SPARD

Spatial Analysis of Rural Development Measures
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The comparison of EU27 analyses and case study analyses

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Abbreviations

AEM	Agri-environmental measures (AEM)
CAP	Common Agricultural Policy
CE	Cambridge Econometric database
CMEF	Common Monitoring and Evaluation Framework
EAFRD	European Agricultural Fund for Rural Development
ESDA	Explanatory Spatial Data Analysis
EU	European Union
GDP	Gross Domestic Product
GVA	Gross Value Added
HNV	High Natural Value (HNV) agricultural land
LDI	Logical Diagrams of Impact (LDI
LFA	Less-favoured areas
LM	Lagrange Multiplier test
MRW	Mankiw, Romer and Weil (MRW) model
NUTS	French abbreviation for Nomenclature des Unités Territoriales Statistiques, a geocode standard for referencing the subdivisions of EU countries for statistical purposes
RD	Rural Development
RDP	Rural Development Programme
RED	Renewable Energy Directive
SPARD	Spatial Analysis of Rural Development Measures

Summary

SPARD has been undertaken to develop a modelling tool that will help policy-makers understand the causal relationships between rural development measures and their results in a spatial dimension. One aspect of the SPARD work programme is to test the application of spatial econometric modelling at different spatial levels that are corresponding to the different territorial levels of both rural development (RD) planning and monitoring.

Scaling for territorial analysis is therefore part of the SPARD operational use of the spatial econometric models under development. The application at the case study level reflects programming needs and data requirements coming from the municipality level, where implementation of RD measures takes place; the same modelling technique related to spatial econometrics has been tested at the programming level. The impacts are at a different level than the level of decision-making because spillovers might arise from the RD measures:

Indicator	**Level of system**	**Scale (level of spillovers)**
Agricultural labour productivity	Farmer	Municipality
Biodiversity	Region or landscape (geo-biophysical units)	Region (higher level)
Water quality	Water body	Catchment or river basin
Tourism	Municipality	Region (province)

The spatial modelling in SPARD only dealt with impacts within the EU. Data are (not always) available at the adequate level and/or scale. The econometric model was first developed for national and regional level (NUTS 0, 1 and 2, respectively). Then, the spatial econometrics analysis was employed in case studies, which to the extent possible used data at the most local NUTS levels (3, 4 or 5) also referred to as Local Administrative Units. The EU series of impact indicators for RDP measures (CMEF), however, is only available at NUTS 2 or 3. The issue of spatial scaling was present throughout the different parts of the study. We compared the EU27 analyses and the case study analyses in order to see what the complementary aspects and the differences are.

Spatial econometric approaches for the impact assessment of the effectiveness of RDP measures can be applied at different scale levels. Spatial econometrics is a suitable method to study spillover effects. Unfortunately, the application of the methodology in SPARD was limited by data constraints: insufficient data available at the appropriate level of the system, see table above. Impact analyses are preferably explored at the system level of decision making (farmers and entrepreneurs) and expected impacts. Impacts differed across measures, because the impact indicators of measures relate to different scale levels (agricultural labour productivity at farm level, water quality at catchment or national level, biodiversity at municipality level, and tourism at municipality level).

The CMEF framework seemed to focus on higher level assessments (NUTS-2), although it recognized the bottom up process. Spatial spillovers are expected to show up within system-level assessments, which are lower levels than the NUTS2 levels. Higher level assessments might ignore the local effects of the RDP measures. On the one hand, differences in

institutional settings cannot be measured at case study level. On the other hand, EU level analyses can take into account institutional settings.

The econometric models applied to impact indicators at NUTS2 level for the EU27 can be explored at the level of expected spatial spillovers. These spillovers were likely to show up at municipality level for provinces or countries under the condition that the relevant Impact indicators are available. Data availability for case study analyses relied on the data collection of national statistical offices. The Impact indicators were not available at case study level except for France and Slovenia. For instance, the number of nights spent are available at municipality level in the Netherlands, but are not centrally collected. The case study models mainly focussed on farmer's participation and participation rate models. Participation models cannot be applied at the EU level because data is absent. In particular, participation rates are not (readily) available for all NUTS2 areas in the EU27.

1 Introduction

1.1 Objective of WP4.4

SPARD has been undertaken to develop a modelling tool that will help policy-makers understand the causal relationships between rural development measures and their results in a spatial dimension. One aspect of the SPARD work programme is to test the application of spatial econometric modelling at different spatial levels that are corresponding to the different territorial levels of both rural development (RD) planning and monitoring.

Territorial subsidiarity is a guiding principle in the construction of the EU chain of governance. In the implementation of the rural development part of the CAP through the EAFRD (European Agricultural Fund for Rural Development), the indicators of monitoring the effects of implementation are often at a lower level than the policy-making for the programming of RD specific measures (either a regional or national level), which is itself at a lower level than the decision-making regarding the orientations for the programming (co-decision with the EU).

Scaling for territorial analysis is therefore part of the SPARD operational use of the spatial econometric models under development. The application at the case study level reflects programming needs and data requirements coming from the municipality level, where implementation of RD measures takes place; the same modelling technique related to spatial econometrics has been tested at the programming level. The impacts are at a different level than the level of decision-making because spillovers might arise from the RD measures. We will give a few examples. The Renewable Energy Directive (RED), for example, in which a decision for a minimum level of biofuel incorporation within the EU will have an influence on the extent of growing rape (colza) at the MS level such as in Germany. The increasing extent of crape production will increase the extent of biofuel production and consequently CO_2 production in MS will go down. However, rape production in MS will decrease the use of coarse rape meal in domestically produced fodder. As a result, it is likely that more soya will be demanded and imported from outside the EU (Brazil for instance). As a consequence, Brazil will convert more natural conservation forests into soya plantations, which will results in more production of CO_2 emissions. Impacts will also have a temporal dimension, and the use of territorial monitoring at one level can capture the progression of an impact across a larger spatial range. This is clearly an example of spatial spillovers outside the EU from EU policy. Another example is the evolution of the EU dairy policy, specifically the increase in quota, which allowed comparative advantage to operate in the transfer of dairy operations towards a concentration in the (north-eastern) Atlantic region of the EU; this shift has taken place over time, and is visible in the FADN data series from periodic monitoring of agricultural activity in the EU.

The phenomenon of comparative advantage also operates at the global level, and the prominence of the EU in world wheat production (and export) is mirrored by the expansion of soya production in Brazil, for example. The EU would be unable to produce sufficient protein crops for the current level of livestock, and depends on import of soya not only from Brazil, but also from Argentina and the USA.

The spatial modelling in SPARD occurs only within the EU. The econometric model is developed for national and regional level (NUTS 0, 1 and 2, respectively). Afterwards the spatial econometrics analysis is employed in case studies, which to the extent possible used data at the most local NUTS levels (3, 4 or 5) also referred to as Local Administrative Units. The EU series of impact indicators for RDP measures (CMEF), however, is only available at NUTS 2 or 3. The issue of spatial scaling is present throughout the different parts of the study.

1.2 Scaling and RDP evaluation

One of the main unresolved problems with policy making is the step from scale issues to governance (Veldkamp *et al*., 2011). What is appropriate for a lower level, such as a region or a location, may be considered undesirable at a global scale and vice versa. With the rape example in the previous section, we illustrated the presence of spatial spillovers that emerge at global level from EU policy. Scale definitions refer to quantitative dimensions of a phenomenon defined in space and time (Costanza et al., 1999; Costanza *et al*., 1993; Gibson *et al*., 2000; Wu & Li, 2006). The notion of levels is related to scale. Levels are seen as units of analysis that are located at different positions on a scale continuum. Scale and level are different notions which is useful for the recognition of scale dependency (Peterson & Parker, 1998).

Environmental indicators commonly refers to ecosystem as the level of assessment and its geographical boundaries is the scale level of assessment. The system is delineated by a clear boundary referred to as the extent of the system. Within this delineation of systems, other subsystems can be identified that are expected to be hierarchically nested within the overall system. Examples are a river basin subdivided into sub-basins, which are further subdivided into local catchments.

In economics, the system is defined in terms of actions and individual decision-making units. Economists have paid more attention to the scale of time than the scale of space. The concept of scale in economics is evident in the distinction between micro- and macroeconomics, because the level of economic agents differs. Microeconomics deals with individual consumers or producers, for instance, and concerns the allocation of resources among these economic agents (Russell & Wilkinson, 1979), whereas macroeconomics concerns the way actions of consumers, producers, and public agencies determine economy-wide movements in output, unemployment, and inflation (Blanchard & Fischer, 1989). Economic analyses are rather insensitive for the smallest entity. In micro economics, behaviour of individual economic agents can be projected on the basis of exogenous variables such as prices. At the macro level, however, prices are endogenous. Projections of other variables will constitute significant errors, if this endogeneity is ignored (Costanza, et al., 1993; Norton, 1995; Van der Veen & Otter, 2003). The aggregation of micro-level system to the macro-level system is characterised by complexity, non-linearity and discontinuity (Van der Veen & Otter, 2003). In addition, Walrasian economic models bring complexity down to a manageable level (Vatn,

2005) by using fundamental basic assumptions (e.g., disregarding transaction costs, assuming complete information and complete markets).

This report focuses attention on the assessment of RDP measures at different scale levels. When comparing the data, models and results, we have to keep into mind the scaling issues mentioned in this paragraph. In the RDP, farmers and entrepreneurs are the actual decision makers. Analyses at EU27 level might be affected by aggregation biases with respect to effectiveness of RDP measures, because linear aggregation procedures are used to obtain indicators. However, the use of linear aggregation procedures for complex, non-linear discontinuous systems of decision making introduced aggregation bias. Moreover, the use of administrative boundaries at higher aggregation levels ignore impacts within the region, which might affect the impact of the RDP measures in the assessment.

1.3 Outline of the report

The structure of this report is as follows. Chapter 2 briefly summarizes the spatial econometric analyses of the SPARD project at the EU27 level (see Reinhard *et al*., 2013) and for the six SPARD case study areas: Brandenburg (Germany), Noord Holland (The Netherlands), Emilia-Romagna (Italy), Midi Pyrenees (France), Eastern Slovenia (Slovenia), Scotland (UK). In addition, we present the expected spillovers for RDP measures analysed. In Chapter 3, we discuss the corresponding and deviating issues witnessed at the comparison of EU27 and case study level analyses. This discussion is based on six components, namely processes at different scale levels, institutional aspects, data, econometric models, and results. Finally, chapter 4 concludes.

2 Methodology

2.1 Introduction

To assess the different spatial models in SPARD we started with a general econometric model. This general model contains references to groups of variables that ideally are included in the model to estimate the impact of RDP measures. The actual model to be developed depends mainly on the impact indicator that is selected as dependent variable (to be explained). Reinhard *et al*. (2013) and Uthes *et al*. (2011) presented various theoretical models for the assessment of measures representing the three different axes of the RDP. Due to the differences in the nature of the measures in the axes, the theoretical models and the empirical specifications differ across the analyses of the axes.

Within the CMEF framework, Logical Diagrams of Impact (LDI) have been defined for all RDP measures, see Uthes *et al*. (2011). On the one hand, we can identify different stages of the institutional setting of bringing EU policy for rural development into practice, and on the other hand, we can observe the successfulness of RDP measures subsidized in terms of participation, effectiveness and impact, as seen in Figure 1. Our focus is on the successfulness of RDP measures. The process starts with stage 1: setting a target for EU policy with respect to improving the competitiveness of the agricultural and forestry sectors (Axis 1), improving the environment and the countryside (Axis 2), improving the quality of life in rural areas (Axis 3), from the top downwards. Member states select the budget and type of measures (stage 2). Then the stage of participation starts (physical uptake in stage 3) and the successfulness of this participation (stage 4). In stage 5, the effectiveness of (successful) participants is considered and finally the participation also might induce (unexpected) impacts (stage 6) such as spillovers at regional level.

This is the institutional perspective of providing incentives for participating in RDP measures. At the left-hand side, the spatial scale, starting from the bottom, ranges from individual participation to the impact of measures at regional, national or even EU level. This study discusses the theoretical and empirical issues encountered during the analyses at EU 27 level and in case study regions. From both types of analyses, we can identify the status of the analysis in the LDI of Figure 1.

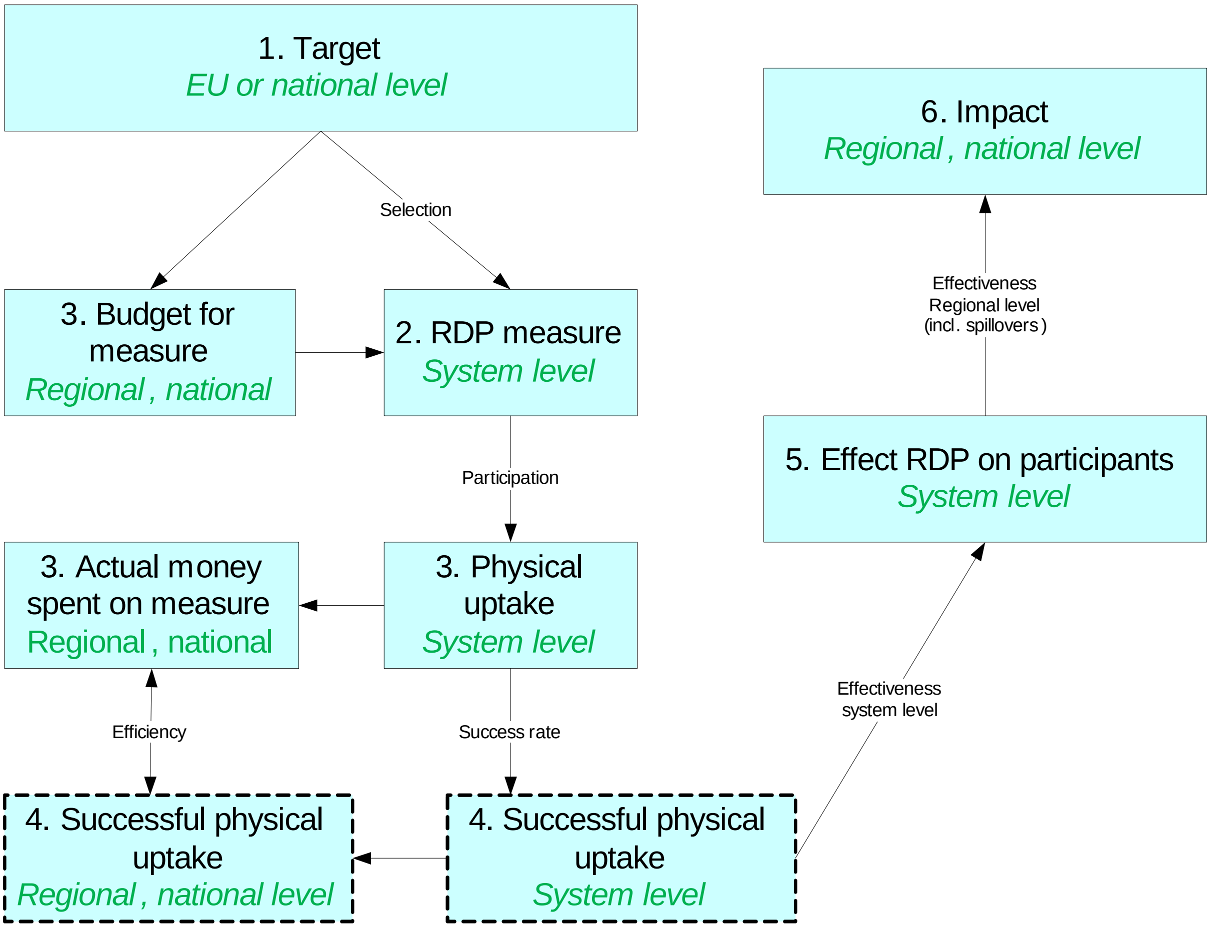

Figure 1: Scheme of the CMEF framework for measures and the different scale levels

We present the different theoretical models for the EU 27 analyses, in section 2.2. Then we discuss the spillovers to be expected from the assessment of RDP measures in section 2.3. Finally, we summarize the results from the case studies and we present generic versions of the different econometric models used in the 5 case studies. The case studies were: Brandenburg (Germany), North Holland (the Netherlands), Emilia Romagna (Italy), Midi Pyrenees (France), Eastern Slovenia (Slovenia) and Scotland (UK).

2.2 EU27 analyses

This section presents the summary of the models which we used in the various analysis. The following measures were analysed, see Reinhard *et al*. (2013):

Axis 1 – Measure 121	Agricultural labour productivity
Axis 2 – Measure 214	Water quality, i.e. nitrogen surplus
	Biodiversity, i.e. High Natural Value (HNV) agricultural Land
Axis 3 – Measures 311/313	Tourism, i.e. number of nights spent

2.2.1 Labour productivity (Axis 1)

Our theoretical model is based on the Mankiw, Romer and Weil (MRW) model, which is a neoclassical growth model, see Chapter 3 of Reinhard *et al*. (2013). These kind of models predict that, under certain conditions (complete markets, free entry and exit, negligible transaction costs, and convex technology relative to market size), countries and regions grow to their maximum potential (Solow, 1956). In the basic Solow model, economic growth is driven by savings and investments (in exogenous determined technologies). Mankiw *et al*. (1992) added human capital as an important factor.

The generic model for Axis 1 is a labour productivity (Y_t) model explaining labour productivity at the regional level:

$$Y_t = f\left(Y_{t-1}, g_t, I_t, REG_t, FARM_t, AGRI_t, RDP_t; (n + g + \delta)\right) + \varepsilon_t \quad (1)$$

Y_t = agricultural labour productivity in year t
g_t = economic growth in year t
I_t = investments in year *t*
REG_t = regional variables in year *t*
$FARM_t$ = type of farm variables in year *t*
$AGRI_t$ = type of agriculture variables in year *t*
RDP_t = RDP spending per holding in year *t*

Labour productivity in agriculture was constructed by taking GVA/employment, and corrected it for countrywide changes in purchasing power. The technical term (n+g+δ) of the MKW model is the summation of local growth rate of labour force (n), general economic growth (g)and general depreciation respectively (δ). NUTS2 level data from Cambridge Econometrics data for the period 2000-2010 were used as well as the Gabriel weight matrix.

When aiming to explain the productivity, we would expect aspects such as the quality of the soil, hours of sunshine, level of technology and human capital to all affect the kind and efficiency of activities, and thus the level of labour productivity. However, the MRW model aims to explain the change over time, so aspects like soil and weather (barring climate change!) are of less importance in such a model. Motorway density, population density, and GDP/capita are included as regional variables. For farm types, we use data on farm sizes (in five different classes) and the share of family labour in total labour. For types of agriculture we have the total share of agricultural land in the region, the share of agricultural land in less favoured areas (LFAs), and measures for some specific types of activities, namely woodlands, vineyards, flowers and livestock, which all have their specific technological and climatic differences..

We estimated both a steady state model and a growth model. It did not make sense to include RDP expenditures in the steady state specification, since RDP spending was available for the period between 2000 and 2010 and not since the dawn of time. In the growth models, these were our main focus of interest, and we included RDP expenditures on Axis 1, Axis 2 and the other axes separately to control for counter-effects between different axes.

Results steady state model

Population density had a significantly negative effect on the labour productivity in agriculture. Regions with a higher income (GDP/capita) had a higher agricultural productivity per employee. When looking at the farm-related variables, we found the share of large farms (in terms of surface) had a significantly positive effect on productivity, but the share of smallest farms also had this same type of effect, albeit only half as strong (the reference category was formed by farms of intermediate size, 10-30 ha). When looking at environmental variables, we saw that productivity is lower in less favoured areas as expected, and in areas with higher livestock density, which may point to areas where soil or intensive agriculture was not permitted. Moreover, the inclusion of country fixed effects took care of a lot of (spatial) variation in climate and soil. We estimated a spatial lag model in which labour productivity in one region is influenced by a series of factors plus labour productivity in surrounding regions. Since the sign for the spatial lag structure (ρ) was positive, the indirect effects reinforced the direct effects to some (small) degree.

Results growth model

As expected, we found that labour productivity in 2000 strongly affected productivity in 2010. Furthermore, the technical term (n+g+d) from the MKW model had a negative effect and investments had a significant positive effect; these findings were both expected. Surprisingly, a higher GDP/capita relates to a lower growth of labour productivity in agriculture. The land use variables showed mixed results, as with the steady state models: a few variables came out statistically significant, most did not. Large farms had a negative impact on labour productivity in these estimations; as well as pastures. The presence of woodlands in an area had a positive relationship with agricultural labour productivity.

For the growth models we did not estimate a spatial lag model, but a linear model with six regimes defined by population density (three classes, each with one third of the regions: urban, intermediate, and rural) and a north/south division. When we considered regional variation in the effects of RDP expenditure, spending on Axis 1 had significantly positive effects in southern rural and urban regions, but negative effects in intermediate regions; in northern intermediate regions, the effect was significantly positive. Spending on Axis 2 were not significant. Spending on other axes (i.e. Axes 3 and 4) had a positive effect. Moreover, in all models, spatial effects were detected for these expenditures. Spending on Axes 3 and 4 in neighbouring regions ensued a positive influence on labour productivity.

An important conclusion that we can draw from the analyses is that spending in general seems to have a positive effect on labour productivity; most strongly in southern rural and urban regions, and also in northern intermediate regions. The effect in southern intermediate regions seems to be negative. Another important conclusion is that expenditures in Axis 2 seems to have a negative effect on labour productivity. This counter-effect should be taken seriously by policy makers.

Furthermore, the effect of expenditures on Axes 1 and 2 in neighbouring regions seems to be very small or non-existent, at least for labour productivity, in a timeframe of 10 years, at the NUTS2 level. However, spill-over effects of spending on the other axes appear to be positively significant. Further research might be needed to indicate if this is desirable or not from the perspective of the objectives of the other axes.

2.2.2 Biodiversity (Axis 2)

An increase in the indicator value of HNV farmland stands for an improvement of agricultural biodiversity. Two key characteristics of HNV are (i) low intensity farming and (ii) high diversity of land cover. The HNV-index constructed was a combination of a livestock density index and crop diversity index. It is not an official EU index. The HNV index was computed based upon the farm structure in the region, see Reinhard *et al*. (2013). This index was available in the program period for 153 regions, mostly at NUTS2 level but for some countries at NUTS1 or NUTS0 level. We modelled agricultural biodiversity as a joint output. The dependent variable was our High Natural Value farmland index. We expected a negative relationship between the environmental agricultural biodiversity and the market output Y, and a positive relationship between HNV and the inputs. The magnitude of the impact indicator in the end year (the dependent variable) was related to the RDP spending (one of the independent variables). HNV was linearly related to the logs of the explanatory variables. The Gabriel weight matrix was used. The model was estimated in a logarithmic specification.

$$HNV_t = f(HNV_0, Y_t, L_t, \textstyle\sum_1^t I_t, \sum_1^t M214_t, \sum_1^t Ax1_t, \sum_1^t Ax2_t, OF_t, Area_t) + \varepsilon_t \qquad (2)$$

HNV_t = High Natural Value farmland indicator
HNV_0 = High Natural Value farmland indicator at the beginning of the period
Y_t = Gross Value Added per ha in year t
L_t = Employment/ha in year t
I_t = Agricultural investments in €1.000 per ha in year t
OF_t = Share (%) of other farmland in year t
$Area_t$ = Area of the region (ha) in year t
$M214_t$ = Expenditures measure 214 in €1.000 per ha in year t
$Ax1_t$ = Expenditures Axis1 in €1.000 per ha in year t
$Ax2_t$ = Expenditures Axis2 in €1.000 per ha in year t (excluding Expenditures on measure 214)

As expected, the incorporation of the HNV-index in the starting year as an explanatory variable gave a rather high R^2. In all the models the HNV-index was positively related to the HNV-index in the starting year. Regions with a high percentage of other land are likely to have smaller crop diversity (and a smaller HNV-index. The expenditures on agri-environmental measures (AEM), i.e. RDP measure 214, were positively related to HNV in the Durbin spatial lag model (and in the other models negatively related). However, the parameter estimates did not differ significantly from 0.

The HNV index can be used in the analysis of the impact of AEM. Omitted variables could be partly compensated for when using the spatial error model. The negative parameter estimate for the percentage of other land was an indication that our constructed HNV-index has to be improved upon to be able to reflect the rate of biodiversity better.

2.2.3 Water quality (Axis 2)

We analysed the impact indicator nitrogen surplus per hectare (in kg/ha) for water quality. Nitrogen surplus is an emission to the environment, and is an undesirable output of agricultural production. We assumed a positive relationship between the environmentally detrimental nitrogen surplus and the market output, and a negative relationship between N-surplus and the other inputs.

$$\Delta N_{it} = f_0(N_{it-1}, Y_{it}, (I_{it} + I_{it-1}), L_{it}, (M214_{it} + M214_{it-1}), (Ax1_{it} + Ax1_{it-1}), (Ax2_{it} + Ax2_{it-1}), TT_t, YD_t, EE_i) + \varepsilon_{it} \quad (3)$$

N_t = nitrogen surplus per ha in year *t*
ΔN_t = N_t/N_{t-1} = annual growth factor of nitrogen surplus per ha in year *t*
Y_t = Gross Value Added per hectare in year *t*
I_t = Investments in agriculture (1000 €/ha) in year *t*
L_t = Employment in agriculture per ha in year *t*
$M214_t$ = Spending on measure 214 (€1000/ha) in year *t*
$Ax1_t$ = Spending on Axis 1 (€1.000/ha) in year *t*
$Ax2_t$ = Spending on Axis 2 (€1.000/ha) in year *t* (excluding measure 214)
TT_t = Time trend where *t*=1 for the year 2001 and *t*=8 for the year 2008
YD_t = Dummy variable for year 2003
EE_t = Dummy for Eastern European countries (CZ, LT, LV, PL, SK)

This “dynamic” version of the N surplus model explains the annual change in N surplus. The model was estimated in a logarithmic specification.

A simplified Durbin model was tested to be the best model. In this Durbin model spatially lagged variables of spending on investment and RDP measures were incorporated into our analysis. The lagged nitrogen surplus parameter had a negative sign reflecting that the higher the nitrogen surplus in the preceding year is, the more likely it is to be reduced. The spending on measure 214 showed a significantly negative parameter, indicating that expenditure on AEM is related to a reduction of the nitrogen surplus. The spending on Axis1 and Axis2 had the expected sign (positive for Axis1 and negative for Axis2), but did not differ significantly from 0.

It proved to be possible to estimate the agriculture production function, including nitrogen surplus on member state level with panel data. The measures of Axis 1 and Axis 2 were counterproductive for the objectives of the other axis. We showed that a spatial specification is preferred over an a-spatial specification. A comprehensive indicator for water quality at NUTS2 level is not available EU wide. Therefore, a NUTS0 data for the period 2000-2008 were used instead. The RDP expenditures for agri-environmental measures are related to a reduction of nitrogen surplus per hectare (an indicator for water quality). Even, The expenditures and impact of agri-environmental measures exhibit spatial correlation, so the use of spatial (econometric) analysis is the appropriate methodology. However, different measures might have different goals, hence expenditures for measure 214 are likely to affect the objective of Axis 1 negatively; Axis 1 stimulates more efficient agricultural production.

2.2.4 Tourism (Axis 3)

We defined our model for tourism based on the literature, which was defined in such a way that spatial econometric analysis was explored instead of the more common time series analyses. Tourism (*TOUR*) was defined as the number of nights spent in a region by tourists in 2009. The specification for tourism in a region was as follows:

$$Tour_t = f(Tour_0, \Delta Cap_t, Cap_0, SocEcon, NatEnv, Acc, RDP) + \varepsilon \quad (4)$$

$Tour_0$	= the number of nights spent in a region by tourists in 2001.
ΔCap_t	= the change in capacity of tourist accommodations is a proxy for change in capital.
Cap_0	= the capacity of tourist accommodations in 2001 is a proxy for capital in 2001.
SocEcon	= the socio-economic variables, which is a proxy for a labour factor and economic indicators for the region.
NatEnv	= the set of natural environment variables, such as the shares of mountains, forests, and wetlands and the presence of beaches.
Acc	= is the set of accessibility variables like the presence of infrastructure.
RDP	= the expenditures on RDP measures on stimulating tourism including measures 311 and 313 (*RDP*).

In principle, the RDP measures for stimulating tourism might be used by entrepreneurs for the increase of the number of bed places. We did not expect any impact of RDP spending on the number of bed places, because the RDP measures focus more on tourism-related infrastructure and marketing rather than the increase of the number of bed places in a region. For the socio-economic variables, we used the unemployment rate of a region, because gross value added per region showed high correlations with the demographic variables. Climate variables (precipitation, temperature, etc.) are likely to affect tourism. Due to the absence of good quality climate variables data, however, we ignored climate variables. However, we included country specific dummies in all analyses which largely absorbed differences in climate variables.

There are four different tourism indicators (total number of nights spent) distinguished based on domestic-inbound tourism and based on the type of accommodations:

- Inbound tourism in hotels and similar accommodations;
- Inbound tourism in holiday houses and camping sites;
- Domestic tourism in hotels and similar accommodations;
- Domestic tourism in holiday houses and camping sites;

We used Eurostat data at the NUTS2 level for almost the whole EU27.

Results

Both linear models for inbound tourism did not show any spatial dependence, while the LM-test for both models for domestic tourism indicated spatial error dependence. For all four models, we took into account spatial heterogeneity by including country specific dummy variables and other spatial variables. For the models for domestic tourism, we applied a spatial error model including additional spatially lagged variables for capacity (number of bed places) and RDP expenditures. The spatial error coefficient λ is significantly negative which means that there is spatial dependence between the residuals of neighbouring regions. Due to the negative spatial correlation, regions with high levels of domestic tourism are likely to be adjacent to regions with low levels of domestic tourism and vice versa.

The level of tourism and the level of capacity (number of bed places) in 2001 largely explained the level of tourism in 2009. In addition, the level of initial capacity (number of bed places in 2001) also positively affected tourism. The increase in capacity in the period 2001-2009 contributed to higher levels of tourism except for inbound tourism in hotels.
For domestic tourism, there is no evidence that spatially lagged capacity affects the level of tourism. In other words, the number of bed places in neighbouring regions do not affect the level of tourism in a region. There is no market access effect.

Higher shares of urban areas increased inbound tourism. Apparently, inbound tourist (i.e. tourist that reside outside the region) are attracted to the presence of nearby urban centres. Landscape attractiveness (share of natural environment areas or presence of beaches) did not have an impact on inbound tourists. Domestic tourist (i.e. tourist residing in the region itself) were particularly attracted by rural landscapes and the presence of wetlands. Also, the presence of large ports increased rural domestic tourism.

The effects of RDP expenditures on the tourism indicators showed mixed results: i) RDP spending increases domestic rural tourism in holiday houses; ii) RDP spending in neighbouring regions increases domestic tourism in hotels; and iii) RDP spending has a negative impact on inbound tourism in urban areas but there is no positive impact of RDP spending on inbound tourism in rural accommodations such as holiday houses or camping sites. Moreover, the spatially lagged spending is significant for domestic tourism in hotels.

2.2.5 Data and Results of the EU 27 models

With the EU27 analyses, we have tried to identify the impact of RDP measures at the level of NUTS2 areas. The results of the (spatial) impact of RDP spending is not very convincing with respect to labour productivity, environmental models (either HNV farmland or nutrient surpluses) or tourism. One of the reasons is that RDP spending often involves subsidies on local or regional projects, see Reinhard *et al.* (2013). As a result the impact of the RDP spending and possible spill-over effects will be best observed at the local or regional level. Conclusions of the EU wide analysis are as follows:

- Spatial analyses and spatial econometrics matters in the assessment of the effectiveness of RDP variables, because results and impact indicators mentioned in the

CMEF framework such as agricultural labour productivity, water quality, biodiversity and tourism show spatial dependences based on ESDA analysis.

- Impacts of RDP on result and impact indicators are not convincing, although there are indications for spatial impacts of several types of RDP spending.
- Reinhard *et al*. (2013) concluded that one of the reasons of the lack of convincing evidence is that not-area related RDP measures are often project-based measures with a very local impact.
- Spatial spill over are more likely to occur at lower level than analysed in the EU 27 models (NUTS2 and 0).

2.3 Spillover effects and spatial analysis

Spillovers for labour productivity in agriculture

The growth models for agricultural labour productivity were not estimate with a spatial lag specification. In fact, spatial heterogeneity was amongst others captured by using dummy variables for six regimes. These six regions were defined by population density (three classes, each with one third of the regions: urban, intermediate, and rural) and a north/south division. When allowing for regional variation in the effects of RDP spending, spending on Axis 1 had significantly positive effects in southern rural and urban regions, but negative effects in intermediate regions. In northern intermediate regions, the effect was significantly positive. Spending on Axis 2 did not have any effect on labour productivity, see Reinhard *et al*. (2013). The explanation is that Axis 2 contains mainly agro-environmental measures focused on environmental rather than pecuniary benefits; however the effect of spending on Axis 2 was insignificant. Spending on other axes (i.e., Axes 3 and 4) had a positive effect. Moreover, in all models, a spatial effect was detected for these expenditures; when such spending took place in neighbouring regions, a positive influence on labour productivity ensued.

Spillover effects in biodiversity

Biodiversity typically exhibited spatial spill-over effects. Animals are free to migrate across the border of regions for instance. The actual rate of animals crossing borders largely depended on the species. Birds easily migrate more than reptiles. We used a HNV farmland indicator as a proxy for agricultural biodiversity. An indicator for farmland birds was not available EU wide for the programming period under study. Also an (official EU) High Natural Value farmland index is not available EU wide in the programming period. For illustration purposes we constructed a HNV index that consists of two components namely, a livestock density index and a crop diversity index. Those variables were determined by regional characteristics and do not have a direct spillover effect, although the HNV indicator has.

Spillover effects in water quality and nitrogen surplus

Water quality had a distinctive spill-over effect. Pollution emitted to a river flows downstream and pollutes the surface water on its way to the sea. Assuming that the NUTS regions are not defined based on the watersheds, water quality is a clear example of a spillover. The water quality status in a region affects the adjacent regions downstream.

Water quality was defined as nitrogen surplus per hectare, and was therefore tied to a territorial unit. Deposition of nitrogen (by air) is an element of nitrogen surplus and a clear spillover, because it is caused by nitrogen emitted to another location. Transport of manure, from farms with a manure surplus towards farms with a manure deficit, was included in the computation of N-surplus. Thus, a direct spill-over also existed.

Spillover effects in tourism

Spillover effects in tourism reflected indirect of a region's tourism industry due to tourism flows to other regions. In other words, tourism in a region benefited from regional tourism developments in their neighbouring regions. For our analysis, we explored the applicability of spillovers: demonstration effect, competition effect, market access spillovers, and joint promotion. The demonstration effect reflects the fact that tourism employers learn from neighbouring high productivity regions. Spillovers might be reflected in spatially lagged indicators such as tourism capacity and RDP spending. The competition effect deals with the attractiveness of a region, such as the presence of natural conservation areas or wetlands. Finally, market access spillovers usually occurred when regions with a high shares in the tourist market become overbooked, and neighbouring regions benefited. This impact also was expected at inbound tourism, not domestic tourism by definition. In addition, joint promotion of areas had a positive impact on tourism. The competition effect and market access spillovers were expected to occur in inbound tourism.

2.4 Spatial econometric models at the regional level

In theory, the models used in the EU 27 analyses can be applied at the level of cases studies as well. Due to data limitations, however, it turned out that impact indicators (as defined in the CMEF framework) are not (always) available at lower administrative levels in the different case studies. Instead, result indicators such as participation of farmers or other agents were present at lower administrative levels in most case studies (Viaggi, 2013).

The absence of reliable impact indicators forced the researchers to search for alternative specifications of the models in order to be able to analyse the effectiveness of measures based on result indicators. The models for the EU 27 analysis as presented in the previous sections were adjusted accordingly. In the case study regions three different types of models were used to analyse the presence of spatial dependence and spillover effects: participation models at two different levels (farmers or region) and spending models. All indicators require specific model specifications. Based on the generic specification on labour productivity, we specify the corresponding models in the case study areas. We only present the models for labour productivity, but similar adjustments can also be applied to the models for biodiversity, water quality and tourism. However, each model can be applied to other individual RDP measures across different axis.

Farmer's participation model

In the case of a farmers participation model, the participation in measure 121 (improving agricultural labour productivity) is analysed, where farmers participate (*P*=1) or not (*P*=0). The resulting model is a probability model (Probit or logit type of model) which explains the probability of participating in measure 121:

$$P^* = f(AGout, AGin, AGstruc, RURAL, REG, SPAT) + \varepsilon \quad (5)$$

With $P = 1 \; if \; P^* > 0$ i.e. if the farmer participates, and $P = 0 \; if \; P^* \leq 0$ if the farmer does not participate. P^* is unobserved.

AGout	= Agricultural output variables
AGin	= Agricultural input variables
AGstruc	= Agricultural structure variables
RURAL	= Rural characteristics
REG	= Regional characteristics
SPAT	= Spatial characteristics

Similar models can be used for the other RDP measures. The farmers' participation model identifies the explanatory variables that affect the probability of farmers participating in a specific RDP measure. The connection to the impact of the participation is ignored.

Participation model at the regional level

Participation can also be analysed at regional level. The participation rate (*R*) is defined as the number of farmers in the region participating over the number of (eligible) farmers in the region. The participation rate is a continuous variable between 0 and 1.

$$R = f(AGout, AGin, AGstruc, RURAL, REG, SPAT) + \varepsilon \quad (6)$$

If there are many extreme values (either 0 or 1) for the participation rate, then the specification becomes a censored model. This participation model only explains the participation rate of a particular area in a RDP measure. The connection to the impact of the participation is ignored.

Expenditure model

In addition to the participation models, we can also take into account the amount of spending per farmer or per region on a particular measure. Instead of a dichotomous choice or participation rate, a continuous amount is analysed (RDP). Note however, that it might be very likely that the spending is censored, and a Tobit type of model is appropriate (Desjeux *et al*., 2012). This expenditure model can be applied at both the farmer level and the regional level.

$$Expen = f(AGout, AGin, AGstruc, RURAL, REG, SPAT) + \varepsilon \quad (7)$$

The expenditure (*Expen*) model identifies the factors that affect the spending of a farmer or region. Alternatively, the two-stage Heckman approach can be used. In the first stage the participation model is explored and the inverse Mill's ration is only determined for the participants. In the second stage, the spending model is used for participants only (all with positive expenditures), where the inverse Mill's ratio is included as an explanatory variable to correct for the selection bias in the spending model.

Results

This work applied spatial econometrics at Result indicators of RDPs at the scale of programming authorities, using as observations the units at the lowest available aggregation level.

The case studies highlighted the relevance of spatial issues and the potential of spatial econometrics, but also revealed major limitations of application mainly due to data availability. These data limitations were not specifically spatial data limitations but rather the absence of common driving factors of RDP effects (Viaggi, 2013).

The data limitations concerned amongst others the impacts indicators from the CMEF framework at the suitable scale of analysis (farm or municipality). The lack of impact indicators hindered the opportunity to exploit assessments of RDP measures on impact indicators, and in particular those related to spill-overs in the category of causal chain impacts.

The interpretation of the analyses differs from the impact analyses in the EU27 analyses. The farmers' participation model and the participation rate model explain the participation which does not automatically results in impacts as defined within the CMEF framework, thus is a prerequisite for any impact. The spending model only explains the spending granted to a farmer or a region based on the characteristics of a region. Moreover, when analysing spillovers with a participation or expenditure models only provides information on the spillovers in participation or expenditure, not in the impact.

The case study analysis, however, identified (several) data and evaluation gaps, which in case of full availability could build the basis for further better oriented research and policy support activity. Issues like RDP-tailored model specification, matching with priority perception by decision-makers and the use of models' results for ex-ante analysis, have been further developed within the SPARD project, see Viaggi (2013) and the underlying case studies.

The main lessons learnt from the case study analyses are (Viaggi, 2013):

- Data availability is crucial for applying spatial econometrics to RDP evaluation;
- Different designs of measures are very relevant (e.g. measures targeting farms vs. measures targeting land use);
- A certain rate of participation is requires for exploring (spatial) econometric analysis and identifying spillover effects empirically;
- Particular measures (especially for Axis 3 measures) might have multiple target groups (farmers and non-farmers), which is not limited to one specific group of beneficiaries. The spillover effects might then not be expected and the usefulness of an analysis of spillovers is then limited.

2.5 Conclusions

The main conclusion of the case study analyses is that impacts are hardly assessed due to data limitations. CMEF output indicators such as participation at farm level or participation rates at municipality level are evaluated in most case studies. Impact indicators were incidentally analysed in France and Slovenia. As a consequence, the presence of spillovers are hardly tested in case study analyses, because the spillovers are expected to show up in analyses of the impact indicators. Regardless the analyses of impacts or participation, all analyses took into account spatial heterogeneity (spatial variables).

The basic models of the EU27 analyses for the assessment of the RDP spending in Section 2.2 could be applied at lower administrative levels under the condition that data on impact indicators and baseline indicators are available. In practice, it turned out that Impact indicators are only incidentally available at case study level. Information on Result indicators (participation and expenditure) is widely available at the case study level.

Further research in spatial modelling at case studies would include: suitable modelling of spatial contiguity for RDP-related spillovers; adaptation of spatial models to different concepts of dependent variables (participation, outcome, impact). However, consistent and complete data bases with impact and base line indicators are then required.

In the next Chapter, we will discuss the differences between the EU27 analysis and the case study analyses in more detail.

3 Issues of downscaling spatial econometric models

3.1 Introduction

In principle, the models used in the EU27 analyses can be applied at the level of cases studies as well. However, the application of the framework of the EU27 analysis turned out to be rather difficult for a number of reasons. This Chapter will discuss the overlapping elements and the differences between the EU27 analysis and the case study areas. Moreover, we discuss the consequences for the interpretation of the results. We discuss a number of items in this Chapter such as processes at different levels, the institutional settings, data, type of econometric model, and the scaling of results.

3.2 Scaling: Processes at different levels

Top down processes of defining the RDP according to the institutional scale that define the participation or participation rate in the case studies (see section 2.4). With RDP, the EU has defined an EU wide policy (in general broad objectives). An array of measures is proposed that can be selected by Member States based on their own priorities (related to the economic and environmental characteristics of the member state). The measures are targeted (by the regional government) for special groups to allow support along the lines of the Member State policy. The policy design of RDP is Member State specific.

The Logical Diagrams of Impact of Uthes *et al*. (2011) showed that the impacts can emerge at different processes with respect to the rural development programme, and that these occur at distinctive levels (see stages 5 and 6 in Figure 1). The magnitude of the impact is determined by a bottom up process that starts with the participation of farmers and entrepreneurs. The attractiveness of a measure for a farmer determines the participation rate. The farmer (or other potential recipient) decides whether he will apply for a subsidy for a RDP measure (see Figure 1). In the physical process the farmer changes the physical environment, as induced by a RDP measure (compared to the situation of non-participation). This will affect the physical aspects of the farm. The external effects (and the intended environmental effects) can affect the farm neighbourhood; for instance by a reduction of the N concentration in groundwater (Reinhard, et al., 2013) or by

- Physical spillovers
- Knowledge spillover
- Economic spillover – indirect effects.

For most measures, farmers and other entrepreneurs have changed their behaviour (management of the firm) based on the RDP. These changes have impacts on the region. Hence, each element of the impact of RDP is related to a level in spatial scale.

First of all, measures are targeted at specific stakeholders (i.e. farmers, entrepreneurs in tourism,). For instance, the Axis 3 measures have different target groups (farmers, tourism entrepreneurs, citizens).

Secondly, the level of analysis also affects the results of the (spatial) econometric analysis. In order to obtain adequate results, the level of analysis should correspond to the level of involvement as much as possible. Since the participation in measures is related to individual farmers or entrepreneurs, the most adequate level of analysis would be the micro-level analyses of individual farmers or entrepreneurs. However, an impact analysis at this level has hardly been feasible due to data constraints.

Thirdly, the summary of case studies made clear that there are differences in the way that the expenditures are distributed. Usually, farmers or entrepreneurs can apply individually. In Italy, however, cooperatives are organized at a different level than farmers or administrative boundaries. Those cooperatives often stimulate associated farmers to apply for subsidies to implement RDP measures. Italian examples are cooperatives for producing bio-energy (Axis 2) and infrastructure for tourism (Axis 3).

In addition, the impacts of RDP measures also show up at different levels than administrative levels. According to the CMEF framework for the different measures, the result, output and impact indicators are measure specific. Impact indicators, however, are not always adequately measured by indicators related to administrative boundaries (water quality, biodiversity). Moreover, the impact indicators related to administrative boundaries do not always adequately reflect the change of the impact indicators over time.

3.3 Institutional differences impact at different levels

The actual impact of measures will differ depending on the local environmental and institutional conditions. For instance, the current intensity of agricultural production will determine the effect of measures that will stimulate extensification of agricultural practices. Nearby urbanisation will affect measures in Axis 3 differently (Lange, Prior, Siebert, & Zasada, 2013). Some of these environmental and institutional conditions can be modelled explicitly, other have to be dealt with differently.

First of all, the appropriate level of analysis takes into account the level of the decision makers (farmers and other entrepreneurs) and the level of the expected impacts (see section 1.2 for a more extensive discussion). Secondly, the targeting of RDP funds differs across EU Member States.

At the EU27 level, the indicators used might suffer from aggregation bias, because local impacts of measured are unlikely to show up at the regional or national level.

One disadvantage of the farmer level analyses is that it is likely that the farmers all are influenced by a similar institutional setting. Different strategies for targeting cannot be taken into account if a regional analysis is explored. Within a EU27 analyses, elements of different targeting strategies can be taken into account. In the EU27 analysis, the impact of differences in institutional settings are included in country-specific dummy variables or in other country-related dummy variables.

3.4 Data at different levels

Data are gathered at different levels. Data can be aggregated to a higher level, but this leads to aggregation bias. Environmental data (e.g. water quality), for instance, is available at local and regional level. This information is difficult to aggregate in a meaningful way to higher levels (e.g. percentage of water bodies that fulfil requirements).

For the EU27 analyses, the impact indicators were collected in WP2. The data on RDP spending were collected in WP3 and a summary was published in (Uthes, et al., 2011). In addition to the impact indicators to be analysed and the expenditure data, relevant variables were collected from Cambridge Econometric (CE) database and Eurostat. Except for nutrient balance information, data were available at the NUTS2 level, and could be aggregated to higher levels, i.e. NUTS0 and NUTS1. For the expenditure data, we observed that not all RDP spending could be addressed at NUTS2 levels. Some RDP projects are not assigned to particular areas.

With respect to the CMEF framework, Eurostat collects data for several impact and base line indicators (COM, 2006). However, the data collection of Eurostat is focused on NUTS2 level data. This means that impact and baseline indicators are not necessarily available at lower administrative levels. As a consequence, exploration of the EU27 models at a lower administrative level is not straightforward and crucially depends on the availability of data at the appropriate administrative levels. Data for Impact and Baseline indicators have to be collected from national or regional data sources, such as the national statistical offices, and regional governments amongst others. Note that the data collection for case study analyses is not necessarily framed to fit into the CMEF framework for the evaluation of the RDP measures.

Economic data are available at firm level and at NUTS2 level and above (we will check how these data are constructed). In addition, the available level of spending data might differ across member states, see Uthes *et al*. (2011).

In the case studies, the impact indicators agricultural labour productivity, N-surplus, HNV farmland index and tourism were hardly available at lower administrative levels (NUTS 4 or 5), like municipalities. Only for the case studies in France and Slovenia, some impact indicators were used in spatial econometric analyses for the assessment of the effectiveness of RDP measures. For the other case studies, Result indicators (participation of individual farmers or participation rate of entrepreneurs) were more broadly available.

With the use of Result indicators at regional level or the use of data at individual entrepreneurs level, the level of measurement of indicators changes. For instance, at farmer level, uptake is a dichotomous variable (with the value equal to 1 for participating farmers and 0 otherwise). Another example is that the expenditure variables might be left-censored, because there are farmer’s or regions without expenditures on particular measures. The use of those type of Result indicators also required a different type of econometric model (see Viaggi, 2013, for a summary of models from case studies). Another problem arises if the indicator is scale invariant, which means that the aggregation of the indicator from levels is highly non-linear. Given the fact that result indicators are broadly available at case study level, we could also have attempted to use the case study models for the EU 27 analyses. This would have required that the Result indicators would be available for all NUTS2 areas in the EU27. Data on participation, however, is not (readily) available at NUTS2 level across the EU27, so that it is not possible to explore the use of a participation model at the EU27 level. The Eurostat database does not publish this kind of information.

3.5 Type of econometric model

Based on the previous chapters the possibilities of scaling the CSA results to a higher level will be elaborated. RDP is defined at EU level. Measures are selected at member state or regional level. Locally relevant policy design components (e.g. zoning and targeting) will affect the impact of RDP measures. These differences in policy design have to be taken into account when comparing results of case studies mutually or comparing case study results with results of EU27 analyses.

In theory, the same econometric models can be used at different scale levels. When including fixed effects, for example, different general characteristics of the different scale levels can be accounted for. However, at the lower level it might be difficult to have enough (spatial) observations to be able to run a robust model. Regional information is increasingly made available: for the NUTS2 regions a wide range of variables is available, and also for NUTS3 regions this is increasing. However, when looking at municipalities or even lower scale levels, data availability differs very much between countries and even between regions.

If the number of spatial observations is too small, instead of a spatial lag or error type of model, which uses information about neighbours, certain dummies can be used to account for spatial effects. A dummy variable can capture geographical effects, such as nearby mountains, coasts, rivers, etc., but also distances to a large city or being located along a (national) border.

In contrast, the participation models cannot be up scaled to an EU27 analysis, because the CMEF Output indicators (participation) are not readily available at the local level.

3.6 Scaling the results of CSAs

A model is a simplification of reality. This simplification is done by making all kinds of assumptions, by focusing on a small aspect of reality or on a particular region. Many models, for example, look only at one type of agent, one sector, one year, one country, or one region. Sometimes multiple sectors, multiple years or multiple regions are taken into account, but this quickly adds to the complexity of the model. That is why it is often difficult to generalize conclusions from one level to the other.

The main reasons why results are different for different spatial levels are:

- at different levels, different mechanisms play a role; labour productivity at the national or farm level are affected by totally different factors and thus a model explaining the level of productivity will be very different as well.
- at different levels, different information is available;
- at different levels, different types of spill-overs take place.

Let us assume that we are interested in labour productivity in the agricultural sector. A model that focuses at the national level within the EU would have levels of the national labour productivity as dependent variable. For the independent variables we could think of things like average education level, average climate, kinds of agricultural activities and perhaps average level of technologies, as described in Reinhard *et al*. (2013). However, when we focus on a set of regions within one country, these national (average) levels would not make sense anymore since they are the same for each region. Instead local variability in climate could be used, specific types of agriculture, but also things like accessibility, distance to a large city, presence of local organizations or leadership etc. When looking at a set of regions in different countries, probably a mix of these independent variable should be used, since national differences matter, as well as local ones.

But, probably it will be difficult to find (many) local variables that are comparable between different countries, simply because different independent variables are relevant. Paelinck (2000) in his article on aggregation in spatial econometric modeling, concludes that “in practical work, one has to limit oneself to the statistically available aggregate data”, even if these often rest on heterogeneous types of spatial aggregation, which can cause certain biases. When a model at the NUTS0 level shows how education level significantly affects labour productivity, this might not be the case for the region a case-study is looking at, it might not even be the case for the country of that specific case-study. However, the way to deal with it is to take the aggregation bias explicitly into account, for example by using composite parameters such as region dummies, or differential spatial regimes.

Finally, at different levels, spatial spill-overs will differ. Within SPARD, we expected to find more or at least stronger spatial spill-over effects for the case-studies. The reason was mainly, that at this level we hoped to be able to use the right information for the right econometric model, tailored to the specific local situation. Unfortunately, in most cases, this appeared to be more difficult than expected. On the other hand, even if we would have found important significant results, it would still not have been possible to simply translate them back to the EU level. Not only should different processes be taken into account at the EU level, as we discussed above; more importantly, the definitions of neighbors will differ – a regional spatial weight matrix is not simply an aggregation of a lower level matrix (Anselin, 2002).

4 Concluding remarks

Spatial econometric approaches for the impact assessment of the effectiveness of RDP measures can be applied at different scale levels. Spatial econometrics is a suitable method to study spillover effects. Unfortunately, the application of the methodology is limited by data constraints: insufficient data available at the appropriate level of the system:

Indicator	Level of system	Scale (level of spillovers)
Agricultural labour productivity	Farmer	Municipality
Biodiversity	Region or landscape (geo-biophysical units)	Region (higher level)
Water quality	Water body	Catchment or river basin
Tourism	Municipality	Region (province)

The impact analysis is preferably explored at the system level, which corresponds to the level of decision making (farmers and entrepreneurs) and the level at which the expected impacts are witnessed. Impacts differ across measures, because the impact indicators of measures relate to different scale levels (agricultural labour productivity at farm level, water quality at catchment or national level, biodiversity at municipality level, and tourism at municipality level).

The CMEF framework seems to focus on higher level assessments (NUTS-2), although it recognizes the bottom up process. Spatial spillovers are expected to show up within system-level assessments, which are lower levels than the NUTS2 levels. Higher level assessments might ignore the local effects of the RDP measures. On the one hand, differences in institutional settings cannot be measured at case study level. On the other hand, EU level analyses can take into account institutional settings.

The econometric models applied to impact indicators at NUTS2 level for the EU27 can be explored at the level of expected spatial spillovers. These spillovers might show up at municipality level for provinces or countries under the condition that the relevant Impact indicators and Baseline indicators are available at the lower level;

Data availability for case study analyses relies on the data collection of national statistical offices. The Impact indicators were not available at case study level except for France and Slovenia. For instance, the number of nights spent are available at municipality level in the Netherlands, but are not centrally collected. The case study models mainly focussed on farmer's participation and participation rate models. Participation models cannot be applied at the EU level because data is absent. In particular, participation rates are not (readily) available for all NUTS2 areas in the EU27.

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