

## DEEP-ROOTED CULTURE AND ECONOMIC DEVELOPMENT: TAKING THE SEVEN DEADLY SINS TO BUILD A WELL-BEING COMPOSITE INDICATOR

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### Abstract:

This work involves undertaking a reappraisal of the *Seven Deadly Sins* in order to construct synthetic indicators of well-being aimed at measuring spatial economic disparities and their link to economic development. The *Seven Deadly Sins* constitute a way of describing vices vis-à-vis Christian moral education. Yet they might also be viewed as general norms of social behaviour and interpreted today as notions related to the concept of well-being. For example, the level of concentration of wealth (greed), sustainability of resources (gluttony), safety index (wrath), problems adapting to the labour market or workplace absenteeism (sloth), etc. The *Seven Deadly Sins* have also yielded emblematic examples of artistic iconography and cultural production. How they are perceived and expressed may also differ depending on each group's cultural idiosyncrasy, in the sense of a series of beliefs and attitudes forged over the centuries. Based on these premises, the current work first seeks to compile variables that reflect each conceptual dimension so as to later construct a synthetic indicator of well-being with territorial disaggregation. This enables us to explore spatial disparities and the extent to which they relate to economic development. This is applied to a group of countries in the European Union with NUTS 2 territorial disaggregation (regions). The sources of information are basically Eurostat. The method involves applying Data Envelopment Analysis to construct the synthetic indicator, and spatial econometrics to pinpoint spatial dependence effects.

**Keywords:** cultural identity, welfare indicators, economic development, synthetic indicators, deadly sins, Europe.

**JEL Codes:** Z11, Z13, R12, O12

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### Conflict of Interest:

The authors declare that they have no conflict of interest.

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This work involves undertaking a reappraisal of the Seven Deadly Sins in order to construct synthetic indicators of well-being aimed at measuring spatial economic disparities and their link to economic development. The Seven Deadly Sins constitute a way of describing vices vis-à-vis Christian moral education. Yet they might also be viewed as general norms of social behaviour and interpreted today as notions related to the concept of well-being. For example, the level of concentration of wealth (greed), sustainability of resources (gluttony), safety index (wrath), problems adapting to the labour market or workplace absenteeism (sloth), etc. The Seven Deadly Sins have also yielded emblematic examples of artistic iconography and cultural production throughout history. How they are perceived and expressed may also differ depending on each group's cultural idiosyncrasy, in the sense of a series of beliefs and attitudes forged over the centuries. Based on these premises, the current work first seeks to compile variables that reflect each conceptual dimension so as to later construct a synthetic indicator of well-being with territorial disaggregation. This enables us to explore spatial disparities and the extent to which they relate to economic development. This is applied to a group of countries in the European Union with NUTS 2 territorial disaggregation (regions). The sources of information are basically Eurostat. The method involves applying Data Envelopment Analysis to construct the synthetic indicator, and spatial econometrics to pinpoint spatial dependence effects.

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### 1. Introduction

The *Seven Deadly Sins* provide a way of defining mankind's main Earthly vices with regard to Christian moral education. Yet they may also be viewed as general norms of social behaviour and interpreted today as notions linked to the concept of well-being: for example, the level of concentration of wealth may be seen as an expression of the vice of *greed*, the sustainability of resources as an indicator of *gluttony*, or the problems linked to adapting to the labour market and the efficacy of the education system as variables representing *sloth*. The *Seven Deadly Sins* have also given rise to intense cultural production, since they have constituted an emblematic case of artistic iconography and creative inspiration throughout history. How these vices (and their virtues) are perceived may also differ depending on each group's cultural idiosyncrasy, understood as a set of beliefs and attitudes inherited throughout the centuries and that identify a social group and, in general, a geographical location.

Based on these premises, our goal is to reformulate the deadly sins as partial indicators of well-being and to build a composite indicator, summing up the previous dimensions, with territorial specification. We also aim to examine the distribution of territorial disparities through this synthetic indicator and to pinpoint possible patterns of cultural identity in said territorial areas

and their link to the degree of economic development. By doing so, we aim to ascertain whether there is a relation between *vice* as a cultural feature and economic behaviour as the result, as well as its specification in terms of spatial well-being disparities. This is applied to a set of countries in the European Union, for which a reasonable and homogenous number of representative variables has been compiled, with a NUTS 2 (regions) level of disaggregation. This can provide a more accurate analysis of spatial disparities beyond what are merely possible differences between countries. The method involves applying statistical techniques to sum up information, and Data Envelopment Analysis (DEA) to construct a composite indicator, as well as mapping representation and spatial econometric tools to pinpoint possible spatial dependency effects.

The work is structured in four sections. In addition to this introduction, section 2 deals with the theoretical framework of the research related to the links between economics, culture and religion, and particularly the analysis of the cultural basis of a particular group or geographical area's economic results. The analytical proposal of reformulating the *Seven Deadly Sins* as indicators of well-being is also addressed. Section 3 then reflects the empirical applications, specifying the case study (variables and territorial entities), the results of the spatial distribution of the partial indicators and the composite index and, finally, the analysis of spatial dependency. The work comes to a close with the section outlining the main conclusions.

## **2. Theoretical framework**

### *2.1. Religiosity, culture and economics*

Until recently, economists were reluctant to consider culture and religion as possible drivers of economic phenomena. Yet the issue is currently a hot topic, such that cultural studies and the economic analysis of culture in a number of dimensions have consolidated themselves as an accredited and productive area of study (JEL Z1), which has even given rise to various areas of specific work: analysis of culture as artistic expression (JEL Z11), studying the economic effects of religions and religiosity (JEL Z12), analysis of other kinds of determinants of cultural idiosyncrasy from the anthropological standpoint, ethnic diversity, inherited customs, institutions and social relations (JEL Z13). In line with Guiso et al. (2006), the starting point for these studies involves assuming that culture, perceived as a set of beliefs and values that are handed down from generation to generation by different social, ethnical and religious groups, has an impact on the formation of expectations and preferences, and therefore on long-term economic outcomes. The basis of this causal relation lies in the fact that the idiosyncratic cultural attributes (deep-rooted) embrace an inherited and immutable component, greater than

acquired cultural qualities or accumulated social habits; hence, their determinant nature over time (Becker, 1996).

In this sense, the deadly sins constitute one of the most symptomatic expressions of Christian moral and, therefore, can also represent a form of cultural characterization of a society or group. They were originally defined in the VI century by Pope Gregory the Great, and revised and reformulated by Saint Thomas Aquinas in the XIII century, giving rise to the most widely-known list today of the *Seven Deadly Sins*: greed, envy, wrath, lust, gluttony, sloth and pride (Vid. Table 1). They encapsulate the principles of vices (or, by contrast, virtues) in Christian ethics, yet may also be understood as general norms for the proper behaviour of people, both in individual as well as social terms<sup>1</sup>. Whatever the case, either as a form of cultural characterization or as an interpretation that is closer to notions of well-being and social efficacy, the deadly sins and their contrasting virtues may have an economic meaning (Baker and White, 2015), and the subsequent behaviour could be translated into specific patterns of economic and social characterization at a territorial scale.

These relations between culture, religion and economics have been addressed in the scientific literature from four main standpoints. Firstly, and specifically, by examining the impact that religiosity and the affiliation to certain religions can have on a particular economic behaviour, either from the demand side or the supply side. In this regard, related works include those of Katz-Gerro et al. (2009) and Montoro-Pons and Cuadrado-García (2018) exploring the impact of religiosity on cultural consumption, or the studies of Heineck (2004) and Pérez Villadóniga et al. (2014) concerning the impact of religious affiliation and the intensity of religious practice on individuals' willingness to work. Secondly, and from a wider concept of the notion of culture, embracing all beliefs, values and attitudes inherited by a society or a group over time, we have neo-Weberian inspired works (Weber, 1905) based on ethnic heterogeneity and cultural diversity as determinants of the degree of an economy's development and innovation (Guiso et al, 2006; Tabellini, 2010; Bakens et al., 2015). Following a similar vein are the works of Tubadji (2012) and Tubadji and Nijkamp (2015 and 2016) that provide a notion of the stock of cultural capital based on the accumulation of material and immaterial elements, amassed and present in a society and analyse the impact on regional economic development, from a perspective similar to the assessment of the economic impact of social capital as a productive resource. In this sense, cultural capital is seen to have a significant impact on the levels of

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<sup>1</sup> In fact, the deadly sins are initially assumed to be abuses or excessive versions of humans' natural faculties or passions, and therefore invoke moral norms aimed at preventing an inclination towards evil, by setting behaviour on the right path towards an idea of perfection, achievement of which is by no means hypothetical or transcendental, but which is perfectible on earth and in real terms. This is why what constitutes correct individual behaviour is also reflected in the form of cooperative behaviour and social norms.

economic growth, although also in the opposite direction; in other words, the different levels of development affect the size and dynamism of cultural capital, giving rise to explanations based on the central-peripheral model (Myrdal, 1957) for understanding the origin and existence of new spatial disparities in this area: wealthy regions and countries have powerful and productive cultural resources whereas less developed regions and countries have more scant and less dynamic cultural capital.

Thirdly, and closely linked to the previous line of research are the studies that seek to describe a version of the stock of cultural capital that is closer to its artistic meaning and an expression of the cultural, material or immaterial creativity of a society throughout the centuries. From this perspective, Bucci et al. (2014), Cerisola (2018) and Herrero et al. (2018) explore the impact of this notion of cultural capital on the degree of economic development, while Falk et al. (2011) and Backman and Nilson (2016) show that cultural capital and cultural amenities have a relevant impact on the concentration and quality of human capital and therefore on the capacity for economic growth. Nevertheless, once again the importance of the critical mass of cultural capital is apparent, and only when its presence is sufficiently pervasive does culture become a true driver of economic development, bearing out the hypothesis that unbalanced growth in an area is based on the cultural factor of regions.

Finally, a fourth line or inquiry geared towards estimating subjective well-being indicators (happiness and life satisfaction) and synthetic indicators of quality of life should be highlighted. One feature that emerges as relevant in this field is again the impact of representative variables of cultural capital in its different versions: from the impact of cultural experiences (Kim and Kim, 2009) to cultural indicators spanning a broader spectrum, close to the notion of social capital and representative of values such as the feeling of cohesion, collective pride, level of religiosity (Jagodzinski, 2010); and, finally, aspects of a more material nature such as safety, social inclusion, governance and institutional efficacy (Lin and Li, 2017) that are closer to the notion of the quality of life.

Based on these premises, our method embraces a number of the previous approaches, since we consider the deadly sins in a two-fold sense: on the one hand, as a vector of religion and moral-based cultural identity and, on the other, as a form of social behaviour that has economic implications measured in terms of well-being. In this way, our intention is to gather representative variables of each notion of sin or *vice*, reworked in the form of non-cooperative social behaviour, and to construct composite indexes to describe each dimension, and which ultimately match a synthetic indicator representing the level of well-being, obviously expressed in reverse polarity. Insofar as this indicator considers territorial specification, our aim is also to

explore the spatial disparities and their link to the level of economic development and/or patterns of cultural identity in their area.

## 2.2. *Reformulation of the Seven Deadly Sins into well-being indicators*

In recent years, there has been an increasing proliferation of initiatives focusing on the concept of quality of life and well-being. At the centre of these studies lies the recognition that gross domestic product (GDP) offers only a partial perspective of the factors that affect people's lives. Designed in the 1990's, the *Human Development Index* (HDI) was a pioneering attempt in this direction since it incorporated measures of education, life expectancy and other variables related to people's capabilities, and not just income. From this starting point, a wide field of study and empirical applications has emerged, favoured not only by methodological progress in the construction of synthetic indicators (Nardo et al., 2008; Srakar et al., 2018), but also by the existence of increasingly large and refined databases. All these purposes and efforts have sought to develop tools aimed at finding better measures of economic development and assessing people's living conditions, by increasingly including a number of satisfaction measures. The underlying problem was that GDP growth per capita is a very simple tool and does not always translate into a better life for people.

In this process of theoretical and empirical development, certain works have focused on measuring the quality of life through social indicators. That is the case of Maesen and Walker (2005) who compile variables and build composite indexes taking into account four main dimensions such as socio-economic security, social cohesion, social empowerment and social inclusion. This approach has been followed by Abbott and Wallace (2012) and Lin and Li (2017) employing survey data that predominately include subjective indicators to measure the social quality of life of different samples of countries. Another group of studies focuses on more comprehensive well-being measures, which might be better able to describe real living conditions and could be useful for more accurately designing policies. In this area, we should mention the project headed by the Nobel laureate Joseph Stiglitz (See Stiglitz et al., 2009) that provides guidelines for creating alternatives to GDP as a measure of wealth and social progress considering three basic domains, namely material conditions, quality of life, and sustainability. Since these basic ideas, the largest and probably most well-known initiative was undertaken by the OECD with the *Better Life Index* (BLI) (see Durand, 2015), which provides information on several well-being dimensions covering most areas of daily life. These are: housing, income, jobs, community, education, environment, civic engagement, health, safety and work-life balance. The indicators are available in an open access data set<sup>2</sup>, which is regularly updated. However, it fails to provide an aggregate measure capturing overall well-being, a task which is

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<sup>2</sup> See [www.oecdbetterlifeindex.org](http://www.oecdbetterlifeindex.org)

left for interested users. This has led to numerous studies on building composite indicators based on the BLI information, such as Mizobuchi (2014), Lorenz et al. (2016) and Peiró-Palomino and Tadeo-Picazo (2017) as examples. The OECD framework has also represented the starting point to develop a conceptual structure for measuring societal and economic progress in other territorial disaggregation levels, such as the case of Italian provincial capital cities (Nissi and Sarra, 2016) or Spanish provinces (Murias et al., 2006).

Starting from this conceptual framework, our research purpose is also to construct a better life index, yet one which is based on the suggestive idea of reformulating the list of seven deadly sins into partial indicators of well-being or quality of life. The underlying hypothesis is that they express not only an individual perversion, but also a kind of antisocial behaviour in some of the dimensions just mentioned, added to which they might also respond to a deep-rooted cultural characterization background. The partial indicators and composite index we finally intend to build will be expressed regionally, in an attempt to find specific spatial patterns. Logically, they display an inverse polarity (the higher the indicator, the lower the degree of well-being) and the interpretation of each dimension/indicator is explained as follows (Table 1):

- ✓ Greed (*Avaritia*): it means the excessive desire of riches and possessions and might therefore be interpreted as the extraordinary accumulation of income that we intend to measure in spatial terms. In this sense, it is felt that a high spatial or social concentration of rent is one key source of social inequality. The variables we have thus taken into account are household income per capita of the regions, weighted at the same time by km<sup>2</sup>, following the idea of considering a double concentration of wealth, by individual and by surface. Since this vice has a certain connotation of hoarding money, employment and gross capital formation in the finance and insurance sector have also been considered in the sources of the synthetic indicator. The composite partial index of this dimension is therefore called income inequality or wealth concentration indicator.
- ✓ Envy (*Invidia*): it could be defined as the sadness towards the possessions of others and can therefore be linked to variables related to theft in different meanings (robbery, burglary, pickpocketing, crimes against property, breaking into residential premises, motor vehicle theft, etc.). Adopting such a hypothesis, and in an effort to find a social indicator of safety as a component to reflect quality of life or well-being, we can construct a composite indicator of the variables mentioned. The partial synthetic indicator is therefore a security index.
- ✓ Wrath (*Ira*): it originally means an uncontrolled feeling of anger and hatred towards certain people and, consequently, can simply be societally interpreted as an indicator of violence if, for each spatial unit, we take into account variables such as intentional homicides, deaths

due to voluntary self-harm, to which we also add those people killed in traffic accidents. This last variable might also be connected to the state of road infrastructures and, therefore, to each country and region's degree of economic development. However, it can also be taken as a proxy of the degree of violence, considering the volume of resources derived from public and private expenditure caused by these involuntary deaths.

- ✓ Lust (*Lujuria*): it was originally identified with rampant sexual appetite, but as far as our case study is concerned, we change it into a simple health indicator. This sin proves indeed to be the most difficult notion to transform, since the idea is to turn a hypothetical individual deviation into a non-cooperative failing of a more social nature. Consequently, based on the idea that sexual promiscuity may increase the likelihood of sexually transmitted diseases, we have broadened the concept of the individuals' general health, extending the primary indicators, and their derived implications in terms of social efficacy. We therefore take basic health variables, such as gross mortality rate for several maladies, infectious and tuberculosis diseases and virus infection (virus hepatitis and HIV) as well as life expectancy at birth, in order to build a composite health indicator, and include it in the general index of well-being or quality of life where, as is to be expected.
- ✓ Gluttony (*Gula*): it could be defined as overconsumption of anything to the point of waste and, therefore, can be identified as an indicator of the sustainability of resources from the social point of view. To do this, we will consider variables such as metric tonnes of waste generated by households and small businesses per 1,000 inhabitants, and the estimated degree of soil erosion by water per hectare. In addition to these variables, we add other proxies that are closer to the component of individual disorder this vice implies, such as the number of deaths due to alcohol-related disorders or respiratory diseases, which are mainly caused by smoking. This complements the dimension of the sustainability of resources with a factor related to health or expenses incurred as a result of personal and social disorders or diseases.
- ✓ Sloth (*Desidia*): this vice is identified originally with laziness and excessive leisure and, from our societal point of view, can be reformulated as an indicator of educational and labour market efficiency, attempting to embrace variables such as school dropout rates and young people not in education, employment, or training (NEET)
- ✓ Pride (*Superbia*): it is considered, on almost every list, the original and most serious of the seven deadly sins because it deals with the perversion of the faculties that make humans believe they are essentially and necessarily better, superior, or more important than others, and even a more like God dignity and holiness. It is also thought to be the source of the other capital sins. For this reason and from our societal approach, we view this dimension as a composite indicator of the previous vices and, therefore, consider it as the synthetic index of well-being or quality of life, which has an inverse polarity, as already pointed out.



**Table 1. Defining the seven deadly sins as well-being dimensions: list of variables and synthetic indicators**

SIN/ VICE ( <i>Latin</i> )	VARIABLES (*)	INDICATOR	FORMULAE
Greed ( <i>Avaritia</i> )	AVA 1: Household income pc and per km2, 2014 AVA 2: Employment in finance and security sector, 2015 AVA 3: Gross capital formation in finance and security sector, 2015	Income inequality indicator / Wealth concentration indicator	$I\_AVA_i = \frac{x_{AVA_i}}{\max(x_{AVA_i})}$ , $i=1,2$ $I\_AVA_i = \left( \frac{x_i - x_{i\min}}{x_{i\max} - x_{i\min}} \right)$ , $i=3$ $PI\_AVA = \sqrt[n]{\prod_{i=1}^n I\_AVA_i}$ , $n=3$
Envy ( <i>Invidia</i> )	INV 1: Theft, crimes against property, 2010 INV 2: Breaking into residential premises, 2010 INV 3: Motor vehicle thefts, 2010	Safety indicator	$I\_INV_i = \frac{x_{INV_i}}{\max(x_{INV_i})}$ , $i=1,2,3$ $PI\_INV = \sqrt[n]{\prod_{i=1}^n I\_INV_i}$ , $n=3$
Wrath ( <i>Ira</i> )	IRA 1: Intentional homicides, 2010 IRA 2: Gross mortality rate for voluntary self-harm, 2015 IRA 3: Deaths by traffic accidents, 2016	Violence indicator	$I\_IRA_i = \frac{x_{IRA_i}}{\max(x_{IRA_i})}$ , $i=1,2,3$ $PI\_IRA = \sqrt[n]{\prod_{i=1}^n I\_IRA_i}$ , $n=3$
Lust ( <i>Luxuria</i> )	LUI 1: Life expectancy at birth, 2016 LUI 2: Gross mortality rate for infectious diseases, 2015 LUI 3: Gross mortality rate for tuberculosis disease, 2015 LUI 4: Gross mortality rate for HIV, 2015 LUI 5: Gross mortality rate for hepatitis viral malady, 2015	Health indicator	$I\_LUI_i = \left( \frac{x_{i\max} - x_i}{x_{i\max} - x_{i\min}} \right)$ , $i=1$ $I\_LUI_i = \frac{x_{LUI_i}}{\max(x_{LUI_i})}$ , $i=2,3,4,5$ $PI\_LUI = \sqrt[n]{\prod_{i=1}^n I\_LUI_i}$ , $n=5$
Gluttony ( <i>Gula</i> )	GUL 1: Waste and rubbish in metric tonnes (families and small companies), 2012 GUL 2: Estimated degree of soil erosion for water per hectare, 2012 GUL 3: Gross mortality rate for alcohol-related disorders, 2015 GUL 4: Gross mortality rate for respiratory diseases, 2015	Sustainability indicator	$I\_GUL_i = \frac{x_{GUL_i}}{\max(x_{GUL_i})}$ , $i=1,2$ $PI\_GUL = \sqrt[n]{\prod_{i=1}^n I\_GUL_i}$ , $n=2$
Sloth ( <i>Desidia</i> )	DES 1: School dropout rate, 2017 DES 2: Young person not in education, employment or training rate (NEET), 2017	Educational and labour market efficiency indicator	$I\_DES_i = \frac{x_{DES_i}}{\max(x_{DES_i})}$ , $i=1,2$ $PI\_DES = \sqrt[n]{\prod_{i=1}^n I\_DES_i}$ , $n=2$
Pride ( <i>Superbia</i> )	It is thought to be the source of the other capital sins and we therefore consider this dimension as synthetic indicator of the previous vices	Well-being / Quality of life composite indicator	$CI\_SUP = \max_{w_{r,i}} \sum_{i=1}^n w_{r,i} * PI\_SINS_{r,i}$ , $n=5$

Note: (\*) All variables are measured by 100,000 inhabitants except rate indicators, life expectancy and soil erosion.

Source: Own elaboration and EUROSTAT

Through this, we have been able to reformulate the list of deadly sins, an emblematic example of norms related to education and Cristian moral, by turning them into indicators of well-being and quality of life, and considering that they also constitute standards of social cooperative behaviour. Grounded on this, it proves interesting to analyse the spatial distribution of these indicators and to see whether any spatial patterns emerge that may be due to reasons of cultural idiosyncrasy, and to gauge any possible economic effects involved.

### **3. Empirical application**

#### *3.1. Case study and methodology*

Given that our aim is to reformulate the deadly sins as indicators of well-being and to analyse their territorial distribution so as to test their link to disparities in economic development and determine possible spatial patterns of cultural identification, it is worth considering a wide range of countries that cover a degree of cultural diversity and which, at the same time, have sufficient territorial disaggregation to allow possible internal imbalances to be pinpointed. Our case study is thus made up of a sample of 21 countries in the European Union with a NUTS 2 level of disaggregation, such that a total of 205 regions have been included in the analysis. Even though the countries considered are mainly Cristian, they do display certain differences, since some are eminently Catholic (Poland and southern European countries), some predominantly Lutheran (Nordic countries), whilst others are mainly orthodox Cristian (eastern European countries), with some, such as Germany and the Netherlands, comprising different religious groups depending on regions.

The source of information for gathering the indicators was mainly EUROSTAT and the choice of countries was determined by the wish to secure a sufficiently broad sample of countries and regions, with a relatively homogeneous base of variables, that were representative of each *vice* or *sin*, reshaped in the form of well-being or quality of life<sup>3</sup>. The values of the variables in the database are updated to the closest year available in time and therefore refer mainly to around 2015, except for the variables related to safety, for which there is no updated information available at a regional disaggregation level after 2010<sup>4</sup>. Table 2 shows the descriptive statistics of the variables finally used in the analysis.

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<sup>3</sup> We were unable to compile sufficient and homogeneous information with regional disaggregation for countries such as Ireland, the United Kingdom, Greece, Croatia and Luxembourg. In certain Nordic countries and the Netherlands some health variables did not appear with regional disaggregation, such that we took the regional distribution of national data in terms of demographic size and surface area of each region. For the few regions where data was missing, we took the value of the year immediately prior, or when no data was available this was recovered by allocating the value corresponding to a region in that country that had a similar surface area and demographic size. The final database is available upon request to authors.

<sup>4</sup> We carried out a prior test of constructing a global synthetic indicator for well-being using data from around 2010. Results were virtually the same, at least in the basic structure of the ensuing spatial disparities. This therefore serves

**Table 2 Descriptive statistics of variables**

Acronym	Variable	Minimum	Maximum	Mean	SD
AVA1	Household income pc and per km2	0.086	132.298	4.044	11.380
AVA2	Employment in finance and the security sector	2.059	48.294	10.077	6.596
AVA3	Gross capital formation in finance and the security sector	-5.836	186.325	13.032	19.461
INV1	Theft, crimes against property	6.408	767.608	75.718	89.949
INV2	Breaking into residential premises	8.453	1002.391	228.727	209.219
INV3	Motor vehicle thefts	3.725	657.328	139.126	126.409
IRA1	Intentional homicides	0.000	7.130	1.192	0.887
IRA2	Gross mortality rate for voluntary self-harm	3.600	30.710	12.715	4.538
IRA3	Deaths by traffic accidents	1.108	14.275	5.758	2.459
LUI1	Life expectancy at birth	73.300	85.200	80.726	2.608
LUI2	Gross mortality rate for infectious diseases	1.070	41.840	17.455	7.975
LUI3	Gross mortality rate for tuberculosis	0.070	7.030	0.902	1.164
LUI4	Gross mortality rate for HIV	0.040	6.510	0.671	0.874
LUI5	Gross mortality rate for hepatitis	0.050	7.050	1.335	1.344
GUL1	Waste and rubbish in metric tonnes (families and small companies)	18.066	74.965	45.340	11.519
GUL2	Estimated degree of soil erosion by water per hectare	0.030	17.605	2.635	3.177
GUL3	Gross mortality rate for alcohol-related disorders	0.050	14.180	3.742	3.338
GUL4	Gross mortality rate for respiratory diseases	29.350	213.160	80.724	26.254
DES1	School dropout rate	1.600	27.800	10.524	4.907
DES2	Young persons not in education, employment or training rate (NEET)	2.000	30.900	10.128	5.203

Note and source: *ibid* Table 1

As regards the method, and given the wide range of variables used, which differ enormously due to their very nature and which, therefore, present problems of substitutability, it was decided to follow the HDI accredited method of calculation (UNDP, 2014). We therefore first carried out a normalization of the original values of each variable through the quotient between the actual value of each region and the maximum value of the whole sample or using max-min scales (see also Lin and Li, 2017). We then calculated the composite index that was representative of each *sin* or well-being dimension through the geometric mean of the variables we compiled in order to define each one of them (see. Table 1). This allows us to smooth the extreme values of the original variables for each case. Finally, the synthetic indicator of well-being or quality of life, which is particularly representative of the sin of pride, the father of all sins, is calculated by means of mathematical optimizing all the previous dimensions through DEA. This technique, which is often posited for efficiency evaluation studies by optimizing the production functions of companies or institutional bodies, is increasingly being used to

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to further strengthen the robustness of the results, since it is to be assumed that structural identity trends remain unchanged in the short and medium term.

construct synthetic indicators based on maximizing the output values (in our case, dimensions of well-being or deadly sins) subject to the restriction of a hypothetical unitary input<sup>5</sup>. In this way, the optimisation approach might be expressed as follows

$$I_c = \max_{w_{c,i}} \sum_{i=1}^m w_{r,i} * y_{r,i}$$

subject to:

$$\sum_{i=1}^m w_{r,i} * y_{j,i} \leq 1 \quad \forall j \in \{1, \dots, n\}$$

$$w_{r,i} \geq 0 \quad \forall i \in \{1, \dots, m\}$$

where  $n$  represents the number of regions,  $m$  the number of partial indicators representing the deadly-sins or well-being dimensions (six in all), while  $y_{r,i}$  represents the value of the partial indicator  $i$  for region  $r$ , with  $w_{ri}$  being the respective weightings (See Table 1 for the particular case study specification). This is a basic formulation of an output-oriented DEA, for a hypothetical set of inputs with a reference value equal to one and where the weightings must be positive and less than one as a common restriction in DEA.

The results for both the final synthetic indicator and the partial indicators of well-being, are represented cartographically on a scale of rank quintiles of each index, in order to provide a clearer view of the differences in regional distribution and to determine, as far as possible, spatial identification patterns. Moreover, in order to conduct a more thorough analysis of the indicator's territorial distribution and to pinpoint more efficiently the effects of spatial interaction, econometric spatial autocorrelation techniques, used in other studies in the area of culture are applied (Boal and Herrero, 2018). Moran's I global statistic (Anselin, 1988) allows us to test for the existence of spatial dependency, reflected in the influence that the quality of life in neighbouring regions has on a particular region's well-being. This statistic is defined as:

$$I = \frac{N}{S_0} \frac{\sum_{i,j}^N w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^N (x_i - \bar{x})^2} \quad i \neq j \quad (1)$$

where  $x_i$  is the value of the variable  $x$  in region  $i$ ,  $\bar{x}$  is a simple average of the variable  $x$ ,  $w_{i,j}$  are the components of the spatial weights matrix,  $N$  is the sample size and  $S_0 = \sum_{i=1}^n \sum_{j=1}^n w_{ij}$ .

For its part, Moran's local I statistic, LISA (Anselin, 1995) allows significant spatial clusters in regions with similar levels of well-being to be identified and is a derivative of the previous one:

$$I_i = \frac{z_i}{\sum_i z_i^2 / N} \sum_{j \in J_i} w_{ij} z_j \quad (2)$$

where  $z_i$  is the value taken by the normalized variable in the region  $i$ , and  $J_i$  is the set of areas considered neighbours of  $i$ .

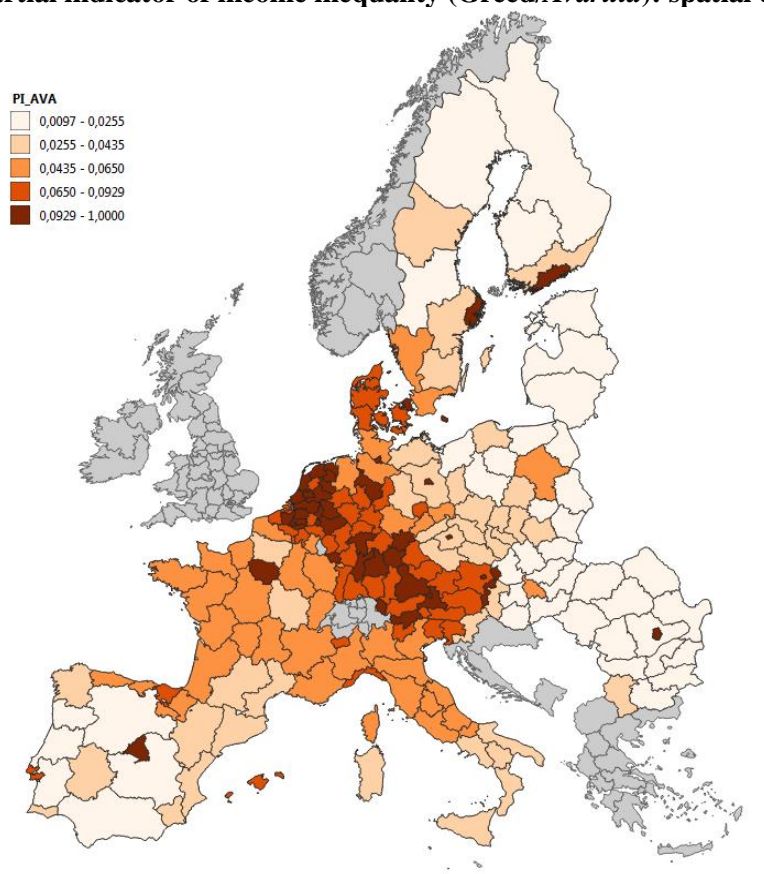
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<sup>5</sup> For constructing synthetic indicators, similar applications can be seen in Murias et al. (2006), Peiró-Palomino and Tadeo-Picazo (2017), Gómez and Herrero (2018).

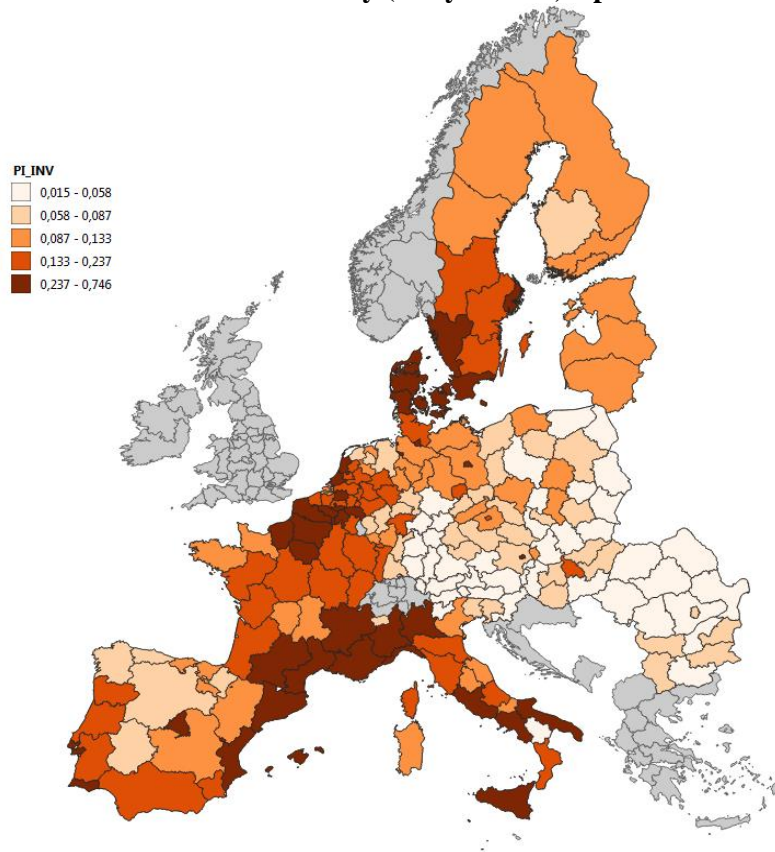
### 3.2. Results

We start by describing the results of the partial indicators of well-being that correspond to the first six deadly sins and which are obtained, as pointed out, as a geometric mean of the original variables that define each of them, normalized in the range value (Table 1). This first gives us *greed* (Figure 1), converted into the indicator of inequality in income or spatial concentration of wealth and which is thus calculated as running counter to the enhanced levels of well-being that would result from greater distribution. It not only takes into account the polarization of regional per capita income but also the scope of financial activities and insurance in terms of employment and investment. It obviously shows a high concentration in the main areas of higher economic development in Europe, particularly in the central regions of the so-called “grand blue”, from Belgium and the Netherlands to northern Italy, and spanning the western regions of Germany and northern France. There is a certain oversizing effect of the value of the indicator in smaller regions due to the weighting by surface of per capita income. The lower ratios of wealth concentration disappear mainly in regions in eastern European countries and south of Spain and Portugal, which are also characterized by lower rates of development than the European average.

**Figure 1. Partial indicator of income inequality (*Greed/Avaritia*): spatial distribution**

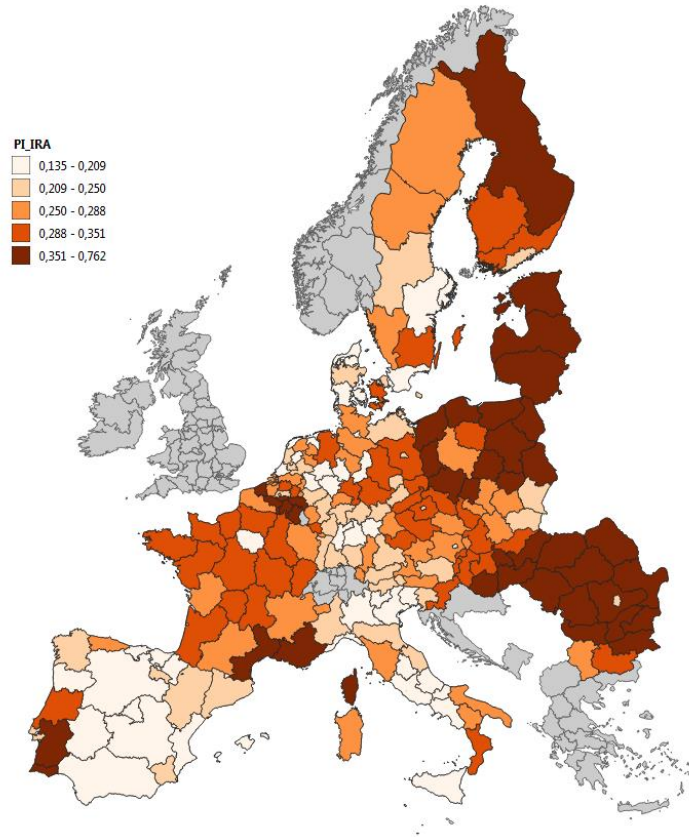


**Figure 2. Partial indicator of safety (Envy/*Invidia*): spatial distribution**

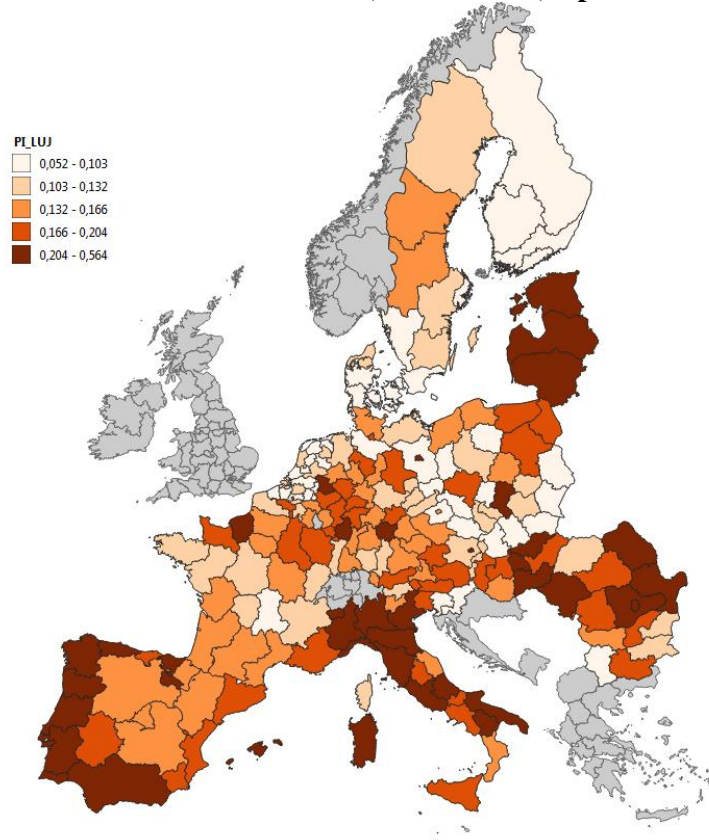


The map (Figure 2) shows that the sin of *envy*, converted into a partial indicator of safety since it sums up several variables reflecting different types of theft and robbery and violence against property, is concentrated in the Mediterranean coastal regions. This might be explained by the prevalence of tourism in these areas, yet it also emerges in northern parts of France, Belgium and the Netherlands, where the main European ports are located, as well as Denmark and Sweden. The sin of *wrath*, however, converted into a complementary index of the previous one, since it constitutes a partial indicator of violence (covering murders, self-harm and victims of traffic accidents), displays a spatial distribution that is far more localized in all the regions of the eastern part of Europe (Figure 3), a fact that may also be explained by it being a less developed area and having poorer transport infrastructures. As we have already justified, the sin of *lust* has been totally transformed into a general indicator of health with inverse means, and therefore comprises variables related to life expectancy and death from various classified diseases (infectious, viral, etc.) that can reflect both a society's state of health as well as how efficient its health system is. In this case (Figure 4), the distribution shows a greater concentration of high values (worse health conditions) in the concentric strip of coastal regions in southern Europe, together with Baltic countries and eastern European countries such as Romania and Bulgaria. Better health values (low values of the indicator) are found in central and northern European countries.

**Figure 3. Partial indicator of violence (Wrath/Ira): spatial distribution**



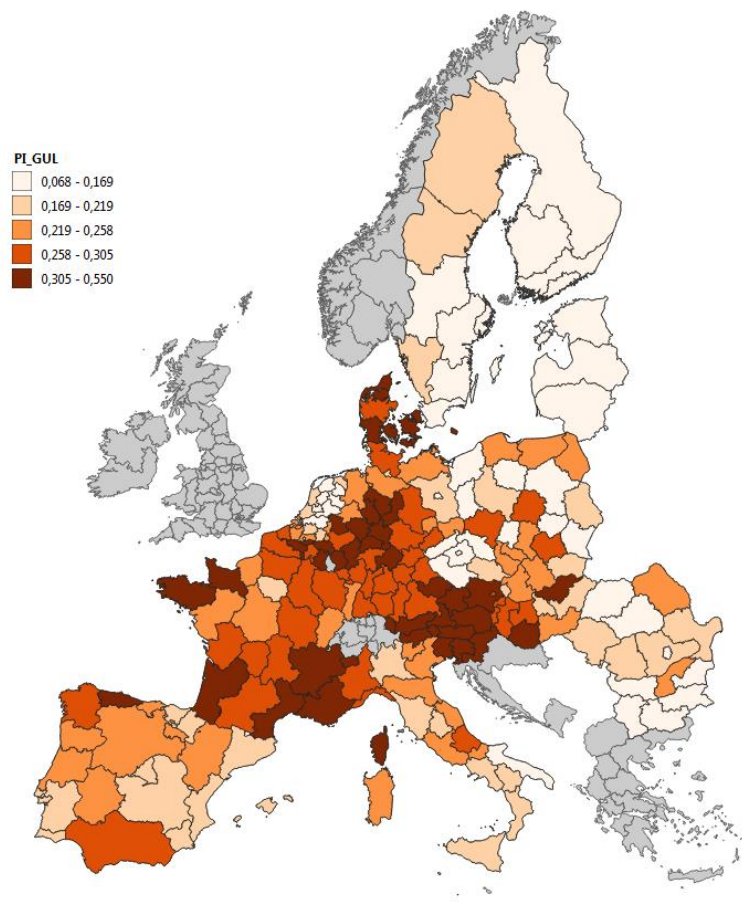
**Figure 4. Partial indicator of health (Lust/Luxuria): spatial distribution**





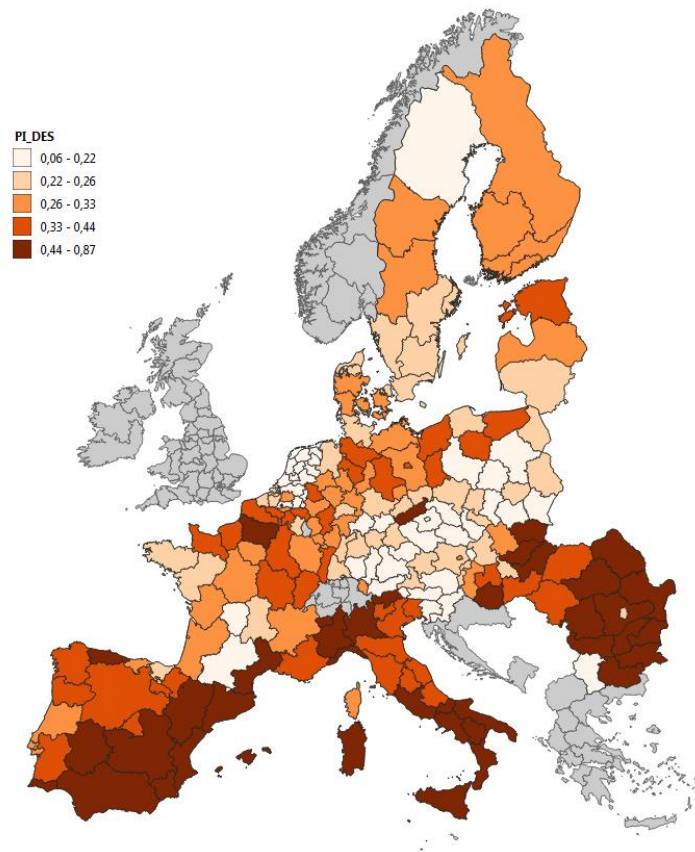
The sin of *gluttony* has been identified as a partial index of the sustainability of a society's resources, measured in terms of environmental degradation (soil erosion), waste generated as well as certain individual disorders caused by alcoholism and smoking. The geographical distribution of this indicator (Figure 5) reflects a greater concentration in central European countries, principally France, the western part of Germany, Denmark and Austria, and is obviously related to the level of economic development in these regions that might give rise to greater amounts of waste, in relative terms. In contrast, the sin of *sloth*, summed up in the form of the indicator representing how efficient the education system is and how the labour market is able to absorb young people (Figure 6), shows a high concentration in Spain, Portugal, Romania, Bulgaria and the south of Italy, countries and regions that have high levels of youth unemployment and suffer from structural problems in the job market and adaptation of the education system.

**Figure 5. Partial indicator of sustainability (Gluttony/Gula): spatial distribution**



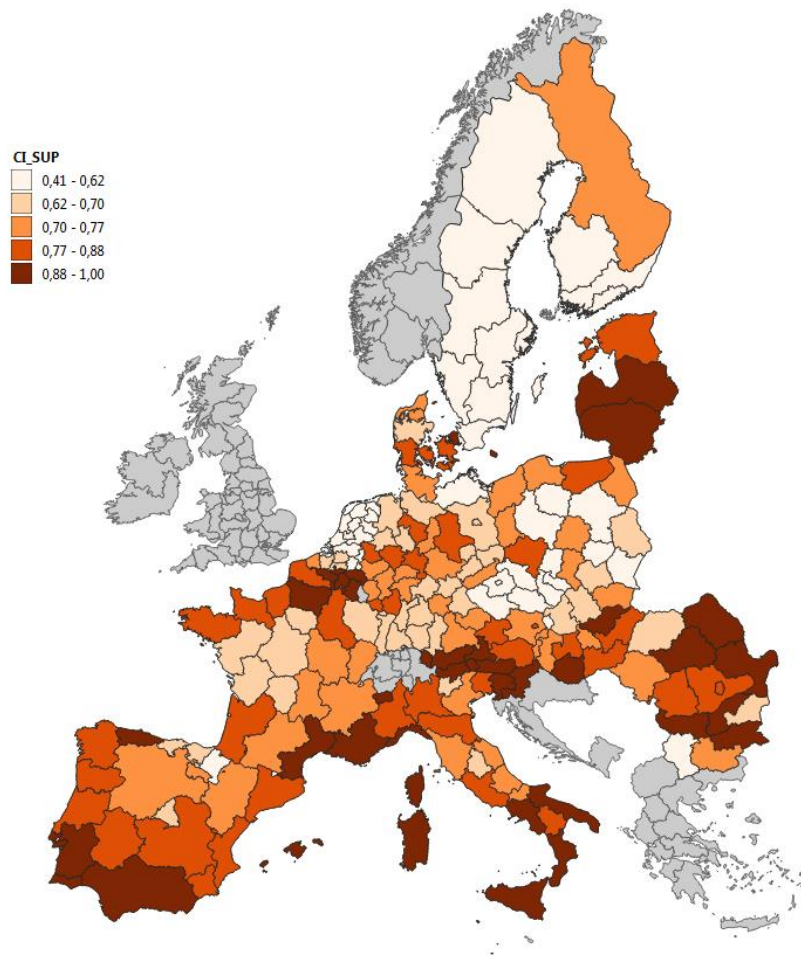


**Figure 6. Partial indicator of educational and labour market efficiency (Sloth/Desidia): spatial distribution**



Finally, what is the geographical distribution of the global synthetic indicator? This is a weighted composite index of the previous partial indexes and can be considered, given the similarity of the dimensions taken into account in other comparable studies, as a summary of the quality of life or indicator of well-being, obviously with inverse polarity. In the analogy with the deadly sins, this indicator is referred to as a summation of the sin of *pride*, since it is deemed to be the origin of all the vices mentioned. Its territorial distribution in the European case study is reflected in Figure 7. A look at the map shows that the worst levels of well-being or quality of life (reflected through high values of the composite indicator) emerge in the regions of the coastal areas of the Mediterranean and Portugal, together with the Baltic countries, Romania and Bulgaria. Other areas that share this situation are northern France, Wallonia in Belgium, Slovenia and lower Austria and Hungary. In contrast, the best levels of quality of life (low values of the indicator) are to be found mainly in regions in central European countries, spreading into Sweden, some parts of Poland and Czech Republic and Finland. Regions displaying an intermediate level of the quality of life are found in northern Spain, central France and the centre and north of Italy.

**Figure 7. Synthetic indicator of well-being/quality of life (Pride/Superbia): spatial distribution**

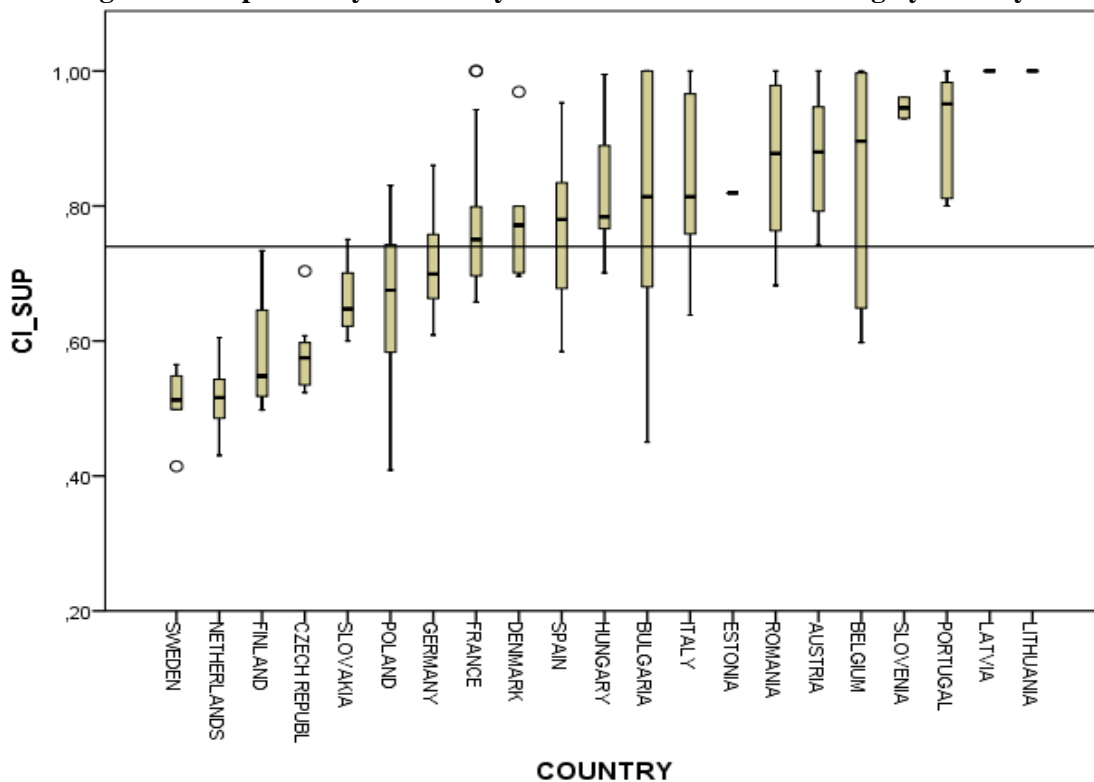


To a certain extent, the clear link between the distribution of the synthetic indicator of well-being we have constructed based on the deadly sins and levels of economic development at a regional scale in Europe is obvious, since many of the dimensions of the quality of life considered in the analysis are related to the notion of economic development, such as the indicator of health, educational efficiency, and even the indicators of safety and violence. Nevertheless, one is forced to ask whether there is any specific pattern of geographical configuration. In this sense, the first relevant result concerns some of the Polish and Czech regions, which display a medium-low level of development compared to the European standard but which, nevertheless, reach relatively low levels in the indicator of well-being, i.e. they reflect high levels of quality of life<sup>6</sup>. On the other hand, if we look at the distribution of the synthetic indicator of well-being in terms of countries through a boxplot (Figure 8), another relevant result emerges. There is a substantial difference between the first seven countries in the

<sup>6</sup> Nevertheless, applying the univariate Pearson correlation between the value of the indicator of well-being and per capita GDP standardized for all the regions in the sample proves significant when excluding or including Polish and Czech regions. In other words, quality of life through our indicator and levels of regional economic development in Europe display a strong correlation in the inverse sense, i.e. higher values of the synthetic indicator (which means lower levels of well-being) imply a comparatively lower level of economic development for the regional structure of the sample of European countries.

graph which are below the median value of the synthetic indicator for the whole set of regions analysed. They display low levels in the well-being index, in other words, an above average quality of life and also have a relatively low level of regional dispersion. In contrast, the rest of the sample of countries begin to show high levels of the indicator, which implies relative losses in levels of well-being as well as a greater dispersion in regional values, reflecting major internal imbalances. There would therefore seem to be a certain kind of cultural configuration in this distribution, since the first group is primarily made up of Protestant countries or countries with a strong presence of these religions in many of their regions (as is the case of Germany and the Netherlands), in addition to the already mentioned exception of Poland. In contrast, the second group mainly contains Catholic and orthodox religion countries. This merely serves, therefore, to bear out the hypothesis concerning the relation between a deep-rooted cultural characterization based on religious affiliation and levels of development and the quality of life, at least in the material expressions taken into account here.

**Figure 8. Boxplot analysis of the synthetic indicator of well-being by country**



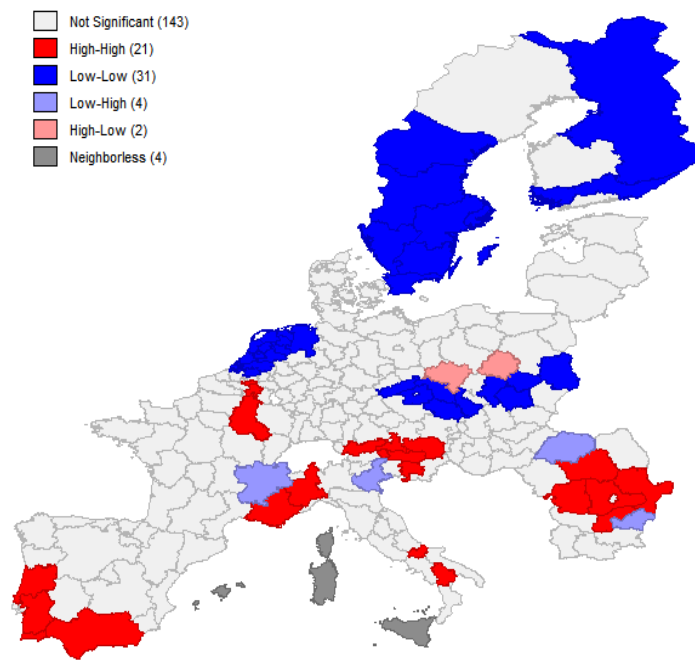
In an effort to further substantiate these results regarding specific spatial patterns based on cultural and economic characterization, an analysis of spatial dependency through *Moran's I statistic* was carried out (see Anselin, 1988 and 1995; Boal and Herrero, 2018). Firstly, *Moran's global I*,  $Z(I)$  standardized statistic shows a positive and significant value for all the dimensions analysed, particularly in the indicator of pride or synthetic index of quality of life (Table 3). This points to the existence of spatial autocorrelation with a positive sign, which is interpreted

as the values of the dimensions of well-being in neighbouring regions mostly being similar and exerting an influence on one another. In other words, there is spatial dependency in the territorial distribution of well-being.

**Table 3. Spatial autocorrelation analysis by synthetic indicators**

Variables	I.G. Moran	Z(I)	p-valor
PI_AVA	0.1593	4.02	0.000
PI_INV	0.5192	10.33	0.000
PI_IRA	0.5057	10.77	0.000
PI_LUJ	0.5008	10.47	0.000
PI_GUL	0.6007	12.91	0.000
PI_DES	0.5616	11.75	0.000
CI_SUP	0.5137	10.14	0.000

**Figure 9. Spatial autocorrelation analysis: regional clusters through Moran's Local I**



This can also be validated by calculating the local indicator of spatial association LISA (*Moran's Local I*), since spatial clusters are seen to exist, made up of those adjacent regions that have similar values and for which the LISA statistic of spatial dependency proves significant. The results are shown in Figure 9, where two groups of regions emerge as significant. The regions shaded red display a major probability of spatial dependency in high values of the well-being indicator (high-high clusters), reflecting poorer quality of life conditions, and are clearly situated in the south of the Iberian Peninsula, south-east France, most of the regions in Romania

and Bulgaria and the convergence of lower Austria and Slovenia. In contrast, the regions shaded blue show significant spatial interaction in low values (low-low clusters), indicating in our case better levels of well-being due to the shift in polarity, and are located in four main areas: the Netherlands and the north of Germany, southern Poland and Czech Republic, southern Sweden and Finland. Results from this analysis also anticipate a certain degree of persistence in the spatial configurations that emerge.

#### **4. Conclusions**

We have been able to reshape the list of deadly sins, an emblematic example of the norms of education and Christian moral, into indicators of well-being and quality of life, considering that they also constitute criteria of social cooperative behaviour. We have compiled objective variables that are representative of each notion of vice or sin and, in the form of composite indexes reflecting the various dimensions of quality of life, we have summed up the indicators that we obtain for health, educational efficiency, violence, safety, sustainability of resources and concentration of wealth. These notions concur with many of the studies exploring objective indicators of well-being, with our intention being to construct a synthetic indicator of quality of life or well-being with territorial identification so as to determine specific spatial patterns for the case study in hand: a sample of 21 European Union countries with a regional disaggregation (NUTS 2).

We were thus able to confirm that the spatial distribution of the synthetic indicator of well-being concurs with the regional economic disparities found in Europe in the sense that the regions with the highest value of the indicator (low relative level of quality of life) generally tend to be found in the regions that have the lowest levels of economic development measured in terms of per capita production. One notable exception was, however, found: the case of some Polish and Czech regions, which display acceptable levels of well-being in the aspects considered and in the final indicator, when they belong to a group of regions with a per capita GDP that is below the European average, but which is gradually increasing.

We also found that the distribution of the synthetic indicator of well-being by countries follows a different order: while Protestant countries show low values of the index (above average quality of life) and there is a relatively low level of regional dispersion, Catholic and Orthodox countries achieve higher values (poorer quality of life) with a greater degree of dispersion in the indicator, reflecting major internal imbalances between their regions. The spatial correlation study also bears out this result, since there are significant clusters of spatial dependency in Europe: in other words, regions with similar values have a high probability of appearing together. Groups of regions with consistently low levels of well-being are mainly located along

the coastal areas of southern Europe, the Baltic countries and eastern European countries (Rumania and Bulgaria), whereas clusters with consistently more appropriate values of well-being are located in northern and central Europe. As a corollary, it can be said that the results to emerge from this research support the relation between cultural identification and religious affiliation, with different levels of well-being and quality of life structures, at least in the economic and social aspects considered that are basically material in essence. Evidence is thus provided of the economic significance that certain elements of a society's cultural and religious idiosyncrasy can come to have. On the other hand, what now remains is to be explored are the conditions of subjective well-being, which need not necessarily coincide with the material conditions of quality of life and which no doubt display a different territorial distribution.

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