**Modelling Rural Economies (MORE)"Spatial policy impact analysis of rural development in NUTS 3 regions"**

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#### Abstract

This paper suggests a spatial impact analysis for Nomenclature of Territorial Units for Statistics 3 (NUTS 3) regions with the objective of capturing local rural/urban effects of the Common Agricultural Policy (CAP). The paper first builds a set of rural-urban SAMs for twelve NUTS 3 regions distributed across the EU, using official statistics and expert information locally available. With the help of CAP's Pillar I and Pillar II information at NUTS3 level, the SAMs are further used in a linear Computable General Equilibrium model for simple policy simulations. Finally, we identify backward and forward structural linkages as well as key sectors in each regional economy and we design an experiment consisting in exogenously shocking the demand of any combination of endogenous activities in the original SAMs, in order to capture the impact of the Common Agricultural Policy (CAP) in each NUTS3 for 2007.

**Keywords**: Social Accounting Matrix, Linear Multiplier Model, Common Agricultural Policy, Impact Analysis.

**1. Introduction**

This paper covers an extension of the previously developed RURAL ECMOD project (<http://agrilife.jrc.ec.europa.eu/rural_ecmod.htm>) by:

* Building additional case studies so as to further enhance the understanding of regional economies by selecting a representative sample of twelve NUTS3 areas.
* Constructing expert NUTS3 Social Accounting Matrices (SAM) and working on the disaggregation of rural and urban activities.
* Collecting and processing information about Common Agricultural Policy (CAP) – Pillar 1 and Pillar 2 – at NUTS3 level.
* Running policy simulations for selected regions within a SAM framework in order to illustrate the potential estimated impacts of the Common Agriculture Policy.
* Building three additional non-expert NUTS3 SAM prototypes using a less exhaustive and automatic procedure and comparing the accuracy of this approach with the expert approach.

**2. Data availability and methodology**

2.1 Data availability

For constructing twelve rural-urban ('rurban') NUTS3 SAMs we have tried to use the full set of statistical (Input Output Tables – IOT – or existing SAM material from national and/or regional official statistical offices) and expert information locally available, always linking this information with official statistics. After careful examination and a discussion between IPTS and researchers regarding possible case studies, we have preferred a selection criteria based on a clusters’ classification to further enhance the understanding of regional economies.

Following Raggi et al. (2013) different clusters are distinguished: Cluster 1 includes provinces classified as intermediate urban/rural, economically diversified, with high accessibility and high gross domestic product (GDP). Cluster 2 contains rural provinces agriculturally dependent, with good accessibility and high GDP. Cluster 3 takes into account NUTS3 predominantly rural and agriculture dependent, with low accessibility and low GDP. Cluster 5 contains rural NUTS3, strongly economically dependent from agriculture with the lowest accessibility index and low GDP. Cluster 6 consists of urban and intermediate provinces with low GDP, intermediate accessibility and intermediate economic diversification.

The list of regions and clusters are presented below:

Table 1. NUTS3 regions and clusters’ classification.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **EU CODE** | **NAME** | **CLUSTER** |
| 1 | DE935 | Lüneburg | 1 |
| 2 | UKH13 | Norfolk | 1 |
| 3 | DE138 | Konstanz | 1 |
| 4 | SI022 | Gorejnska | 2 |
| 5 | SE124 | Örebro | 2 |
| 6 | HU312 | Heves | 3 |
| 7 | EE004 | Lääne-Eesti | 3 |
| 8 | ES241 | Huesca | 5 |
| 9 | PT172 | Península de Setúbal | 6 |
| 10 | PL631 | Słupski | 3 |
| 11 | NL131 | Noord Drenthe | 2 |
| 12 | FR522 | Finistère | 2 |

Source: Own elaboration.

2.2 SAMs at NUTS3 level

Social accounting matrices (SAM) are databases comprising economic transactions which allow us to extract information on the different economic agents such as producers, consumers, the government and the foreign sector; as well as on the behaviour of productive factors and institutions. They complete the information provided by the input-output analysis.

The interest on SAMs is based on the fact that not only do they study the production relationships among the economic sectors but also the transactions that take place among the different institutions of an economic system in terms of revenues or consumption. Besides their statistical content, which enables us to close the circular flow of income, the SAMs have become a useful tool for evaluation of policy interventions in national or regional frameworks.

Moreover, it is feasible to carry out a complete analysis of the productive structure of the economy and also to obtain a general perspective of the changes in terms of importance of key sectors that have occurred. Next, we present technical details regarding the 12 cases of NUTS3 regions. The estimate of the NUTS3 SAM is obtained using a two-step process: first, input-output frameworks have been regionalised (i.e. Supply, Use and Symmetric tables) from the NUTS 1 or countries concerned, using the EURO method (Beutel, 2002, 2008 and Eurostat, 2008). Subsequently, we finalise the SAM estimation of the NUTS3 based on the SUT and additional information.

2.2.1 The EURO method for regionalising Supply and Use Tables

The general balancing problem of matrices basically consists of knowing one single base table (be they SUTs, SIOTs and/or SAMs) and at least the row and column totals for the unknown table that has to be estimated[[1]](#footnote-1). There are two different ways to approach this under-determined problem where unknowns (e.g. elements of the interior tables) outnumber external constraints:

* in the form of row and column totals[[2]](#footnote-2), e.g. the RAS[[3]](#footnote-3) or bi-proportional scaling methods;
* the constrained optimisation methods (Lenzen et al., 2009).

The RAS[[4]](#footnote-4) method was first described by Stone (1961), Stone and Brown (1962) and used extensively by Bacharach (1970) to update an old given input-output table to a more current or even future period for which only the row and column totals are given (Mínguez et al., 2009). The basic idea of RAS was firstly developed to be used with input-output tables and particularly, with the intermediate inputs matrix. It consists in changing the structure of the known base table as little as possible (Bacharach, 1970). Similarly, Hewings (1969, 1977) used bi-proportional techniques to the problem of regionalizing a national input-output table given some row and column totals at the regional level. Later on, Oosterhaven et al. (1986) combined both ideas to solve the problem of updating interregional input-output tables. In addition, there is an extensive literature on the several improved versions of the RAS method: GRAS (Generalised RAS - Junius and Oosterhaven, 2003; Lenzen et al. 2007; Temurshoev et al., 2013); TRAS (Third stage RAS - Gilchrist and St.Louis, 1999, 2004); ERAS (Israilevich, 1986); MRAS (Modified RAS - Paelinck and Waelbroecj, 1963); CRAS (Cell Corrected RAS - Mínguez et al., 2009 and Oosterhaven et al., 2011); and KRAS (Konfliktfreies RAS - Lenzen et al., 2009). On the other hand, constrained optimisation methods have also been used prominently in the literature for updating input-output tables (Stone et al., 1942; Harrigan and Buchanan, 1984; and Tarancón and del Río, 2005, amongst others).

However, none of the two types of methods have been applied to the context of SUTs; they have been focused on SIOTs and/or direct technical coefficients instead (with the exception of Dalgaard and Gysting, 2004). But probably the most important drawback to use any of them in our project is that they require the row sums of SUTs to be known (e.g. commodity output), which is unrealistic even for a nation.

To circumvent this issue, there are one-sided RAS-type methods (e.g. EUKLEMS method as described in Temurshoev et al., 2011) or the so-called SUT-RAS method (Temurshoev and Timmer, 2011) that could have been used here when only industry output (column sums) is known. But similarly to our earlier argumentation, since information on industry output is not available at the NUTS3 level either in terms of value added by industry or GDP, another approach was followed in this report.

Ultimately, the literature provides the Euro method as a way to estimate SUTs and SIOTs with the minimal information as possible, which is indeed our case in this project. Actually, this is the only existing method that allows the estimation of SUTs and SIOTs without given row and column totals. The Euro method (as conceived originally) aims at updating SIOTs at basic prices from one year to another and it is based on a previous version initially developed by Beutel (2002) for Input-Output Tables and further explained by the Eurostat Manual of Supply, Use and Input-Output Tables (2008, Ch. 14).

The Euro method is a robust update procedure with low cost and with limited data requirements. It exclusively uses official data and integrates all quadrants of SIOTs. Row and column totals for intermediate consumption and output and the corresponding final demand structure are derived endogenously, not allowing for arbitrary changes of input-output coefficients. The method is fully consistent with supply and demand through the so-called Leontief quantity model (Eurostat, 2008). Therefore, it is sustained on economic grounds rather than on optimisation and/or pure mathematical techniques.

More recently, Temurshoev et al. (2011) formalised a SUTs variant of the Euro method based on Beutel (2008); besides, Beutel and Rueda-Cantuche (2012) further elaborated a more detailed version to be used in practice by Eurostat. Yet, in line with the pioneering works of Hewings (1969, 1977), we will formulate an adapted version of the latter to be used in this project for the regionalisation of supply and use tables.

So, the projected SUTs are based on regionalisation rates[[5]](#footnote-5) of macroeconomic measures of:

1. value added by industry;
2. total ﬁnal demand by use;
3. total taxes less subsidies on products;
4. total imports.

For total imports at NUTS3 level, we have used the ESTAT data on road freight transport loading (exports) and unloading (imports) in physical terms and made a ratio over the whole country (in physical terms). The method uses these ofﬁcial statistics as exogenous inputs, and replicates them in the derived SUTs. This method involves minimum data requirements, which is appropriate provided the lack of macroeconomic data available at NUTS3 level.

As a novelty, the Euro method has been used in this project as a method for regionalisation while it was originally designed and has, to our knowledge, been only applied for updating SIOTs and/or SUTs and projections. In what follows, we present an adapted and more detailed explanation of the Euro method for SUTs regionalisation mostly based on Temurshoev et al. (2011) description of the Euro method for updating SUTs.

The initial SUTs (typically at the NUTS1 or NUTS2 levels) consist of the following components all expressed at basic prices:

a) Domestic and imported intermediate use matrices (commodity × industry),

b) Domestic and imported ﬁnal demand matrices (commodity × category of final use),

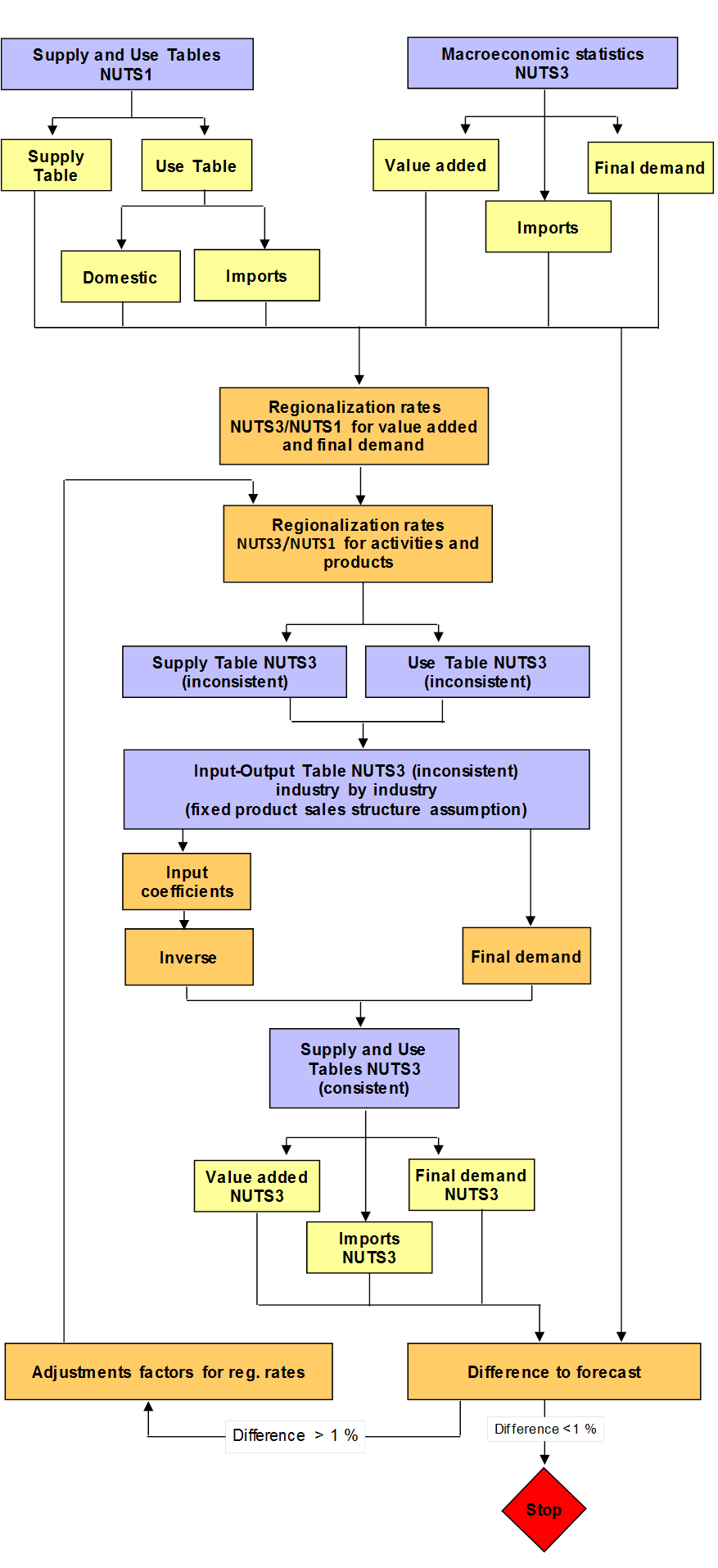
c) Supply matrix (commodity × industry),

d) Vector of total value added of industries (industry × 1)

e) Vector of total taxes less subsidies on products by industries and final use categories

Furthermore, the following macroeconomic statistics for the SUTs at the NUTS3 level are needed: the regionalisation rates of value added per industry, ﬁnal demand totals by use category, total taxes less subsidies on products and total imports. The listed data requirements mean that the vectors of value added per industry, totals of ﬁnal demand categories and aggregate values of taxes less subsidies on products and imports need to be known at the NUTS3 level, too. Following the same line as Thissen et al. (2010), we have used information on interregional transport flows to estimate regional imports and exports. However, Thissen et al. (2010) used more sophisticated methods that might likely be out of the scope of the aims of this project.

Figure 1.Euro method for regionalising SUTs.



Source: Own elaboration based on Beutel and Rueda-Cantuche (2012).

Each of the iterations of the Euro method consists of two steps. The ﬁrst step of the ﬁrst iteration deﬁnes domestic and imported intermediate and ﬁnal uses, the vector of value added, the vector of taxes less subsidies on products, and the supply matrix of the projected SUTs. This first estimation of the (unbalanced) use table is basically a cell-wise arithmetic average resulting from multiplying the corresponding regionalisation rates to the rows and columns of the initial use table. Subsequently, the total commodity output (from the estimated use table) is allocated row-wise proportionally to the initial supply table (i.e. constant market shares) in order to obtain the first estimation of the supply table at NUTS3 level. The total industry outputs and inputs are not equal after this ﬁrst step (column sums of projected supply and use tables). To make the derived SUTs consistent, it is assumed that the domestic and imported input structures of industries and the totals of commodities’ ﬁnal uses from the ﬁrst step are valid. Given this assumption, the so-called ﬁxed commodity sales structure model determines consistent industry output and input levels (Eurostat, 2008, Model D, p. 351). This second step ensures consistency of the industry outputs and inputs, and commodity supply and demand but however, it deviates from macroeconomic statistics, i.e.: value added per industry, final uses of categories, total value added and total imports.

The regionalisation rates initially used are then adjusted in an iterative procedure in order to make the difference between the actual and projected (in each of the iterations) regionalisation rates minimal (less than 1%). The observed deviations are used to correct these rates in such a way that it should ensure that if the model overestimates (underestimates) the available macroeconomic statistics, the corresponding regionalisation rates are decreased (increased). This is done through the so-called correction factors (see Eurostat, 2008 for details). Then, the ﬁrst step of the second iteration computes the projected SUTs components as in the first iteration, i.e.: domestic and imported intermediate and ﬁnal uses, the vector of value added, the vector of taxes less subsidies on products, and the supply matrix of the projected SUTs. As was the case with the first step of the ﬁrst iteration, the results do not ensure the equality of industry outputs and inputs. The consistent industry outputs and inputs are again found using the ﬁxed commodity sales structure model, which is then used to derive the consistent SUTs of the second iteration in exactly the same manner as deﬁned earlier for the first iteration. However, note that now the domestic and imported input structure matrices are derived from the outcomes of the ﬁrst step of the second iteration. As a result, one obtains a new deviation vector, which quantiﬁes the difference of the projected regionalisation rates from the macroeconomic statistics. If the difference between the actual and projected regionalisation rates is acceptable, the resulting SUTs are the ﬁnal outcome of the Euro projection. Otherwise, the steps of the second iteration are repeated until the projected variables resemble (closely or perfectly) those of the macroeconomic statistics. It is important to note that each such subsequent iteration begins with computing new correction factors, which are then used to correct the regionalisation rates from the previous iteration. The convergence in the Euro method can always be found by changing the tolerance level until convergence is reached. The last important point concerning the Euro method is that it requires that the number of industries and commodities have to be equal. Thus, even if the Euro method distinguishes between products and industries, it does not allow for rectangular SUTs estimation[[6]](#footnote-6).

The data requirements of the EURO method are the following for the NUTS3 case studies:

1. Gross value added by industry;
2. Taxes less subsidies on products (total);
3. Final demand components (totals), including exports;
4. Total imports.

Next, we explain the data sources and methods used in the calculation of the necessary data for the projections:

* Gross value added by industry

It is not very common no easy to find detailed data on gross value added by industry at NUTS3 level. In this project, we will use a breakdown of 6 products/sectors (see below), which will be split up to 13 products/sectors according to the NUTS1 or NUTS2 shares, depending on the available information (see below for the details about the 13 products/sectors).

List of products/sectors from original data source:

1. Agriculture, forestry and fishing
2. Manufacturing industry
3. Construction
4. Trade, transport and telecommunications
5. Finance, renting and business services
6. Public services and other services

List of products/sectors of the Project MORE:

1. Agriculture[[7]](#footnote-7)
2. Forestry
3. Fishing
4. Mining
5. Food and beverages
6. Other manufacturing activities
7. Utilities
8. Construction
9. Trade
10. Hotels and restaurants
11. Transport and telecommunications
12. Other private services
13. Public services

* Taxes less subsidies on products (total)

Provided that GDP is available for NUTS3 regions, its difference with respect to the total sum of gross value added at basic prices (also available) makes the overall total of taxes less subsidies on products.

* Final demand components and imports

Gross Domestic Product (GDP) is defined as the sum of: final consumption of households; final consumption of government and non-profit institutions serving households; gross capital formation (investment) and net exports (exports minus imports).

Therefore, by using such definition of GDP, we split up the value of GDP for NUTS3 regions using the shares of GDP’s components from the NUTS2 or NUTS1 regions (wherever available). As an example (see Table 2), the Baden-Württemberg (NUTS2) shares of GDP’s components are given below as well as the GDP of Konstanz (NUTS3) for 2007 and the corresponding calculation of its final demand total by category.

However, we are interested in calculating exports and imports separately and not as net exports. In order to do so, we estimate NUTS3 exports and NUTS3 imports according to the NUTS3/NUTS1 share of the ESTAT data on road freight transport loading (exports) and unloading (imports). As a result, in a second step, net exports are re-calculated and the other final demand components adjusted accordingly.

Table 2. Final demand.

|  |  |  |
| --- | --- | --- |
|  | **Baden-Württemberg** | **Konstanz** |
|  | Share of GDP´s final demand components | Values (Mio. €) |
| Consumption of households | 54.4% | 4,328.71 |
| Consumption of Public Administration and Non Profit Institutions Serving Households | 15.3% | 1,221.22 |
| Gross capital formation | 18.4% | 1,463.84 |
| Net exports | 11.9% | 947.91 |
| **GDP** | **100%** | **7,961.68** |

Source: Own elaboration

**2.2.2 Construction of NUTS3 Social Accounting Matrices**

For the construction of the NUTS3 SAMs, we initially develop a basic SAM information linking the input-output framework previously estimated closing economic flows between productive sectors, commodities and institutional sectors. To do this, we use additional information, most of it from Eurostat in order to achieve greater uniformity in the estimation of the matrices for all NUTS3 analysed. However, when it is necessary to obtain more specific information, we obtain it from local or national statistical offices. The basic sources used are:

* Allocation of primary and secondary income account of households by NUTS1 and NUTS2 regions. (e. g. Baden-Württemberg/Freiburg-Konstanz). Eurostat.
* Income of households by NUTS2 regions (e.g. Freiburg-Konstanz). Eurostat.
* Compensation of employees by NUTS2 regions (e.g. Freiburg-Konstanz). Eurostat.
* Employment by NUTS3 regions. Eurostat.
* Non-financial transactions (e.g. Germany-Konstanz). Eurostat.
* Gross domestic product (GDP) at current market prices by NUTS3 regions. Eurostat.
* Gross value added at basic prices by NUTS3 regions (NACE\_R1). Eurostat.
* Disposable income of households. National statistical offices (e.g. Konstanz: VGR der Länder: Regionaldatenbank Deutschland).
* Input-Output tables at NUTS1 or country level (e.g. Germany 2005. Eurostat and OECD).

This information is incorporated into the provided input-output framework, obtaining a first version of the matrix for each NUTS3. Small discrepancies that may arise in the estimation process are corrected by using a simple technical adjustment through RAS. The result is a NUTS3 level basic SAM composed by the following accounts:

Table 3. NUTS3 SAM accounts.

|  |  |
| --- | --- |
| * A.0-1 | Agriculture, hunting and related services |
| * A.0-2 | Forestry, logging and related services |
| * A.0-3 | Fish |
| * A.0-4 | Mining |
| * A.0-5 | Food industries |
| * A.0-6 | Other manufacturing |
| * A.0-7 | Utilities |
| * A.0-8 | Construction |
| * A.0-9 | Trade |
| * A.0-10 | Hotels and restaurants |
| * A.0-11 | Transport and communication |
| * A.0-12 | Other private services |
| * A.0-13 | Public services |
| * C.0-1 | Products of agriculture, hunting and related services |
| * C.0-2 | Products of forestry, logging and related services |
| * C.0-3 | Fish |
| * C.0-4 | Mining |
| * C.0-5 | Food industries |
| * C.0-6 | Other manufacturing |
| * C.0-7 | Utilities |
| * C.0-8 | Construction |
| * C.0-9 | Trade |
| * C.0-10 | Hotels and restaurants |
| * C.0-11 | Transport and communication |
| * C.0-12 | Other private services |
| * C.0-13 | Public services |
| * L | Labour |
| * K | Capital |
| * ANT | Activity net taxes |
| * CNT | Commodity net taxes |
| * INT | Income net taxes |
| * H | Households |
| * E | Enterprises |
| * G | Government |
| * IS | I-S |
| * ROW | Rest of the World |

Source: Own elaboration

The only exception in this initial procedure is the SAM for Huesca (Aragon, Spain), that comes from a previous experts version for 2005 and that has simply been updated to 2007 using basic information from Eurostat and RAS adjustment.

Basic SAMs for each NUTS3 can be extended to successively incorporate accounts and sectors needed to perform the required analyses of the corresponding regions. For this, the basic SAM accounts are disaggregated by block, using new information, almost entirely from Eurostat to achieve the greatest possible homogeneity:

* Farmland: number of farms and areas by economic size of farm (ESU) and NUTS2 regions [ef\_lu\_ovcropesu].
* Agricultural accounts according to EAA 97 Rev.1.1 by NUTS2 regions [agr\_r\_accts].
* Mean annual earnings by economic activity, sex, occupation [earn\_ses06\_49]. Countries level.
* Employment by occupation and economic activity [lfsa\_eisn2]. Countries level.
* Structure of consumption expenditure by degree of urbanisation (COICOP level 2) (1 000) [hbs\_str\_t226]. Countries level.
* Mean consumption expenditure by degree of urbanisation (in PPS) [hbs\_exp\_t136]. Countries level.
* Household characteristics by urbanisation degree [hbs\_car\_t315]. Countries level.
* Population in Rural Areas (NUTS2-3 level). Eurostat Regional Statistics. Rural Development Indicators.
* Employment (in persons) by rural/urban typology. NACE R1. [urt\_e3empl95]. Countries level.
* Gross value added at basic prices NACE R1 [urt\_e3vabp95]. Countries level.

Here it is necessary to specify the information required to distinguish between rural and urban activities. The first ones are those developed in rural areas, while the latter are those that are based in urban areas.

To determine which areas are urban and which are rural, we take as a reference the database DGURBA2011[[8]](#footnote-8) which provides information on new classification of urbanisation[[9]](#footnote-9). The LAU2 types 1 or 3 are classified directly as urban or rural, respectively, while type 2 are classified using a threshold of 30,000 inhabitants (below this threshold will be considered rural and when over, it will be classified as urban). This typology allows fitting the objectives of the study to better distinguish between cases within ‘intermediate’ areas.

It is very difficult to obtain aggregated and homogeneous accurate information for this split for all cases. We therefore have used an estimate based on a private database from companies at the highest level of geographical disaggregation. Here we use Orbis (by Bureau van Dijk). This database distinguishes number of businesses by industry (NACE R1-R2) at the equivalent of LAU2 level or similar. We have completed the necessary information base with LAU2 demographic data and other Eurostat’s official statistics of predominantly rural, intermediate and predominantly urban areas.

With these data the percentages of rural and urban habitats represented in each sector in each NUTS3 are obtained, which allows the disaggregation between rural and urban sectors in the respective SAMs. This disaggregation based on the number of companies shows an adequate representation of the economic reality of each region as a distinction between rural and urban areas.

For the distinction between large and small farms, we have used data on the number of farms and areas by economic size of farm (ESU) and NUTS 2 regions and Agricultural accounts According To EAA 97 Rev.1.1 by NUTS 2 regions, both available from Eurostat. The threshold of 16 ESU is used to distinguish between large and small farms for all regions. While we acknowledge that such assumption may lead to inaccuracies in the description of farm sectors across the EU, it is necessary to protect some strong degree of data homogeneity.

Regarding the SAM estimations, we must also take into account that the time periods for which we have the additional statistical information do not always coincide with 2007, that is the reference year. In such cases, the nearest periods have been taken and we have always worked using ratios because they are more stable than absolute values.

Finally, once accounts are disaggregated, we apply the Cross Entropy Method to achieve the final adjustment for the final version of the SAMs at NUTS3 level. The Cross Entropy Method (CEM) was published by Robinson et al. (2001). In comparison with RAS estimation method, CEM is more flexible, cost-efficient and consistent with all the information provided by national accounts and other resources. This method has been extensively used in the literature and can also consider relationships to be incorporated into the estimation model as additional restrictions[[10]](#footnote-10).

Finally, the structure of the NUTS3 SAMs comprising 63 accounts, structured as follows:

Table 4. Structure of the NUTS3 SAM for 2007.

|  |  |  |
| --- | --- | --- |
| Rural activities | A.0-1\_1\_R | Small arable crops farms\_Rural |
| A.0-1\_2\_R | Large arable crops farms\_Rural |
| A.0-1\_3\_R | Small permanent crops farms\_Rural |
| A.0-1\_4\_R | Large permanent crops farms\_Rural |
| A.0-1\_5\_R | Small other farms\_Rural |
| A.0-1\_6\_R | Large other farms\_Rural |
| A.0-2\_R | Products of forestry, logging and related services\_Rural |
| A.0-3\_R | Fish\_Rural |
| A.0-4\_R | Mining\_Rural |
| A.0-5\_R | Food industries\_Rural |
| A.0-6\_R | Other manufacturing\_Rural |
| A.0-7\_R | Utilities\_Rural |
| A.0-8\_R | Construction\_Rural |
| A.0-9\_R | Trade\_Rural |
| A.0-10\_R | Hotels and restaurants\_Rural |
| A.0-11\_R | Transport and communication\_Rural |
| A.0-12\_R | Other private services\_Rural |
| A.0-13\_R | Public services\_Rural |

|  |  |  |
| --- | --- | --- |
| Urban activities | A.0-1\_1\_U | Small arable crops farms\_Urban |
| A.0-1\_2\_U | Large arable crops farms\_Urban |
| A.0-1\_3\_U | Small permanent crops farms\_Urban |
| A.0-1\_4\_U | Large permanent crops farms\_Urban |
| A.0-1\_5\_U | Small other farms\_Urban |
| A.0-1\_6\_U | Large other farms\_Urban |
| A.0-2\_U | Products of forestry, logging and related services\_Urban |
| A.0-3\_U | Fish\_Urban |
| A.0-4\_U | Mining\_Urban |
| A.0-5\_U | Food industries\_Urban |
| A.0-6\_U | Other manufacturing\_Urban |
| A.0-7\_U | Utilities\_Urban |
| A.0-8\_U | Construction\_Urban |
| A.0-9\_U | Trade\_Urban |
| A.0-10\_U | Hotels and restaurants\_Urban |
| A.0-11\_U | Transport and communication\_Urban |
| A.0-12\_U | Other private services\_Urban |
| A.0-13\_U | Public services\_Urban |

|  |  |  |
| --- | --- | --- |
| Commodities | C.0-1\_1 | Arable crops products |
| C.0-1\_2 | Permanent crops products |
| C.0-1\_3 | Other agricultural products |
| C.0-2 | Products of forestry, logging and related services |
| C.0-3 | Fish |
| C.0-4 | Mining |
| C.0-5 | Food industries |
| C.0-6 | Other manufacturing |
| C.0-7 | Utilities |
| C.0-8 | Construction |
| C.0-9 | Trade |
| C.0-10 | Hotels and restaurants |
| C.0-11 | Transport and communication |
| C.0-12 | Other private services |
| C.0-13 | Public services |
| Factors | SL | Skilled Labour |
| UL | Unskilled labour |
| K | Capital |
| Taxes (net) | ANT | Activity net taxes |
| CNT | Commodity net taxes |
| INT | Income net taxes |
| Institutional sectors | RH | Rural households |
| UH | Urban households |
| E | Enterprises |
| G | Government |
| Investment / Save | IS | I-S |
| Rest of the world | ROW | Rest of the World |

Source: Own elaboration.

**3. Mapping policies and economic structures**

A survey of the CAP implementation at NUTS3 level is now presented (financing period 2007-2013 and 2000-2006 when possible): Pillar 1 payments, Pillar 2 payments per axis (programmed and executed), National Payments (RD or other national measures) and private RD share.

3.1 Data collection of CAP Pillars 1 and 2 spend

To assess the effects of the CAP in the analysed regions, we collect the expenditure on programs and measures included in Pillar 1 and Pillar 2. For Pillar 1, we estimate funding from the European Agricultural Fund for Guarantee (EAFG). For the allocation of EAGF aid, we take the amounts specified by item in the corresponding budgets for each NUTS3. Data are directly provided by the Commission regarding these items and covering the periods 2007-2011. The level of disaggregation used is as follows

* 50201 Cereals
* 50202 Rice
* 50203 Refunds on non-Annex 1 products
* 50204 Food programmes
* 50205 Sugar
* 50206 Olive oil
* 50207 Textile plants
* 50208 Fruit and vegetables
* 50209 Products of the wine-growing sector
* 50210 Promotion
* 50211 Other plant products/measures
* 50212 Milk and milk products
* 50213 Beef and veal
* 50214 Sheep meat and goat meat
* 50215 Pig meat, eggs and poultry, bee-keeping and other animal products
* 50216 Sugar Restructuring Fund
* 50301 Decoupled direct aids
* 50302 Other direct aids
* 50303 Additional amounts of aid
* 50304 Ancillary direct aids (outstanding balances, small producers, agri-monetary aids, etc.)
* 50701 Control of agricultural expenditure
* 50702 Settlement of disputes

These amounts are distributed within each region by sector in order to assess the economic impact of these funds. Specifically, they are distributed among the agricultural production sectors considered in the SAM estimates:

• Small arable crops farms

• Large arable crops farms

• Small permanent crops farms

• Large permanent crops farms

• Small other farms

• Large other farms

The way to make this distribution is based on the participation of these subsectors in the structure of the agricultural sector in each NUTS3 with reference to the same distribution of production and consumption used in the breakdown on the corresponding SAM. Therefore, the distribution of these funds is based on the number of farms and their areas by economic size of farm (ESU) and accounts Agricultural according to EAA 97 Rev.1.1, data obtained from Eurostat.

Regarding Pillar 2, the European Agricultural Fund for Rural Development (EAFRD), budget data at NUTS3 level are provided by the European Commission (JRC.IPTS) for expenditure between 2007 and 2011. These data provide the amounts from the rural development fund for each disaggregated NUTS3 by the different measures specified in each area:

Table 5. EAFRD axes and measures

|  |  |  |  |
| --- | --- | --- | --- |
| 1. Improving the competitiveness of agriculture and forestry sector | Human Resources | 111 | Vocational training and information actions |
| 112 | Setting up of young farmers |
| 113 | Early retirement |
| 114 | Use of advisory services |
| 115 | Setting up of management, relief and advisory services |
| Physical capital | 121 | Modernisation of agricultural holdings |
| 122 | Improvement of the economic value of forests |
| 123 | Adding value to agricultural and forestry products |
| 124 | Cooperation for development of new products, processes and technologies in the agriculture and food sector and in the forestry sector |
| 125 | Infrastructure related to the development and adaptation of agriculture and forestry |
| 126 | Restoring agricultural production potential |
| Food quality | 131 | Meeting standards based on EU legislation |
| 132 | Participation of farmers in food quality schemes |
| 133 | Information and promotion activities |
| Transitional measures | 141 | Semi-subsistence farming |
| 142 | Producer groups |
| 143 | Providing farm advisory and extension services |
| 144 | Holdings undergoing restructuring due to a reform of a common market organisation |
| 2. Improving the environment and the countryside | Sustainable use of agricultural land | 211 | Natural handicap payments to farmers in mountain areas |
| 212 | Payments to farmers in areas with handicaps, other than mountain areas |
| 213 | Natura 2000 payments and payments linked to Directive 2000/60/EC |
| 214 | Agri-environment payments |
| 215 | Animal welfare payments |
| 216 | Non-productive investments |
| Sustainable use of forestry land | 221 | First afforestation of agricultural land |
| 222 | First establishment of agroforestry systems on agricultural land |
| 223 | First afforestation of non-agricultural land |
| 224 | Natura 2000 payments |
| 225 | Forest-environment payments |
| 226 | Restoring forestry potential and introducing prevention actions |
| 227 | Non-productive investments |
| 3. Quality of life in rural areas and diversification of the rural economy | Diversification of the rural economy | 311 | Diversification into non-agricultural activities |
| 312 | Support for business creation and development |
| 313 | Encouragement of tourism activities |
| Improvement of the quality of life in rural areas | 321 | Basic services for the economy and rural population |
| 322 | Village renewal and development |
| 323 | Conservation and upgrading of the rural heritage |
| Training, skills acquisition and animation | 331 | Training and information |
| 341 | Skills-acquisition and animation measure with a view to preparing and implementing a local development strategy |
| 4. Leader | | 411 | Competitiveness |
| 412 | Environment/land management |
| 413 | Quality of life/diversification |
| 421 | Implementing cooperation projects |
| 431 | Running the LAG, skills acquisition, animation |
|  |  | 511 | Technical assistance |
|  |  | 611 | Complimentary direct payments |

Source: Own elaboration from European Network for Rural Development.

The amounts of these items can be translated into a demand for goods and services to achieve certain goals. The allocation of such amounts has been made taking into account the objective of each of the measures; for example, training measures can be related with increased demand on educational goods and services). Thus, we estimate the effects on the demand of the following types of goods (although in some cases, e.g. Early retirement (M113), Payments to farmers (M211, M212, M213, the effect can be directly transferred to household incomes) :

|  |
| --- |
| * Products of agriculture, hunting and related services |
| * Products of forestry, logging and related services |
| * Fish |
| * Mining |
| * Food industries |
| * Other manufacturing |
| * Utilities |
| * Construction |
| * Trade |
| * Hotels and restaurants |
| * Transport and communication |
| * Other private services |
| * Public services |
| * Households (rural) |

The choice of these sectors corresponds to the potential (main) recipients of the various budget actions that fall into each of the measures considers by the EAFRD. The mapping between these measures and sectors is summarised in the following table and the specific CAP assessment is based on the production of each of these sectors in the corresponding NUTS3 (in the amounts shown in the SAMs). Sectors are highly aggregated and each sector incorporates relatively different potential activities that do receive funds, so the distribution of CAP funds is rather straightforward. However, doing so imposes some strong assumptions on the distribution function of final demand. More specific amounts for each sector are very difficult to estimate without specific fieldwork and falls outside the scope of this work. Therefore it is assumed that sectors with more weight in each region are the most funds monopolise within each measure involved. The use of highly aggregated sectors softens the impact of this scenario.

Table 6. Assigning of EAFRD measures to activity sectors

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Measure** | **Other manufacturing** | **Utilities** | **Construction** | **Trade** | **Hotels**  **and restaurants** | **Transport**  **and communication** | **Other private services** | **Public services** | **Households** |
| **111** |  |  |  |  |  |  | X | X |  |
| **112** | X |  | X |  |  | X |  | X |  |
| **113** |  |  |  |  |  |  |  |  | X |
| **114** |  |  |  |  |  |  | X | X |  |
| **115** |  |  |  |  |  |  | X | X |  |
| **121** | X |  | X |  |  | X | X | X |  |
| **122** | X |  | X |  |  | X | X | X |  |
| **123** |  |  |  |  |  |  | X | X |  |
| **124** |  |  |  |  |  |  | X | X |  |
| **125** | X |  | X |  |  | X | X | X |  |
| **126** | X |  | X |  |  | X | X | X |  |
| **131** |  |  |  |  |  |  | X | X |  |
| **132** |  |  |  |  |  |  | X | X |  |
| **133** |  |  |  |  |  |  | X | X |  |
| **141** |  |  |  |  |  |  |  |  | X |
| **142** | X |  | X |  |  | X | X | X |  |
| **143** |  |  |  |  |  |  | X | X |  |
| **144** | X |  | X |  |  | X | X | X |  |
| **211** |  |  |  |  |  |  |  |  | X |
| **212** |  |  |  |  |  |  |  |  | X |
| **213** |  |  |  |  |  |  |  |  | X |
| **214** | X |  | X |  |  | X | X | X |  |
| **215** | X |  | X |  |  | X | X | X |  |
| **216** | X |  | X |  |  | X | X | X |  |
| **221** | X |  | X |  |  | X | X | X |  |
| **222** | X |  | X |  |  | X | X | X |  |
| **223** | X |  | X |  |  | X | X | X |  |
| **224** | X |  | X |  |  | X | X | X |  |
| **225** | X |  | X |  |  | X | X | X |  |
| **226** | X |  | X |  |  | X | X | X |  |
| **227** | X |  | X |  |  | X | X | X |  |
| **311** | X |  | X | X | X | X | X | X |  |
| **312** | X |  | X | X | X | X | X | X |  |
| **313** |  |  |  |  | X |  |  |  |  |
| **321** |  |  |  |  |  |  | X | X |  |
| **322** |  |  | X |  |  |  | X | X |  |
| **323** |  |  | X |  |  |  | X | X |  |
| **331** |  |  |  |  |  |  | X | X |  |
| **341** |  |  |  |  |  |  | X | X |  |
| **411** |  |  |  |  |  |  | X | X |  |
| **412** |  |  |  |  |  |  | X | X |  |
| **413** |  |  |  |  |  |  | X | X |  |
| **421** |  |  |  |  |  |  | X | X |  |
| **431** |  |  |  |  |  |  | X | X |  |
| **511** |  |  |  |  |  |  | X | X |  |
| **611** |  |  |  |  |  |  |  |  |  |

Source: Own elaboration.

3.2 Structural description of regional economies

The aim of this section is to analyse the economic structure of the NUTS3 regions built in this project to detect the most important economic sectors. We further use the SIMSIPSAM software[[11]](#footnote-11) (Parra and Wodon, 2008) to analyse the impact of the CAP in these areas. In this study, the software is used to detect backward and forward structural linkages as well as key sectors. Key sector analysis makes it possible to extract the main tendencies in the behaviour of an economy and to develop its corresponding structural view.

The methodologies commonly used to determine productive key sectors are usually classified into two categories: *traditional methods*, and *hypothetical extraction methods*. Briefly, both methods are based on the combination of two indicators: a *backward linkage* (*BL*) and a *forward linkage* (*FL*), both traditionally obtained from a symmetrical input-output table.

The backward linkage indicator (*BL*) for a given sector analyses the effect of a change in the final demand of this specific sector on the economy’s total production, whereas the forward linkage indicator (*FL*) values the effect of a joint change in the final demand of all sectors on the production of this specific sector.

From these indicators, it is possible to determine the key sectors in an economy. These sectors generate a high multiplier and fostering effect on production, allowing development strategies to be designed upon them as part of the economic policies.

In this analysis we use a more complex database than the traditional SIOT to determine the key sectors. This database is the Social Accounting Matrix (SAM). It is well known that the SAM means an enlargement of the traditional input-output framework in the sense that considers and reflects the complete circular flow of income. From this perspective, the measurement of economic transactions incorporated in a SAM allows to extract more precise information about the different economic agents, such as producers, consumers, public administration and the foreign sector, as well as about the behaviour of the productive factors[[12]](#footnote-12).

* Analysis of Key Sectors

The analysis of linkages, used to examine the interdependences between productive structures, has a long history starting from the pioneer works of Chenery and Watanabe (1958), Rasmussen (1956) or Hirschman (1958).

In this analysis we use the methodology developed by Rasmussen (1956) to obtain the *BL*, and that of Augustinovics (1970), designed to obtain the *FL*, both of them are traditional methods. More precisely, for the *BL* the method suggests that the database should be a SAM and not a SIOT. This SAM should have a high degree of endogenisation of institutional sectors, so that the circular flow of income can be adequately closed. At least, productive factors (labour and capital) and households should be endogenised. Thus, when analysing *BL*, the change in the final demand of a certain sector will reflect how the rest of the sectors change in order to “supply” the alteration in the final demand; also, since the productive activity will increase, the remuneration of production factors and consumers’ expenditures will increase as well, thus influencing again the productive sectors in a “second round”.

Starting with the method proposed by Rasmussen (1956), from the associated inverse matrix -1, being  an identity matrix of size *n*, we obtain the expression of the *BL*:

  (2)

 denoting the elements of the inverse matrix associated.

Once this indicator is normalised, if the backward linkage is greater than one, a one-unit change in the final demand of sector *j* will generate an increase greater than the average in the economy’s global activity.

In 1976, Jones stated that the obtaining of the *FL* as defined by Rasmussen did not have the quality of being a symmetrical measure in relation to the *BL*, and, from a similar perspective, Augustinovics (1970) had already defined the obtaining of *FL* as the row sum of the Goshiana inverse, where the distribution coefficients (*δij*) – obtained from the symmetrical IOT through dividing each cell by the row total, not the column total – replace the technical coefficients. This way, *FL* is calculated as *Oi*.:

   (3)

from which it can value the joint effect of altering the supply of primary inputs in a particular sector on all sectors. Again, after its normalization, if the indicator is greater than one, a one unit change in all sectors, will generate an increase above the average in sector *i*. In this case, it will use the SIOT because, if it leaves as exogenous the primary inputs, which are the thread of the circular flow of income, the economic interpretation lying in the *FL* will lose its meaning once the institutional sectors are endogenised through the use of the SAM.

Below, we present a table with key sectors and Figures with the backward, forward linkages and key sectors. First, table 7 records the key sectors for each NUTS3. These activities are the sectors with the “diffusion effect” or backward linkage and the “absorption effect” or forward linkage above one.

Table 7. Key Sectors at NUTS3

|  |  |  |
| --- | --- | --- |
|  | **Rural** | **Urban** |
| **Huesca** | (2) Large arable crops farms; (10) Food industries; (13) Construction; (17) Other private services |  |
| **Konstanz** | (11) Other manufacturing; (12) Utilities; (14) Trade; (16) Transport and communication; (17) Other private services; (18) Public services | (35) Other private services |
| **Lüneburg** | (17) Other private services | (29) Other manufacturing; (35) Other private services; (36) Public services |
| **Noord Drenthe** |  | (20) Large arable crops farms; (28) Food industries; (30) Utilities; (32) Trade; (34) Transport and communication; (35) Other private services; (36) Public services |
| **Finistère** | (2) Large arable crops farms; (11) Other manufacturing; (14) Trade; (16) Transport and communication; (17) Other private services | (35) Other private services |
| **Setúbal** | (10) Food industries; (14) Trade; (16) Transport and communication; (17) Other private services |  |
| **Örebro** | (11) Other manufacturing; (12) Utilities; (16) Transport and communication | (35) Other private services |
| **Norfolk** | (17) Other private services | (32) Trade; (35) Other private services |
| **Slupski** | (11) Other manufacturing; (14) Trade | (29) Other manufacturing; (32) Trade; (35) Other private services |
| **Heves** | (2) Large arable crops farms; (17) Other private services | (35) Other private services |
| **Lääne-Eesti** | (2) Large arable crops farms; (10) Food industries; (11) Other manufacturing; (16) Transport and communication; (17) Other private services | (35) Other private services |
| **Gorenjska** | (10) Food industries; (14) Trade; (16) Transport and communication; (17) Other private services | (35) Other private services |

Source: Own elaboration.

* **Structural-path analysis**

Following Sonis et al. (1997), to complete this sectoral analysis of the different economies, we calculate the Multiplier Product Matrix (MPM), derived from the SAM, which allows analysing the sectoral interdependencies of these economies. From *M*, it defines the elements of this matrix as the product of the multiplier *M* row (*Mi*) and column (*M*j) divided by total intensity factor, this factor is calculated as the sum of all elements of matrix *M*:



(4)

Thus, the MPM structure is essentially connected with the properties of sector backward and forward linkages. The rows and columns of the matrix M can be rearranged along the magnitude of the values of backward and forward linkages from the largest to the smallest to provide the hierarchy of backward (for columns) and forward (for rows) linkages. Using the MPM matrix, it is possible to construct economic landscapes to provide a summary view of the economic structure, that allows visually identifying which are the sectors that generate above-average impact on the economy through changes in themselves, what are the sectors that are most influenced by changes in the rest of the economy, and how they interact with the rest of the other sectors.

Next, we develop the landscapes for each NUTS3, presenting the most important links between the main 18 accounts in each economy. We are going to present three regions like case studies of this research (Huesca, Konstanz and Lüneburg).

Figure 14. Landscape, Huesca 2007.



Source: Own elaboration.

In Figure 14 we can identify the most important sectors and the most important linkages in the economy of Huesca using structural path analysis. The most important sectors in this economy are Other manufacturing\_Rural (11), Other private services\_Rural (17) and Food industries\_Rural (10). With this landscape, we can detect the most important links between sectors; so, we can see that Other manufacturing\_Rural (11) and Construction\_Rural (13) register the closest link. The highest forward linkage value corresponds to Other manufacturing\_Rural (11) and the one for backward linkages is Construction\_Rural (13).

Figure 15. Landscape, Konstanz 2007.



Source: Own elaboration.

The most important sectors and the most important linkages in the economy of Konstanz are represented in Figure 15. Sectors with higher importance in this economy are Other private services\_Rural (17), Other manufacturing\_Rural (11) and Other private services\_Urban (35). With this landscape, we can detect the most important links between sectors: Other private services\_Rural (17) and Transport and communication\_Rural (16) register the most important link, because the greatest forward linkage value corresponds to Other private services\_Rural (17) and the one for backward linkages is Transport and communication\_Rural (16).

Figure 16. Landscape, Lüneburg 2007



Source: Own elaboration.

In Figure 16 we can identify the most important sectors and the most important linkages in the Lüneburg economy, following structural path analysis methodology. Sectors with higher importance in this economy are: Other private services\_Urban (35), Public services\_Urban (36) and Other private services\_Rural (17). With this landscape, we can detect the most important links among sectors. This way, Other private services\_Urban (35) with the sector Food industries\_Rural (10) is the most important link, because the greatest forward linkage value corresponds to sector 35 and the one for backward linkages is sector 10.

* CAP Impact on NUTS3 regions

We have designed an illustrative experiment with SIMSIPSAM consisting in exogenously shocking the demand of any combination of endogenous activities in the original SAMs, in order to capture the impact of the Common Agricultural Policy (CAP) in each NUTS3 region for 2007. Next, we present the tables with the amount of shocks within 2007 – 2011with EAGF and EAFRD. The repartition of funds between accounts has been made taking weights depending on the total output in each NUTS 3 in one year.

Table 8. Amount realised EAGF 2007-2011. Euros

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Small arable crops farms | Large arable crops farms | Small permanent crops farms | Large permanent crops farms | Small other farms | Large other farms | Total |
| Huesca | 176,741,452 | 639,986,572 | 2,887,577 | 7,291,147 | 512,875 | 316,470 | 827,736,094 |
| Konstanz | 6,903,496 | 41,639,967 | 369,742 | 1,767,800 | 70,763 | 70,048 | 50,821,816 |
| Lüneburg | 3,751,364 | 92,933,264 | 0 | 0 | 472,595 | 2,077,876 | 99,235,099 |
| Noord Drenthe | 2,786,171 | 124,938,432 | 0 | 2,496 | 473,247 | 6,638,855 | 99,235,099 |
| Heves | 46,860,952 | 141,505,014 | 64,881 | 2,108,637 | 992,935 | 937,678 | 192,470,097 |
| Slupski | 56,658,367 | 68,626,339 | 691,368 | 22,469,452 | 0 | 0 | 148,445,526 |
| Lääne-Eesti | 11,755,028 | 39,795,735 | 9,899 | 321,721 | 38,855 | 7,819 | 51,929,057 |
| Gorenjska | 9,742,494 | 6,529,422 | 1,941 | 63,075 | 6,905 | 541 | 16,344,378 |
| Setúbal | 17,448,113 | 25,293,205 | 2,684,822 | 5,409,866 | 112,124 | 80,420 | 51,028,549 |
| Finistère | 18,505,317 | 482,578,069 | 11,581,155 | 65,544,407 | 0 | 0 | 578,208,948 |
| Örebro | 10,474,228 | 36,912,840 | 14,518 | 471,834 | 45,385 | 59,420 | 47,978,224 |
| Norfolk | 14,281,426 | 487,867,772 | 8,556 | 215,111 | 5,637,512 | 20,651,136 | 528,661,514 |

Source: Own elaboration.

Table 9. Amount realised EAFRD 2007-2011. Euros.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Food industries | Other manufacturing | Construction | Trade | Hotels and restaurants | Transport and communication | Other private services | Public services | Households (rural) | Total |
| Huesca | 0 | 16,764,383 | 15,826,111 | 0 | 286,595 | 2,409,793 | 20,503,589 | 18,478,680 | 6,916,996 | 81,186,149 |
| Konstanz | 0 | 2,565,027 | 554,232 | 36,467 | 5,505 | 766,114 | 3,333,378 | 1,437,322 | 1,323,220 | 10,021,266 |
| Lüneburg | 0 | 5,791,121 | 1,426,879 | 8,087 | 43,341 | 1,729,674 | 7,079,045 | 3,168,644 | 893,968 | 20,144,652 |
| Noord Drenthe | 0 | 1,452,496 | 483,553 | 6,130 | 808,750 | 433,827 | 2,325,993 | 1,333,157 | 18,820 | 6,862,726 |
| Heves | 46,433 | 15,914,850 | 2,826,442 | 51,340 | 226,118 | 2,823,493 | 9,703,885 | 7,139,804 | 1,691,060 | 40,423,423 |
| Slupski | 138,018 | 23,027,239 | 6,691,652 | 227,521 | 16,402 | 6,358,501 | 15,054,650 | 12,527,538 | 39,156,159 | 103,197,682 |
| Lääne-Eesti | 278,211 | 22,713,817 | 8,247,413 | 354,080 | 62,282 | 8,529,413 | 15,316,911 | 9,460,022 | 13,073,125 | 78,035,275 |
| Gorenjska | 8,992 | 4,532,207 | 627,398 | 14,358 | 2,717 | 767,463 | 1,657,531 | 913,997 | 10,369,732 | 18,894,396 |
| Setúbal |  | 2,236,659 | 725,958 | 0 | 0 | 609,049 | 2,300,770 | 2,273,482 | 228,067 | 8,373,984 |
| Finistère | 378 | 5,398,841 | 1,988,891 | 734 | 147 | 1,950,166 | 7,220,109 | 5,932,111 | 471,863 | 22,963,241 |
| Örebro | 20,541 | 3,726,462 | 720,520 | 50,729 | 103,911 | 1,475,824 | 3,371,339 | 2,622,854 | 2,112,773 | 14,204,951 |
| Norfolk | 8,562 | 12,380,069 | 7,119,492 | 23,547 | 125,089 | 6,957,309 | 20,757,911 | 15,900,899 | 9,901 | 63,282,780 |

Source: Own elaboration.

Next, we present the size of the shock and their corresponding results in the three regions case studies presented in this paper.

Table 10. Total Impact in production / Income for Huesca. Millions Euros.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SAM Accounts | Size of the shock Huesca | Total impact in production/income | Percentage change after shock |
| 1 | Agriculture, hunting and related services\_Rural | -53.98 | -100.15 | -40.64 |
| 2 | Products of forestry, logging and related services\_Rural | 0.00 | -0.47 | -3.30 |
| 3 | Fish\_Rural | 0.00 | -0.13 | -3.30 |
| 4 | Mining\_Rural | 0.00 | -2.02 | -1.30 |
| 5 | Food industries\_Rural | 0.00 | -39.03 | -4.11 |
| 6 | Other manufacturing\_Rural | 0.00 | -39.32 | -2.75 |
| 7 | Utilities\_Rural | 0.00 | -3.54 | -3.19 |
| 8 | Construction\_Rural | 0.00 | -23.37 | -1.50 |
| 9 | Trade\_Rural | 0.00 | -11.90 | -2.57 |
| 10 | Hotels and restaurants\_Rural | 0.00 | -11.08 | -2.40 |
| 11 | Transport and communication\_Rural | 0.00 | -8.79 | -2.97 |
| 12 | Other private services\_Rural | 0.00 | -25.82 | -2.55 |
| 13 | Public services\_Rural | 0.00 | -4.56 | -0.42 |
| 14 | Agriculture, hunting and related services\_Urban | -111.57 | -114.63 | -670.94 |
| 15 | Products of forestry, logging and related services\_Urban | 0.00 | -0.03 | -3.30 |
| 16 | Fish\_Urban | 0.00 | -0.01 | -3.30 |
| 17 | Mining\_Urban | 0.00 | -0.12 | -1.30 |
| 18 | Food industries\_Urban | 0.00 | -2.37 | -4.11 |
| 19 | Other manufacturing\_Urban | 0.00 | -9.74 | -2.75 |
| 20 | Utilities\_Urban | 0.00 | -0.69 | -3.19 |
| 21 | Construction\_Urban | 0.00 | -6.85 | -1.50 |
| 22 | Trade\_Urban | 0.00 | -4.36 | -2.57 |
| 23 | Hotels and restaurants\_Urban | 0.00 | -2.83 | -2.40 |
| 24 | Transport and communication\_Urban | 0.00 | -1.98 | -2.97 |
| 25 | Other private services\_Urban | 0.00 | -9.48 | -2.55 |
| 26 | Public services\_Urban | 0.00 | -1.14 | -0.42 |
| 27 | Agriculture, hunting and related services | 0.00 | -69.20 | -9.95 |
| 28 | Products of forestry, logging and related services | 0.00 | -0.75 | -3.32 |
| 29 | Fish | 0.00 | -0.20 | -3.32 |
| 30 | Mining | 0.00 | -3.02 | -1.27 |
| 31 | Food industries | 0.00 | -61.48 | -4.33 |
| 32 | Other manufacturing | -3.35 | -80.97 | -2.77 |
| 33 | Utilities | 0.00 | -7.12 | -3.34 |
| 34 | Construction | -3.17 | -30.59 | -1.50 |
| 35 | Trade | 0.00 | -19.52 | -2.49 |
| 36 | Hotels and restaurants | -0.06 | -25.00 | -2.40 |
| 37 | Transport and communication | -0.48 | -12.17 | -3.01 |
| 38 | Other private services | -4.10 | -40.15 | -2.62 |
| 39 | Public services | -3.70 | -4.39 | -0.32 |
| 40 | Skilled Labour | 0.00 | -33.91 | -1.73 |
| 41 | Unskilled labour | 0.00 | -8.13 | -2.41 |
| 42 | Capital | 0.00 | -120.09 | -4.92 |
| 43 | Enterprises | 0.00 | -41.99 | -3.47 |
| 44 | Rural households | -1.38 | -40.10 | -2.52 |
| 45 | Urban households | 0.00 | -99.34 | -2.43 |
|  | **Aggregate** | -181.78 | -424.39[[13]](#footnote-13) | -3.88 |

Source: Own elaboration.

In Table 10, we present the results for Huesca aggregating the agricultural sector. We can see that the loss in the aggregated impact in production/income when we detract the CAP is around 425 million Euros, approximately 3.9 per cent of its income.

Table 11. Total Impact in production / income for Konstanz. Millions Euros.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | SAM Accounts | Size of the shock Konstanz | Total impact in production/income | | Percentage change after shock |
| 1 | | Agriculture, hunting and related services\_Rural | -3.74 | -4.20 | | -13.97 |
| 2 | | Products of forestry, logging and related services\_Rural | 0.00 | -0.04 | | -0.20 |
| 3 | | Fish\_Rural | 0.00 | 0.00 | | -0.13 |
| 4 | | Mining\_Rural | 0.00 | -0.07 | | -0.14 |
| 5 | | Food industries\_Rural | 0.00 | -1.39 | | -0.28 |
| 6 | | Other manufacturing\_Rural | 0.00 | -3.06 | | -0.14 |
| 7 | | Utilities\_Rural | 0.00 | -1.14 | | -0.05 |
| 8 | | Construction\_Rural | 0.00 | -0.30 | | -0.06 |
| 9 | | Trade\_Rural | 0.00 | -1.33 | | -0.17 |
| 10 | | Hotels and restaurants\_Rural | 0.00 | -0.18 | | -0.15 |
| 11 | | Transport and communication\_Rural | 0.00 | -1.07 | | -0.15 |
| 12 | | Other private services\_Rural | 0.00 | -4.04 | | -0.20 |
| 13 | | Public services\_Rural | 0.00 | -1.45 | | -0.08 |
| 14 | | Agriculture, hunting and related services\_Urban | -6.73 | -6.76 | | -337.42 |
| 15 | | Products of forestry, logging and related services\_Urban | 0.00 | 0.00 | | -0.20 |
| 16 | | Fish\_Urban | 0.00 | 0.00 | | -0.13 |
| 17 | | Mining\_Urban | 0.00 | -0.01 | | -0.14 |
| 18 | | Food industries\_Urban | 0.00 | -0.15 | | -0.28 |
| 19 | | Other manufacturing\_Urban | 0.00 | -1.11 | | -0.14 |
| 20 | | Utilities\_Urban | 0.00 | -0.39 | | -0.05 |
| 21 | | Construction\_Urban | 0.00 | -0.09 | | -0.06 |
| 22 | | Trade\_Urban | 0.00 | -0.74 | | -0.17 |
| 23 | | Hotels and restaurants\_Urban | 0.00 | -0.11 | | -0.15 |
| 24 | | Transport and communication\_Urban | 0.00 | -0.45 | | -0.15 |
| 25 | | Other private services\_Urban | 0.00 | -1.85 | | -0.20 |
| 26 | | Public services\_Urban | 0.00 | -0.29 | | -0.08 |
| 27 | | Agriculture, hunting and related services | 0.00 | -0.68 | | -0.87 |
| 28 | | Products of forestry, logging and related services | 0.00 | -0.05 | | -0.23 |
| 29 | | Fish | 0.00 | 0.00 | | -0.15 |
| 30 | | Mining | 0.00 | -0.42 | | -0.16 |
| 31 | | Food industries | 0.00 | -1.91 | | -0.28 |
| 32 | | Other manufacturing | -0.51 | -5.36 | | -0.15 |
| 33 | | Utilities | 0.00 | -1.72 | | -0.05 |
| 34 | | Construction | -0.11 | -0.39 | | -0.06 |
| 35 | | Trade | 0.00 | -2.32 | | -0.17 |
| 36 | | Hotels and restaurants | 0.00 | -0.31 | | -0.15 |
| 37 | | Transport and communication | -0.15 | -1.68 | | -0.15 |
| 38 | | Other private services | -0.67 | -6.43 | | -0.20 |
| 39 | | Public services | -0.29 | -1.74 | | -0.08 |
| 40 | | Skilled Labour | 0.00 | -5.66 | | -0.17 |
| 41 | | Unskilled labour | 0.00 | -1.21 | | -0.21 |
| 42 | | Capital | 0.00 | -7.82 | | -0.25 |
| 43 | | Enterprises | 0.00 | -5.89 | | -0.19 |
| 44 | | Rural households | -0.26 | -2.03 | | -0.17 |
| 45 | | Urban households | 0.00 | -10.83 | | -0.15 |
|  | **Aggregate** | | -12.47 | | -30.22 | -0.21 |

Source: Own elaboration.

In Table 11, we present the results for Konstanz aggregating the agricultural sector. In this case, we note that the loss in the aggregate impact in production/income when we detract the CAP is around 30 million Euros, approximately a 0.2 per cent of its income.

Table 12. Total Impact in production / income for Lüneburg. Millions Euros.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SAM Accounts | Size of the shock Lüneburg | Total impact in production/income | Percentage change after shock |
| 1 | Agriculture, hunting and related services\_Rural | -8.98 | -9.50 | -296.60 |
| 2 | Products of forestry, logging and related services\_Rural | 0.00 | -0.05 | -0.40 |
| 3 | Fish\_Rural | 0.00 | 0.00 | -0.28 |
| 4 | Mining\_Rural | 0.00 | -0.05 | -0.31 |
| 5 | Food industries\_Rural | 0.00 | -0.96 | -0.53 |
| 6 | Other manufacturing\_Rural | 0.00 | -1.44 | -0.33 |
| 7 | Utilities\_Rural | 0.00 | -0.87 | -0.11 |
| 8 | Construction\_Rural | 0.00 | -0.35 | -0.21 |
| 9 | Trade\_Rural | 0.00 | -1.01 | -0.35 |
| 10 | Hotels and restaurants\_Rural | 0.00 | -0.13 | -0.35 |
| 11 | Transport and communication\_Rural | 0.00 | -0.92 | -0.36 |
| 12 | Other private services\_Rural | 0.00 | -3.20 | -0.50 |
| 13 | Public services\_Rural | 0.00 | -0.52 | -0.26 |
| 14 | Agriculture, hunting and related services\_Urban | -1.28 | -1.36 | -296.60 |
| 15 | Products of forestry, logging and related services\_Urban | 0.00 | -0.01 | -0.40 |
| 16 | Fish\_Urban | 0.00 | 0.00 | -0.28 |
| 17 | Mining\_Urban | 0.00 | -0.01 | -0.31 |
| 18 | Food industries\_Urban | 0.00 | -0.19 | -0.53 |
| 19 | Other manufacturing\_Urban | 0.00 | -2.05 | -0.33 |
| 20 | Utilities\_Urban | 0.00 | -0.24 | -0.11 |
| 21 | Construction\_Urban | 0.00 | -0.26 | -0.21 |
| 22 | Trade\_Urban | 0.00 | -1.17 | -0.35 |
| 23 | Hotels and restaurants\_Urban | 0.00 | -0.21 | -0.35 |
| 24 | Transport and communication\_Urban | 0.00 | -0.88 | -0.36 |
| 25 | Other private services\_Urban | 0.00 | -3.99 | -0.50 |
| 26 | Public services\_Urban | 0.00 | -3.12 | -0.26 |
| 27 | Agriculture, hunting and related services | 0.00 | -0.82 | -1.77 |
| 28 | Products of forestry, logging and related services | 0.00 | -0.06 | -0.45 |
| 29 | Fish | 0.00 | -0.01 | -0.31 |
| 30 | Mining | 0.00 | -0.37 | -0.37 |
| 31 | Food industries | 0.00 | -1.44 | -0.54 |
| 32 | Other manufacturing | -1.16 | -4.69 | -0.33 |
| 33 | Utilities | 0.00 | -1.25 | -0.08 |
| 34 | Construction | -0.29 | -0.63 | -0.21 |
| 35 | Trade | 0.00 | -2.45 | -0.35 |
| 36 | Hotels and restaurants | -0.01 | -0.37 | -0.35 |
| 37 | Transport and communication | -0.35 | -2.02 | -0.36 |
| 38 | Other private services | -1.42 | -7.91 | -0.50 |
| 39 | Public services | -0.63 | -3.64 | -0.26 |
| 40 | Skilled Labour | 0.00 | -7.77 | -0.38 |
| 41 | Unskilled labour | 0.00 | -1.53 | -0.47 |
| 42 | Capital | 0.00 | -7.34 | -0.78 |
| 43 | Enterprises | 0.00 | -4.81 | -0.49 |
| 44 | Rural households | -0.18 | -3.98 | -0.38 |
| 45 | Urban households | 0.00 | -10.51 | -0.36 |
|  | **Aggregate** | -14.29 | -32.50 | -0.47 |

Source: Own elaboration.

In Table 12, we present the results for Lüneburg. In this case, note that the loss in the aggregate impact in production/income when we detract the CAP is 32.5 million Euros, approximately a 0.5 per cent of its total income.

**4. An approach for obtaining 'automatic' SAMs at NUTS3 level and comparative assessment of ‘automatic’ and ‘expert’ SAMS**

In this section we present a solution which on this base can be envisaged in order to regionalise at NUTS 3 level; for each potential solution, the data set at NUTS2 level to be used will be described and assessed. Regionalisation and balancing procedures proposed will be documented. In principal, we propose to use provincial GDP, and other macroeconomic indicators, e.g. total output, to obtain the SAM at NUTS 3, following Cardenete and Sancho (2004).

To develop this procedure, that can be useful as a simple tool for regionalisation , we propose a procedure called RAS, which has been traditionally used to estimate input output tables with minimum data requirements based on intermediate demand, total intermediate consumption and year of the estimation. In addition, we are going to propose a new technique called Cross Entropy Method, technique whichwas presented at the XII International Conference on Input-Output Techniques of New York in 1998. Entropy techniques have been adapted by Golan, Judge and Robinson (1994); Thissen and Lofgren (1999), Robinson, Cattaneo and El-Said (2001) from information theory to the updating of Input-Output tables and Social Accounting Matrices.

The Cross-Entropy approach involves projecting technical coefficients instead of total SAM flows. Once the new coefficients have been obtained, the new SAM can be derived in the usual way. Because Cross Entropy aims directly at estimating technical coefficients, the scaling method does not work. The problem would consist of minimisation:

n n

d(A0, Â1)= Σ Σ (âij1/Xj).(ln(âij1/Xj )- ln(âij0/Xj0)) (5)

i=1 j=1

s.t. n

Σ âij1= Xi for all i

j=1

aij0 = 0 implies âij1= 0

where *A=(aij)* represent a matrix in the set An of the *nxn* non-negative matrices that have no zero row or column. Considering now a matrix *A0* ∈ *An* a positive vector *X* ∈ *R+n [[14]](#footnote-14)*, and a loss function *d:* *An x An 🡪 R. Xj0 = Σi aij0* is the level value for the *jth* row and column sum in the original matrix, and *aij0/ Xj0* and *âij0/ Xj* initial and updatedtechnical coefficients, respectively.

This methodology has been applied to regionalise SAMs NUTS2 and the following minimum requirements have been introduced for each region:

1. Well-known prior matrix –NUTS2- built by experts and previous IPTS works.
2. Totals by rows or columns (marginal) in the new base region NUTS3;
3. And Gross Domestic Product structure –income and expenditure- for the new region NUTS3.

One of the methodologies proposed (Cardenete and Sancho, 2004) will be tested for three NUTS2 areas corresponding to case studies and previous IPTS work (Aragón, Baden-Württemberg and Niedersachsen). We propose to analyse these economies with different indicators (key sectors, Landscape and Le Masné Index). The index that is used to analyse the changes in technical coefficients has been used in several studies, e.g. Antille, Fontela, Guillet (2000), Soza-Amigo (2009), Cardenete y Lopez (2012), Cardenete, Congregado, de Miguel y Perez (2000). Social Accounting Matrices have been aggregated to do possible the comparison between procedures. The new structure of these matrices is:

Table 13. New structure of NUTS3 SAMs.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | aAGR | Agriculture | 15 | cMAN | Other manufacturing |
| 2 | aFOR | Forestry | 16 | cENE | Energy products |
| 3 | aOPP | Other primary production | 17 | cCNS | Construction |
| 4 | aFOP | Food processing | 18 | cTTR | Trade and Transport |
| 5 | aMAN | Other manufacturing | 19 | cHOT | Hotels and Restaurants |
| 6 | aENE | Energy products | 20 | cSERV | Servicies |
| 7 | aCNS | Construction | 21 | LABOR | Labour |
| 8 | aTTR | Trade and Transport | 22 | CAPITAL | Capital |
| 9 | aHOT | Hotels and Restaurants | 23 | LAND | Land |
| 10 | aSERV | Services | 24 | HOUS | Households |
| 11 | cAGR | Agriculture | 25 | TAX\_LESS\_SUB | Tax less subsidies |
| 12 | cFOR | Forestry | 26 | GOV | Government |
| 13 | cOPP | Other primary production | 27 | INV | Investment |
| 14 | cFOP | Food processing | 28 | ROW | Rest of the world |

Source: Own elaboration.

* **Key Sectors**

Below we present tables with the backward and forward linkages and key sectors for each comparative NUTS3 with an automatic procedure versus an expert procedure. In this case, the concept of key sectors has been relaxed, and now can be defined as key, sectors with a BL or FL greater than 0.9.

Table 14. Key sectors for Huesca. Automatic procedure vs. Expert procedure.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **AUTOMATIC**  **PROCEDURE** | | **EXPERT**  **PROCEDURE** | |
|  |  | **Backward Linkages** | **Forward Linkages** | **Backward Linkages** | **Forward Linkages** |
| 1 | aAGR | 1.193 | 0.603 | 1.088 | 0.904 |
| 2 | aFOR | 1.158 | 0.319 | 1.088 | 0.307 |
| 3 | aOPP | 0.993 | 0.309 | 0.995 | 0.392 |
| 4 | aFOP | 1.223 | 0.772 | 1.119 | 0.819 |
| 5 | aMAN | 1.073 | 1.159 | 0.995 | 1.021 |
| 6 | aENE | 1.015 | 0.518 | 1.168 | 0.417 |
| 7 | aCNS | 1.127 | 0.593 | 1.265 | 1.142 |
| 8 | aTTR | 1.100 | 1.138 | 1.069 | 0.993 |
| 9 | aHOT | 1.133 | 0.802 | 1.023 | 0.622 |
| 10 | aSERV | 1.071 | 1.419 | 1.111 | 1.218 |

Source: Own elaboration.

Table 14 records the BL and FL for Huesca with the two different procedures. We can outline that the most important sectors of Huesca with automatic procedure are: aMAN (5), aTTR (8), and aSERV (10). With an expert procedure, three of the most important sectors are the same (aMAN, aTTR and aSERV) but two additional key sectors can be detected: aAGR (1) and aCNS (7).

Table 15 records the BL and FL for Konstanz with two different procedures. So, we can see that the most important sectors of Konstanz with automatic procedure are the same for Konstanz with expert procedure: aMAN (5), aTTR (8), and aSERV (10).

Table 16 records the BL and FL for Lüneburg with two different procedures. Again, the most important sectors of Lüneburg with automatic procedure are the same for Lüneburg with expert procedure: aMAN (5), aTTR (8), and aSERV (10). No significant changes are found in the second and third example used for the comparison of procedures.

Table 15. Key sectors for Konstanz. Automatic procedure vs. Expert procedure.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **AUTOMATIC**  **PROCEDURE** | | **EXPERT**  **PROCEDURE** | |
|  |  | **Backward Linkages** | **Forward Linkages** | **Backward Linkages** | **Forward Linkages** |
| 1 | aAGR | 1.241 | 0.433 | 1.097 | 0.394 |
| 2 | aFOR | 1.285 | 0.436 | 1.075 | 0.352 |
| 3 | aOPP | 0.216 | 0.216 | 1.035 | 0.204 |
| 4 | aFOP | 1.153 | 0.792 | 1.125 | 0.593 |
| 5 | aMAN | 1.195 | 1.337 | 1.051 | 1.247 |
| 6 | aENE | 0.723 | 0.592 | 1.083 | 0.763 |
| 7 | aCNS | 1.203 | 0.457 | 1.101 | 0.378 |
| 8 | aTTR | 1.135 | 1.097 | 1.112 | 1.276 |
| 9 | aHOT | 1.175 | 0.484 | 1.098 | 0.374 |
| 10 | aSERV | 1.155 | 1.732 | 1.060 | 1.994 |

Source: Own elaboration.

Table 16. Key sectors for Lüneburg. Automatic procedure vs. Expert procedure.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **AUTOMATIC**  **PROCEDURE** | | **EXPERT**  **PROCEDURE** | |
|  |  | **Backward Linkages** | **Forward Linkages** | **Backward Linkages** | **Forward Linkages** |
| 1 | aAGR | 1.152 | 0.575 | 1.081 | 0.463 |
| 2 | aFOR | 1.206 | 0.392 | 1.057 | 0.374 |
| 3 | aOPP | 0.969 | 0.255 | 1.090 | 0.203 |
| 4 | aFOP | 1.159 | 0.631 | 1.151 | 0.524 |
| 5 | aMAN | 1.035 | 1.047 | 1.110 | 0.939 |
| 6 | aENE | 1.004 | 0.405 | 1.128 | 0.620 |
| 7 | aCNS | 1.079 | 0.450 | 1.115 | 0.402 |
| 8 | aTTR | 1.098 | 1.182 | 1.117 | 1.327 |
| 9 | aHOT | 1.114 | 0.528 | 1.114 | 0.391 |
| 10 | aSERV | 1.102 | 1.930 | 1.058 | 2.472 |

Source: Own elaboration.

* Le Masné Index

In order to analyse changes in technical coefficients, the first idea is to measure some indicators of statistical distancesbetween the I/O or SAM tables. When pairs of Input-Output or SAM tables are compared, it is possible to compute the Le Masné Index for the sector *j*:

*Sj = 100\*(1 - 0.5 sum i |aij A - aij S|)* (6)

The Le Masné Index will be close to 100 in cases of high similarity, and is therefore one of the many statistical distance indicators that can be analysed for the purpose of studying the similarity between tables. In Table 17, 18 and 19 we present Le Masné index for Huesca, Konstanz and Lüneburg for analysing the similarity between a SAM built with an automatic procedure and a SAM built with an expert procedure.

Table 17. Le Masné Index. Automatic procedure vs. Expert procedure.

|  |  |  |
| --- | --- | --- |
|  |  | **Le Masné Index** |
| 1 | aAGR | 95.85 |
| 2 | aFOR | 91.14 |
| 3 | aOPP | 83.43 |
| 4 | aFOP | 95.10 |
| 5 | aMAN | 98.48 |
| 6 | aENE | 90.82 |
| 7 | aCNS | 86.06 |
| 8 | aTTR | 88.60 |
| 9 | aHOT | 88.58 |
| 10 | aSERV | 88.27 |
| 11 | cAGR | 49.86 |
| 12 | cFOR | 99.56 |
| 13 | cOPP | 96.98 |
| 14 | cFOP | 86.78 |
| 15 | cMAN | 80.88 |
| 16 | cENE | 81.45 |
| 17 | cCNS | 78.20 |
| 18 | cTTR | 69.18 |
| 19 | cHOT | 96.59 |
| 20 | cSERV | 51.21 |
| 21 | LABOR | 99.64 |
| 22 | CAPITAL | 61.82 |
| 23 | LAND | 81.77 |
| 24 | HOUS | 80.70 |
| 25 | TAX\_LESS\_SUB | 89.74 |
| 26 | GOV | 84.95 |
| 27 | INV | 94.86 |
| 28 | ROW | 54.85 |
|  | **AVERAGE** | **83.76** |

Source: Own elaboration.

Table 18. Le Masné Index Konstanz. Automatic procedure vs Expert procedure.

|  |  |  |
| --- | --- | --- |
|  |  | **Le Masné Index** |
| 1 | aAGR | 88.11 |
| 2 | aFOR | 94.87 |
| 3 | aOPP | 91.05 |
| 4 | aFOP | 97.97 |
| 5 | aMAN | 95.23 |
| 6 | aENE | 91.83 |
| 7 | aCNS | 94.73 |
| 8 | aTTR | 87.19 |
| 9 | aHOT | 92.94 |
| 10 | aSERV | 83.90 |
| 11 | cAGR | 98.81 |
| 12 | cFOR | 97.63 |
| 13 | cOPP | 80.53 |
| 14 | cFOP | 98.43 |
| 15 | cMAN | 91.37 |
| 16 | cENE | 51.97 |
| 17 | cCNS | 99.61 |
| 18 | cTTR | 95.43 |
| 19 | cHOT | 99.32 |
| 20 | cSERV | 56.55 |
| 21 | LABOR | 61.38 |
| 22 | CAPITAL | 70.44 |
| 23 | LAND | 82.53 |
| 24 | HOUS | 65.58 |
| 25 | TAX\_LESS\_SUB | 86.75 |
| 26 | GOV | 88.11 |
| 27 | INV | 96.40 |
| 28 | ROW | 32.53 |
|  | **AVERAGE** | **84.68** |

Source: Own elaboration.

Table 19. Le Masné Index Lüneburg. Automatic procedure vs Expert procedure.

|  |  |  |
| --- | --- | --- |
|  |  | **Le Masné Index** |
| 1 | aAGR | 90.90 |
| 2 | aFOR | 90.64 |
| 3 | aOPP | 99.52 |
| 4 | aFOP | 91.80 |
| 5 | aMAN | 89.20 |
| 6 | aENE | 80.40 |
| 7 | aCNS | 96.13 |
| 8 | aTTR | 90.62 |
| 9 | aHOT | 98.54 |
| 10 | aSERV | 86.42 |
| 11 | cAGR | 93.04 |
| 12 | cFOR | 97.34 |
| 13 | cOPP | 99.79 |
| 14 | cFOP | 95.16 |
| 15 | cMAN | 71.15 |
| 16 | cENE | 67.34 |
| 17 | cCNS | 97.25 |
| 18 | cTTR | 95.90 |
| 19 | cHOT | 98.25 |
| 20 | cSERV | 72.09 |
| 21 | LABOR | 61.72 |
| 22 | CAPITAL | 86.75 |
| 23 | LAND | 88.93 |
| 24 | HOUS | 64.56 |
| 25 | TAX\_LESS\_SUB | 77.30 |
| 26 | GOV | 82.57 |
| 27 | INV | 97.00 |
| 28 | ROW | 57.36 |
|  | **AVERAGE** | **86.34** |

Source: Own elaboration.

Tables 17, 18 and 19 record the Le Masné index for Huesca, Konstanz and Lüneburg. We can point out that the average similarity between procedures is an 83.76% for Huesca, 84.68% for Konstanz and 86.34% for Lüneburg. We can observe a high degree of similarity in the majority of accounts, being higher in Lüneburg and smaller in Huesca. However, the case of Huesca is slightly different and the similarity indicator is the lowest. This may be due to the specific characteristics in the construction and later updating of this database.

5. Conclusions

In this paper we have constructed SAMs for a selection of NUTS3 regions in the EU. After dealing with problems regarding data availability, we have focussed on the distribution between rural and urban activities. As a novelty, the Euro method has been used in this project as a method for regionalisation.

Also, we have developed a more simple automatic procedure for having an approximate picture of NUTS3 regions under few data requirements. Finally, we have compared the results obtained under the two different scenarios for the three prototypes presented. A significant battery of results has been outlined, which may be useful for policy implementation.

We have also applied a multiplier analysis as well as a landscapes study and results seem reasonable as experts from Huesca and Konstanz have agreed. In fact, regarding Huesca, the results show as key sectors *Large farms arable crops (Rural)*, *Food Industries (Rural)*, *Construction (Rural)* and *Other private services (Rural)*. This is consistent with the economy of a region with a unique urban core (Huesca) as the provincial capital that maintains a public service based activity. While, in the population areas that surround it, mainly rural, the agricultural and food processing activities that sustain the SAMs, the economy of the area as well as construction companies that carry out business throughout the area, are concentrated. The provision of services to the population is also concentrated in these rural communities. After designing the CAP pillar vector, we have proposed a counterfactual analysis by assessing the effect of the removal of this funding. The results show a range of impact in terms of production/income from a small influence for Konstanz (0.21%) and Lüneburg (0.47) to the higher impacts of Huesca (3.88%).

On the basis of the comparative analysis above, we have been able to design a mechanical procedure that can provide a first picture of a regional SAMs at NUTS3 level.

Looking at the results above, we can observe that with an automatic procedure, it is possible to have an initial overview of the economies. This is the conclusion we can derive from a Le Masné Index higher than 80% for the three case studies, which seems to be a reasonable value for not discarding this simple procedure as a basic approximation to the main features of an economy. But we shall not forget that this first approach does not provide the refinements and accuracy that a non-automatic procedure can offer, especially if, as it is the case here, we are interested in policy simulation where the better the database is, the closer to reality the policy results are.

So to finish, and after the results commented, we do not discard an automatic procedure for an initial perspective of regional economies at NUTS3 level and for simple shocks or aggregate policy simulations. But we recommend going on working within this line of research based on Experts SAMs if we are interested in specific shocks that may provide more reflexive conclusions both in ex-ante and ex-post policy simulations.

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1. Mínguez et al (2009) and Oosterhaven et al (2011) consider several known tables as base tables but the lack of information at NUTS3 level makes this analysis inappropriate for our purpose. [↑](#footnote-ref-1)
2. Other types of arbitrarily sized and shaped subsets of constraints can also be added to the fixed row and column sums, such as in Lenzen et al (2009), Gilchrist and St. Louis (1999) and Paelinck and Waelbroeck (1963). However, though it has been proved that the use of additional partial information improves the accuracy of projections; this is inapplicable here due to the little available information at the NUTS3 level. [↑](#footnote-ref-2)
3. In the original presentation of this method (i.e. working paper), the vector of row multipliers was designated by *r*, the table of inter-industry transactions in coefficient form in the base year by *A* and the vector of column multipliers by *s*. Hence the juxtaposition of the notation led to the nomenclature RAS. [↑](#footnote-ref-3)
4. The RAS method dates back to the 1930s according to Bregman (1967), who attributes it to the Leningrad architect Sheleikhovskii. However, it was not until Leontief (1941) and, explicitly, Stone (1961) when the RAS method was applied to National Accounts and Input-Output Tables. [↑](#footnote-ref-4)
5. They are calculated as regional/national ratios. [↑](#footnote-ref-5)
6. In this project, the Euro method is programmed in the Eviews software and Excel templates are used to accommodate the results to the Eurostat standard format. [↑](#footnote-ref-6)
7. This industry still needs further split into arable crops, permanent crops and other agricultural products. [↑](#footnote-ref-7)
8. http://ec.europa.eu/eurostat/ramon/miscellaneous/index.cfm?TargetURL=DSP\_DEGURBA [↑](#footnote-ref-8)
9. The classification we use is: 1: densely populated (urban); 2: Intermediate (small towns and suburbs) and 3: sparsely populated (rural). We use too population at level LAU2 (completed with data from national statistical offices). [↑](#footnote-ref-9)
10. For further details, see Cardenete and Sancho (2004). [↑](#footnote-ref-10)
11. SIMSIPSAM is a user-friendly Excel-based application to analyse SAMs and I-O tables. The tool works with MATLAB as the computation engine and no license or knowledge of MATLAB is required. It performs a large number of decompositions and analyses including two algorithms for SAM balancing (RAS and Cross Entropy Method), SAM aggregation, multiplier decompositions, several types of economic linkages, income-redistribution analysis, structural-path analysis, several methods to analyse structural change (fields of influence, direction of change, importance of technical coefficients), supply constraints, price models, price controls, together with poverty and income-distribution analysis by linking the tool to household survey data. Several studies have been realised with SIMSIPSAM software. See Bostwick (2012), Nganou et al. (2011), Fofana et al. (2011) and Parra (2008). [↑](#footnote-ref-11)
12. For a demonstration of the advantages in the use of multipliers based on SAM instead of IO, see Roland-Holst, D.W. (1990). [↑](#footnote-ref-12)
13. The second column is the sum of activities (from 1 to 36) and the third column is equal to the total impact in production divided by the sum of total output, multiplied by 100. [↑](#footnote-ref-13)
14. Positive natural numbers [↑](#footnote-ref-14)