	0,0000
Population density, 2010	0,0004	0,0000	0,0003	0,0001
Livestock Unit / UAA (ha)	0,7327	0,0000	0,6335	0,0000
Purpose of agricultural production, % of sale	0,0050	0,0000	0,0043	0,0000
UAA, % of small farms (0<2 ha)	0,0155	0,0000	0,0133	0,0000
Intercept	-0,6820	0,0000	-0,6344	0,0000
Number of observations	193		193	
Weight matrix			Queen contiguity	
R^2 (%)	84,94		86,59	
Breusch-Pagan test	43,9	0,00	47,6	0,00
Rho			0,2267	0,00

Given the insight on the spatial dependencies, we firs check the OLS results for spatial dependence using the standard Moran and LM tests (Table 2 and Table 5). The value of Moran's I of 0,5335 confirms the presence of a positive autocorrelation between the neighbouring municipalities in the sample. The spatial dependence is further explored by LM tests (Table 2), which suggest that the spatial lag model better captures the spatial patterns in the sample than the spatial error model.

Table 20: Diagnostic for spatial dependence of the aspatial model 1

LM test	Value	p-values
Moran's I (error)	3,7748	0,0002
Lagrange Multiplier (lag)	20,7825	0,0000

Lagrange Multiplier (error)	10,1122	0,0015
Robust test (lag)	11,8778	0,0006
Robust test (error)	1,2074	0,2718

Table 21: Results of the participation models for measure 121 (model 1: labour productivity)

Economic size (as SO in 1000 eur) / AWU	Aspatial model		Spatial error model	
	coef.	p-value	coef.	p-value
RDP spending per farm (in €), from measure 121	0,0002	0,0306	0,0002	0,0561
No. of persons participating in Agricultural Pension and Disability Insurance	0,0398	0,0034	0,0427	0,0008
LFA, % of hilly areas	-0,0144	0,0044	-0,0127	0,0184
Type of production, % of integrated	0,0204	0,0080	0,0209	0,0049
Average LSU, only on farms with livestock breeding	0,5132	0,0000	0,5290	0,0000
Purpose of agricultural production, % of sale	0,0693	0,0003	0,0700	0,0004
Average UAA per farm	0,5760	0,0000	0,5491	0,0000
UAA, % of medium farms (5<10 ha)	-0,1447	0,0000	-0,1424	0,0000
UAA, % of large farms (>10 ha)	0,0329	0,0184	-0,0751	0,0233
Intercept	5,9002	0,0000	5,7200	0,0000
Number of observations	193		193	
Weight matrix			Queen contiguity	
R^2 (%)	75,65		76,68	
Breusch-Pagan test	24,6	0,0003	32,1	0,0002
LAMBDA			0,2575	0,0085

LM tests for Model 2 suggest that the spatial error model is more appropriate.

Model results reveal a positive relationship between the RDP support for measure 121 and the agricultural labour productivity. In this sense, the model results give an indication that public support for farm investments yields positive impacts in terms of labour productivity. The latter is obviously linked also with various indicators denoting farm size (livestock status, farm size) and farm specialization (eg. livestock breeding). with some Furthermore, results suggest that labour productivity is higher in areas with higher representation of full-time farms, and lower in areas with aggravated production conditions (LFA). Participation in quality schemes (eg. Integrated production) and market orientation of farms contribute towards larger labour productivity.

Table 22: Diagnostic for spatial dependence of the aspatial model 2

LM test	Value	p-values
Moran's I (error)	2,8647	0,0042
Lagrange Multiplier (lag)	3,0520	0,0806
Lagrange Multiplier (error)	2,6018	0,0186

Table 23: Participation models for measure 121: Moran I for dependent and independent variables and source of the data

Model	Dependent variables	Moran I (Queen contiguity)
Model 1	Economic size (as SO in 1000 eur) / UAA in ha (log)	0,5335
Model 2	Economic size (as SO in 1000 eur) / AWU	0,2538
	Independent variables, Source of data	
	I. Group of data: RDP data	
Model 1 & 2	RDP spending per farm (in €), from measure 121	0,1805
Model 1 & 2	Number of insurances on the farm, sum per municipality	0,0612
Model 1	LFA, % of mountain area	0,6125
Model 2	LFA, % of hilly areas	0,6446
Model 1	Livestock Unit before investment, sum per municipality	-0,0305
Model 1 & 2	Type of production, % of integrated	0,3727
Model 1	Type of investments , % of mechanization	0,1520
	II. Group of data: National statistic	
Model 1	Population density, 2010	0,3421
	III. Group of data: Agricultural Census	
Model 1	Livestock Unit / UAA (ha)	0,5512
Model 2	Average LSU, only on farms with livestock breeding	0,3369
Model 1 & 2	Purpose of agricultural production, % of sale	0,4238
Model 2	Average UAA per farm	0,1520
Model 1	UAA, % of small farms (0<2 ha)	0,6278
Model 2	UAA, % of medium farms (5<10 ha)	0,4907
Model 2	UAA, % of large farms (>10 ha)	0,3489

5   Annex

5.1   Descriptive statistics

5.1.1   Independent variables

Table 24: Descriptive statistics of independent variables, Group I (Agricultural structures)

	Mean	sd	min	max	n	NA	zeros
CD3	12.77	7.06	3.35	46.82	210	0	0
CD5	1.04	0.26	0.37	1.96	210	0	0
CD7	3.48	0.40	2.25	4.84	210	0	0
CD11	80.25	11.83	18.81	95.00	210	0	0
CD12	7.35	3.94	0.56	30.39	210	0	0
CD13	0.89	0.36	0.05	1.99	210	0	0
CD16	41.30	13.68	11.11	86.04	210	0	0
CD17	6.66	2.55	1.78	26.54	210	0	0
CD22	26.61	12.39	0.00	80.70	210	0	2
CD23	33.20	8.01	0.00	63.64	210	0	2
CD24	23.35	8.61	0.00	47.33	210	0	6
CD25	16.84	9.94	0.00	75.00	210	0	6
CD27	87.09	7.65	52.29	100.00	210	0	0
CD32	33.36	6.08	0.00	51.24	210	0	2
CD33	14.53	1.81	9.92	19.90	210	0	0
CD34	31.16	4.21	20.08	52.17	210	0	0
CD35	20.95	3.36	10.74	41.89	210	0	0
CDR_D	16,00	20.88	0.00	98.15	209	1	13
CDT8_D	33.23	10.37	0.00	64.52	209	1	2
CDZ_D	50.78	25.97	0.00	90.39	209	1	11
AA	1.80	0.75	0.60	4.84	210	0	0
AAA	11.20	4.70	4.93	30.73	210	0	0

Table 25: Descriptive statistics of independent variables, Group II (socio-economic conditions)

	Mean	sd	min	max	n	NA	zeros
NS11	113.20	123.65	5.00	1017.80	210	0	0
NS22	41.71	1.79	37.20	49.00	210	0	0
NS33	117.26	29.06	61.50	272.20	210	0	0
NS44	0.00	0.01	-0,02	0,01	210	0	0
NSI1	33.96	7.38	15.46	60.93	210	0	0
NSI2	52.42	4.27	33.33	62.75	210	0	0
NSI3	13.63	4.35	4.76	32.84	210	0	0
NTRG2	7.66	6.32	0.29	35.80	210	0	0
NTRG3	11.54	3.54	4.60	23.20	210	0	0
NTRG4	932.53	108.54	640.88	1300.54	210	0	0
NTRG5	5.52	0.62	3.87	7.52	210	0	0

Table 26: Descriptive statistics of independent variables, Group III (Geographical conditions)

	Mean	sd	min	max	n	NA	zeros
NAT_D	30.53	30.31	0.00	100.00	210	0	14
OMD_D	75.55	35.11	0.00	100.00	210	0	11
VVO_D	9.13	15.48	0.00	93.84	210	0	55

Table 27: Descriptive statistics of independent variables, Group IVa (RDP measure 121)

	Mean	sd	min	max	n	NA	zeros
B4	1173.577	2214.67	0.00	19902.76	210	0	17
F2	11.51	14.83	0.00	100.00	210	0	98
G2	3.50	11.75	0.00	100.00	210	0	173
H11	0.03	0.04	0.00	0.37	210	0	33
I1	19.37	22.36	0.00	100.00	210	0	79
J1	73.13	31.80	0.00	100.00	210	0	22
L11	16.26	16.62	0.00	96.15	210	0	17
M1	8.98	21.10	0.00	100.00	210	0	145
M2	20.35	27.79	0.00	100.00	210	0	106
M3	61.24	34.42	0.00	100.00	210	0	34
N1	11.96	15.87	0.00	75.00	210	0	103
N2	14.73	22.82	0.00	100.00	210	0	110
N3	64.77	32.28	0.00	100.00	210	0	26
O1	64.82	31.25	0.00	100.00	210	0	25
O2	18.63	21.68	0.00	100.00	210	0	78
O3	8.45	14.91	0.00	100.00	210	0	123

Table 28: Descriptive statistics of independent variables, Group IVa (RDP measure 214)

	Mean	sd	min	max	n	NA	zeros
nk	11.13	9.11	2.16	108.10	210	0	0
nn	10.32	22.97	0.00	214.42	210	0	51
nt	3.26	4.91	0.00	43.61	210	0	51
pph	246.87	72.11	106.65	440.99	210	0	0
ps1	942.38	746.79	11.90	5276.51	210	0	0
pt	1298.09	700.44	52.72	6785.63	210	0	0
pt1	382.49	370.22	2.74	3377.87	210	0	0

5.1.2 Dependent variables

Table 29: Descriptive statistics of dependent variables

	Mean	sd	min	max	n	NA	zeros
y1_121	140.81	181.52	0.00	1206.06	208	2	17
y2_121	3.11	2.91	0.00	13.33	209	1	17
y1_all	45.12	19.95	6.04	100.00	210	0	0
y1_ek	6.48	8.71	0.00	48.19	210	0	28
y1_njiv	13.80	20.93	0.00	90.97	210	0	51
y1_trav	6.97	11.29	0.00	65.47	210	0	51
y2_all	29.59	14.29	5.11	87.27	210	0	0
y2_ek	3.30	4.29	0.00	29.09	210	0	28
y2_njiv	12.76	19.66	0.00	100.00	210	0	51
y2_trav	14.58	21.40	0.00	100.00	210	0	51
y3_all	97.61	59.95	12.43	331.31	210	0	0
y3_ek	24.17	32.39	0.00	180.21	210	0	28
y3_njiv	39.62	64.88	0.00	308.72	210	0	51
y3_trav	6.71	10.54	0.00	57.60	210	0	51

5.2 Correlation matrices

5.2.1 Independent variables

Table 30: Correlation matrix of explanatory variables, Group I (Agricultural structures)

	AA	AAA	CD 3	CD 5	CD 7	CD 11	CD 12	CD 13	CD 16	CD 17	CD 22	CD 23	CD 24	CD 25	CD 27	CD 32	CD 33	CD 34	CD 35	CD R_D	CD T8	CD Z_D
AA		0.58 ***	0.65 ***	0.41 ***	0.02	-0.14	0.39 ***	0.42 ***	0.37 ***	-0.07	0.35 ***	-0.28 **	-0.28 **	0.02	-0.10	0.08	0.02	-0.02	-0.14	0.14	0.15	-0.17
AAA			0.86 ***	0.21	0.01	-0.01	0.64 ***	0.30 **	0.51 ***	0.60 ***	-0.01	-0.26 *	-0.18	0.37 ***	0.15	0.06	-0.06	-0.04	-0.03	0.12	0.18	-0.17
CD3				0.64 ***	0.13	0.17	0.83 ***	0.52 ***	0.58 ***	0.63 ***	-0.15	-0.31 ***	-0.03	0.46 ***	0.20	0.21	0.05	-0.21	-0.15	-0.16	0.04	0.11
CD5					0.32 ***	0.44 ***	0.66 ***	0.63 ***	0.49 ***	0.37 ***	-0.34 ***	-0.32 ***	0.29 **	0.43 ***	0.20	0.40 ***	0.21	-0.39 ***	-0.36 ***	-0.52 ***	-0.10	0.46 ***
CD7						0.42 ***	0.28 **	0.42 ***	0.30 **	0.10	-0.40 ***	-0.17	0.38 ***	0.30 **	0.40* **	0.73 ***	0.13	-0.69 ***	-0.54 ***	-0.36 ***	-0.06	0.31 ***
CD11							0.38 ***	0.62 ***	0.06	0.21	-0.62 ***	0.09	0.44 ***	0.33 ***	0.37 ***	0.46 ***	0.16	-0.47 ***	-0.33 ***	-0.80 ***	0.04	0.63 ***
CD12								0.76 ***	0.56 ***	0.65 ***	-0.46 ***	-0.34 ***	0.24 *	0.64 ***	0.28 **	0.35 ***	0.21	-0.38 ***	-0.26 *	-0.47 ***	-0.16	0.44 ***
CD13									0.35 ***	0.14	-0.44 ***	-0.12	0.33 ***	0.36 ***	0.26 *	0.47 ***	0.29 **	-0.49 ***	-0.41 ***	-0.67 ***	-0.10	0.58 ***
CD16										0.47 ***	-0.29 **	-0.64 ***	0.23	0.67 ***	0.38 ***	0.28 **	0.13	-0.26 *	-0.24 *	-0.08	-0.05	0.09
CD17											-0.42 ***	-0.32 ***	0.17	0.62 ***	0.26 *	0.17	-0.05	-0.16	-0.09	-0.21	-0.10	0.21
CD22												0.09	-0.81 ***	-0.62 ***	-0.55 ***	-0.47 ***	-0.21	0.54 ***	0.29 **	0.67 ***	0.23	-0.63 ***
CD23													-0.25 *	-0.67 ***	-0.11	-0.22	0.06	0.16	0.17	-0.02	0.07	-0.01
CD24														0.36 ***	0.48 ***	0.46 ***	0.19	-0.53 ***	-0.28 **	-0.56 ***	-0.25 *	0.55 ***
CD25															0.36 ***	0.36 ***	0.06	-0.34 ***	-0.26 *	-0.35 ***	-0.12	0.33 ***
CD27																0.29 **	0.09	-0.38 ***	-0.10	-0.26 *	-0.11	0.26 *
CD32																	-0.02	-0.84 ***	-0.76 ***	-0.44 ***	-0.07	0.38 ***
CD33																		-0.25 *	-0.19	-0.22	-0.06	0.20
CD34																			0.40 ***	0.46 ***	0.12	-0.42 ***
CD35																				0.34 ***	0.01	-0.28 **
CDR_D																					0.30 **	-0.92 ***
CDT8_D																						-0.64 ***

CDZ_D	

Table 31: Correlation matrix of explanatory variables, Group II (socio-economic characteristics)

	NS11	NS22	NS33	NS44	NSI1	NSI2	NSI3	NTRG2	NTRG3	NTRG4	NTRG5
NS11		-0.03	-0.02	0.12	-0.46***	0.25**	0.54***	-0.38***	0.05	0.31***	0.32***
NS22			0.96 ***	-0.60 ***	0.13	-0.12	-0.09	0.10	0.37***	-0.12	-0.12
NS33				-0.59 ***	0.17	-0.17	-0.13	0.17	0.32***	-0.12	-0.11
NS44					-0.40 ***	0.29***	0.39***	-0.33***	-0.39***	0.15	0.15
NSI1						-0.85***	-0.86***	0.83***	0.35***	-0.26**	-0.25**
NSI2							0.46***	-0.72***	-0.22*	0.11	0.09
NSI3								-0.71***	-0.37***	0.33***	0.33***
NTRG2									0.27**	-0.26**	-0.25**
NTRG3										-0.13	-0.13
NTRG4											0.99***
NTRG5											

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 32: Correlation matrix of explanatory variables, Group II (Geographical attributes)

	NAT_D	OMD_D	VVO_D
NAT_D		0,21**	0,17*
OMD_D			0,07
VVO_D			

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 33: Correlation matrix of explanatory variables, Group IVa (measure 121)

	B4	F2	G2	H11	I1	J1	L11	M1	M2	M3	N1	N2	N3	O1	O2	O3	y1_121
B4		0.04	0.47 ***	0.47 ***	-0.03	-0.06	0.41 ***	-0.13	0.13	0.11	0.06	0.32 ***	-0.12	-0.14	0.33 ***	0.10	0.94 ***
F2			-0.08	0.10	0.03	0.15	0.10	0.02	0.04	0.15	0.13	-0.05	0.07	0.10	0.10	0.06	0.03
G2				-0.06	-0.14	-0.06	0.29 **	-0.07	0.19	-0.03	0.01	0.19	-0.06	-0.09	0.20	0.07	0.53 ***
H11					0.11	0.05	0.64 ***	-0.18	0.18	0.16	0.17	0.22	-0.03	0.03	0.15	0.14	0.36 ***
I1						0.25*	0.10	0.15	0.03	0.09	0.25*	-0.08	0.16	0.24	0.08	-0.14	-0.04
J1							0.13	0.27 **	0.29 **	0.13	0.08	0.08	0.47 ***	0.45 ***	0.13	0.13	-0.09
L11								-0.18	0.17	0.21	0.19	0.11	0.09	0.07	0.09	0.24 *	0.32 ***
M1									-0.23	-0.32 ***	-0.04	-0.13	0.16	0.14	0.03	-0.11	-0.14
M2										-0.48 ***	0.02	0.23	0.02	-0.03	0.23	0.11	0.11
M3											0.18	0.05	0.35 ***	0.40 ***	0.01	0.12	0.12
N1												-0.08	-0.23	0.10	0.13	0.02	0.05
N2													-0.49 ***	-0.11	0.22	0.27 *	0.36 ***
N3														0.58 ***	-0.06	-0.05	-0.14
O1															-0.45 ***	-0.30 ***	-0.17
O2																-0.04	0.37 ***
O3																	0.09
y1_121																	

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 34: Correlation matrix of explanatory variables, Group IVa (measure 214)

	nk	nn	nt	pph	ps1	pt	pt1	y3_all
nk		0.82***	0.00	0.21*	0.67***	0.13	0.05	0.48
nn			-0.03	0.15	0.59***	0.26**	0.19	0.36
nt				-0.37***	-0.14	0.35***	0.24**	-0.12
pph					0.47***	-0.52***	-0.49***	0.32
ps1						0.03	0.22*	0.69
pt							0.78***	-0.22*
pt1								0.08
y3_all								

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

5.2.2 Dependent Vs independent variables

Table 35: Correlation matrix dependent Vs. independent variables (agricultural structures)

	y1_121	y2_121	y1_all	y1_ek	y1_njiv	y1_trav	y2_all	y2_ek	y2_njiv	y2_trav	y3_all	y3_ek	y3_njiv	y3_trav
AA	0.53***	0.40***	-0.19	-0.42***	0.19	-0.14	-0.21	-0.35***	0.19	-0.15	0.01	-0.42***	0.17	-0.14
AAA	0.47***	0.49***	0.14	-0.19	0.51***	-0.22	0.00	-0.17	0.45***	-0.23	0.33*	-0.19	0.49***	-0.23
CD3	0.51***	0.54***	0.04	-0.19	0.35***	-0.10	-0.01	-0.10	0.27*	-0.07	0.19	-0.19	0.34***	-0.10
CD5	0.32***	0.42***	-0.08	-0.09	-0.02	0.17	0.09	0.11	-0.05	0.29**	-0.07	-0.09	-0.01	0.19
CD7	0.05	0.13	0.08	0.00	-0.02	0.22	0.23	0.13	0.07	0.27*	-0.07	-0.01	-0.03	0.22
CD11	0.08	0.25*	-0.02	0.04	-0.09	0.36***	0.21	0.21	-0.02	0.41***	-0.25	0.04	-0.10	0.36***
CD12	0.38***	0.50***	-0.01	0.00	0.05	0.06	0.11	0.11	0.07	0.11	-0.04	0.00	0.05	0.06
CD13	0.38***	0.46***	-0.19	-0.18	-0.13	0.23	0.05	-0.02	-0.04	0.25	-0.33***	-0.18	-0.14	0.24
CD16	0.27*	0.44***	0.24	-0.04	0.26*	0.09	0.36***	0.14	0.30**	0.20	0.30**	-0.05	0.26*	0.10
CD17	0.15	0.29**	0.28*	0.25	0.25	-0.03	0.25	0.30**	0.17	0.04	0.31**	0.25	0.25	-0.03
CD22	-0.03	-0.22	-0.04	-0.18	0.21	-0.32	-0.34***	-0.32***	0.09	-0.40***	0.23	-0.18	0.22	-0.33***
CD23	-0.10	-0.24	-0.14	-0.14	0.01	-0.06	-0.29**	-0.30**	-0.04	-0.17	-0.15	-0.13	0.01	-0.07
CD24	-0.02	0.13	-0.02	0.10	-0.34***	0.35***	0.31**	0.25	-0.22	0.44***	-0.31	0.10	-0.34***	0.37***
CD25	0.15	0.35***	0.18	0.25	0.02	0.15	0.38***	0.42***	0.10	0.26*	0.10	0.25	0.01	0.15
CD27	0.01	0.15	0.06	-0.05	0.06	0.06	0.21	0.05	0.13	0.13	-0.09	-0.05	0.04	0.05
CD32	0.13	0.17	-0.03	-0.17	-0.07	0.25	0.17	0.05	-0.03	0.32***	-0.18	-0.17	-0.08	0.27*
CD33	0.04	0.15	-0.16	-0.13	-0.10	0.00	-0.01	-0.09	-0.02	0.06	-0.19	-0.13	-0.09	0.01
CD34	-0.09	-0.16	0.08	0.25	0.06	-0.17	-0.12	0.07	0.01	-0.22	0.26*	0.26	0.07	-0.18
CD35	-0.14	-0.19	0.04	0.05	0.11	-0.25	-0.15	-0.13	0.05	-0.35***	0.10	0.06	0.11	-0.27*
CDR_D	-0.04	-0.23	0.06	-0.18	0.44***	-0.49***	-0.24	-0.35***	0.39***	-0.54***	0.39***	-0.18	0.43***	-0.50***
CDT8_D	0.18	0.17	0.04	-0.22	0.52***	-0.28*	-0.08	-0.26*	0.54***	-0.26*	0.30**	-0.22	0.50***	-0.26*
CDZ_D	-0.04	0.12	-0.07	0.23	-0.56***	0.51***	0.23	0.39***	-0.53***	0.54***	-0.43***	0.23	-0.54***	0.51***

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 36: Correlation matrix dependent Vs. independent variables (socio-economic)

	y1_121	y2_121	y1_all	y1_ek	y1_njiv	y1_trav	y2_all	y2_ek	y2_njiv	y2_trav	y3_all	y3_ek	y3_njiv	y3_trav
NS11	0.15	0.06	-0.07	-0.20**	0.18*	-0.18*	-0.23***	-0.18**	0.02	-0.17*	0.07	-0.20**	0.17*	-0.18**
NS22	-0.13	-0.15	0.32***	0.33***	0.13	0.02	0.14*	0.23***	0.12	-0.11	0.35***	0.33***	0.13	-0.01
NS33	-0.12	-0.17	0.30***	0.29***	0.13	0.01	0.12	0.19**	0.13	-0.12	0.33***	0.30***	0.14*	-0.02
NS44	0.06	0.04	-0.21**	-0.13	-0.22**	-0.03	-0.09	-0.13	-0.21**	0.00	-0.29***	-0.13	-0.21**	-0.02
NSI1	-0.03	-0.05	0.01	-0.09	0.21**	-0.02	-0.03	-0.12	0.33***	-0.04	0.11	-0.09	0.19**	-0.01
NSI2	0.07	0.12	0.02	0.11	-0.16*	0.07	0.11	0.17*	-0.25***	0.10	-0.04	0.11	-0.13	0.06
NSI3	-0.02	-0.04	-0.03	0.04	-0.20**	-0.03	-0.05	0.04	-0.30***	-0.03	-0.14*	0.04	-0.19**	-0.05
NTRG2	0.04	-0.02	-0.02	-0.22**	0.29***	-0.09	-0.05	-0.20**	0.42***	-0.13	0.10	-0.22**	0.26***	-0.09
NTRG3	0.15	0.10	0.13	-0.06	0.49***	-0.18**	-0.07	-0.09	0.47***	-0.19**	0.41***	-0.06	0.48***	-0.17*
NTRG4	-0.04	-0.02	-0.03	0.00	-0.05	-0.04	-0.02	-0.01	-0.04	0.00	-0.03	0.00	-0.05	-0.04
NTRG5	-0.05	-0.03	-0.04	0.00	-0.06	-0.06	-0.02	-0.01	-0.04	-0.01	-0.03	0.00	-0.06	-0.06

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 37: Correlation matrix dependent Vs. independent variables (geographical features)

	y1_121	y2_121	y1_all	y1_ek	y1_njiv	y1_trav	y2_all	y2_ek	y2_njiv	y2_trav	y3_all	y3_ek	y3_njiv	y3_trav
NAT_D	-0.30***	-0.33***	0.17	0.30***	-0.03	0.00	0.09	0.22	0.00	-0.10	0.11	0.30***	-0.04	-0.03
OMD_D	-0.17*	-0.19*	-0.01	0.34***	-0.64***	0.35***	0.21	0.36***	-0.57***	0.38***	-0.30***	0.34***	-0.63***	0.36***
VVO_D	-0.18*	-0.20*	0.05	0.13	-0.12	-0.05	0.03	0.07	-0.19	-0.07	0.00	0.13	-0.10	-0.07

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 38: Correlation matrix dependent Vs. independent variables (measure-specific, 121)

	y1_121	y2_121
B4	0,92***	0,72***
F2	0,13	0,19
G2	0,14	0,04
H11	0,66***	0,9***
I1	0,03	0,15
J1	0,06	0,07
L11	0,62***	0,73***
M1	-0,2	-0,19**
M2	0,23	0,12*
M3	0,14	0,27
N1	0,23	0,27
N2	0,24	0,18
N3	-0,06	0,03
O1	-0,12	0,1
O2	0,35***	0,16
O3	0,21	0,16

***p<0,001, **0,001>p<0,01, *0,01>p<0,05

Table 39: Correlation matrix dependent Vs. independent variables (measure-specific, 214)

			y1_all	y1_ek	y1_njiv	y1_trav	y2_all	y2_ek	y2_njiv	y2_trav	y3_all	y3_ek	y3_njiv	y3_trav
nk			0,33***	0,04	0,49***	-0,12	-0,10	0,01	0,16	-0,16	0,48***	0,04	0,51***	-0,14
nn			0,18	-0,01	0,38***	-0,17	-0,12	-0,03	0,10	-0,17	0,36***	-0,01	0,39***	-0,17
nt			0,11	0,21	-0,29**	0,47***	0,07	0,24*	-0,29***	0,20	-0,12	0,21	-0,27**	0,41***
pph			-0,03	-0,57***	0,78***	-0,42***	-0,21	-0,53***	0,79***	-0,40***	0,32***	-0,58***	0,75***	-0,42***
ps1			0,58***	-0,02	0,72***	-0,07	0,33***	0,05	0,59***	-0,05	0,69***	-0,02	0,73***	-0,08
ps2			0,32***	-0,15	0,51***	-0,14	0,11	-0,13	0,38***	-0,11	0,45***	-0,15	0,53***	-0,15
pt			0,08	0,49***	-0,51***	0,30***	0,18	0,48***	-0,51***	0,28**	-0,22	0,50***	-0,51***	0,28**
pt1			0,47***	0,62***	-0,39***	0,54***	0,68***	0,69***	-0,35***	0,58***	0,08	0,62***	-0,38***	0,53***

***p<0,001, **0,001>p<0,01, *0,01>p<0,05