ANNEX II //

Contribution of cultural heritage to societal well-being

Annex II – The quantitative pan European analysis on the relation between tangible cultural heritage and societal well being

Final report // June 2022

Coordination
Manuela Samek Lodovici (Project manager), Istituto per la Ricerca Sociale (IT)
Cristina Vasilescu (Deputy project manager), Istituto per la Ricerca Sociale (IT)

Outreach
Flavia Barca (outreach manager, ACUME); Simone Asciamprener and Cristina Vasilescu (IRS)

Authors
Manuela Samek Lodovici, Cristina Vasilescu, Erica Melloni, Alessandra Crippa, Serena Drufuca, Emma Paladino, Monica Patrizio, Flavia Pesce, Istituto per la Ricerca Sociale (IT); Andreas Wiesand, Victoria Ateca-Amestoy, ERICarts (DE); Pietro Valentino, Fabio Bacchini, Roberto Iannaccone, Associazione Per Economia Della Cultura (IT); Flavia Barca, ACUME – subcontractor (IT)

HERIWELL Case study experts
V. Ateca-Amestoy (Arquitectura de la Memoria case study, Spain), N. von Breska Ficović (ECoC Mons 2015: Long-term vision and strategy for cultural heritage, Belgium), D. Haselbach (Weimar memories, Germany), K. Jagodzińska, J. Sanetra-Szeliga, J. Purchla (How heritage changes environment and communities: Podgórze Museum in Kraków, Poland), E. Melloni (Mann Pilot case study, Italy), A. Ormston (Village Design Statement and Collaborative Town Centre Health Check programmes, Ireland), P. Petrová (The Czech Blueprint Handicraft, Czechia), G.B. Ween (Sámi cultural institutions as a source of societal well-being in Norway, Norway)

HERIWELL Team of Country experts
V. Ateca-Amestoy (ES), C. Ballé (FR), G. Barbaro-Sant (MT), N. von Breska Ficović (BE), K. Chainoglou (EL and CY), A. Cicerchia (IT), I. Conde (PT), C. Croitoru (RO), K. J. Borowiecki (DK), E. Kaaber (IS), O. Göbel (DE and LU), A. Hennius (SE), D. Haselbach (CH and LI), P. Inkei (HU), P. Koleva (BG), P. Mangset (NO), S. Asikainen (FI), A. Ormston (IE and UK), J. Purchla (PL), V. Ratzenböck (AU), Z. Révészová (SK), R. Siil (EE), C. Smithuijsen (NL), A. Srakar (SI), B. Tjarve (LT and LV), J. Tomanova (CZ), A. Uzelac (HR)

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Abbreviations

AES	Adult Education Survey
AT	Austria
BA	Bosnia and Herzegovina
BD	Business demography
BE	Belgium
BES	Benessere e sostenibilità [Equitable and sustainable well-being]
BG	Bulgaria
BoP	Balance of payments
CEE	Central and eastern European countries
CoE	Council of Europe
CCI	Cultural and creative industries
CCS	Cultural and creative sectors
CH	Cultural heritage
CH	Switzerland
COFOG	Classification of the functions of government
CZ	Czechia
CY	Cyprus
DE	Germany
DG EAC	Directorate-General for Education and Culture
DG REGIO	Directorate-General for Regional and Urban Policy
DK	Denmark
EARDF	European Agricultural and Rural Development Fund
EBLIDA	European Bureau of Library, Information and Documentation Associations
EC	European Commission
ECoC	European Capitals of Culture
EEA	European Environment Agency
EE	Estonia
EFTA	European Free Trade Association
EGMUS	European group on museum statistics
EHHF	European Heritage Heads Forum
EMFF	European Maritime and Fisheries Fund
EQI	European Quality of Government Index
ERDF	European Regional Development Fund
ES	Spain
ESA	European System of National Accounts
ESF	European Social Fund
ESIF	European Structural and Investment Funds
ESPON	European Territorial Observatory Network
ESPON EGTC	ESPON European Grouping of Territorial Cooperation
EU	European Union
EU-LFS	European Union Labour Force Survey
EU-SILC	European Union Statistics on Income and Living Conditions
ETC	European Territorial Cooperation
EYCH	European Year of Cultural Heritage
FGM	Female genital mutilation
FI	Finland
FR	France
FSS	Farm structure survey
GDP	Gross domestic product
GR	Greece
GSNI	Gender Social Norms Index
GVA	Gross value added
H2020	Horizon 2020
HBSs	National Household Budget Surveys
HDI	Human Development Index
HEREIN	[European cultural] heritage information network
HERIWELL	Short name for the ESPON project 'Cultural Heritage as a Source of Societal Well-being in European Regions'
HR	Croatia
HU	Hungary
ICH	Intangible cultural heritage
ICOM	International Council of Museums
ICT	Information, communication and technology
IE	Ireland
IFLA	International Federation of Library Associations

IT	Italy
IS	Iceland
JPI	Joint Programming Initiative
JRC	Joint Research Centre
LCS	Labour cost surveys
LGBTQ	Lesbian, gay, bisexual, transgender and questioning (or queer)
LI	Liechtenstein
LT	Lithuania
LU	Luxembourg
LV	Latvia
MCH	Material cultural heritage
MT	Malta
MS	Member States
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne
NEET	Not in education, employment or training
NEMO	Network of European Museums Organisations
NL	Netherlands
NO	Norway
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
OMC	Open method of coordination
OP	Operational programme
PL	Poland
PT	Portugal
RO	Romania
RS	Russia
SBS	Structural business statistics
SDGs	Sustainable Development Goals
SE	Sweden
SMEs	Small and medium enterprises
SK	Slovakia
SI	Slovenia
SWB	Societal well-being
TCH	Tangible cultural heritage
TEU	Treaty on European Union
TO	Thematic objective
UA	Ukraine
UK	United Kingdom
UIS	UNESCO Institute for Statistics
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDEMO	Unified Demography
UOE	UNESCO OECD Eurostat

1   Introduction

This Scientific Annex aims at illustrating an in-depth addition to the methodology that is related to the main results illustrated in the Main Report of the ESPON project 'HERIWELL' for the pan-European quantitative analysis. It contains a more detailed elaboration on the multivariate and regression analysis searching for the main socio-economic and cultural drivers of Life Satisfaction (LS) considered as a proxy of Societal Well-Being (SWB, (quality of life, societal cohesion dimensions and material condition).

The Annex illustrates:

-   the results of the multivariate analysis (Cluster and Principal components), that have helped in the selection of the main indicators to use for testing the relationship with the Tangible Cultural Heritage (TCH) indicators;

-   the regression analysis conducted between the Heritage/culture indicators and the indicators that, based on the multivariate analysis, are the main drivers that characterize the different dimensions of Societal Well-Being;

-   a new indicator, homogeneous and comparable at the regional level, to approximate TCH based on the TripAdvisor source.

After the presentation of the methodology (§2), this annex illustrates the list of considered indicators (§2), the cross-section analysis for 2018 and 2013 (§4), the impact of TCH indicators (§5), the analysis at NUTS2 level (§6) and finally the potentialities of using big data sources like TripAdvisor and Wikipedia (§7).

2   The methodology

As detailed in the Figure 2.1 the analyses carried out can be synthesised into the following steps:

At national level:

1) identification of the list of indicators:

> 1.A) representative of the multiple dimensions of LS/SWB (Quality of life, Societal cohesion, Material conditions) and of the interdependencies between THC and the Cultural and Creative Sector (CCS). To identify the indicators, the analysis explored the information available from 3 different platforms on the Eurostat's database: Sustainable Development Goals (SDGs), Cultural statistics, and the ad hoc module of the EU-SILC survey that, every 5 years, is devoted to monitoring Quality of Life (Eurostat, 2018)[1]. As detailed in Table 2.1 and 2.2 the final dataset refers to 31 indicators including an indicator for **"life satisfaction"** considered a proxy of SWB. All indicators refer to 2018[2] and 2013.

> 1.B) the TCH proxies (ratio of pre-1919 dwellings; share of European Regional Development Fund (ERDF) allocated to cultural heritage)

2) Selection of the main drivers of LS /SWB. A Multivariate analysis (mainly based on the Principal Components Analysis) and an iterative regression analysis have been jointly used to identify the drivers (most important indicators) of LS/SWB from the subset 1.A.

3) Regression analysis, measuring the impact on TCH (ratio of pre-1919 dwellings and share of ERDF allocated to cultural heritage) on LS/SWB considering the main drivers that characterise the different dimensions of well-being.

At regional level;

4.A) Selection of the indicators available at regional level from the list of indicators from 1.A. Identification of the main drivers of LS/SWB/SWB using the same methodology applied at national level (point 2);

4.B) Identification of the TCH proxy available at regional level (ratio of pre-1919 dwellings)

5) Regression analysis, at regional level, measuring the impact of TCH on LS/SWB, considering the main drivers that characterise the different dimensions of well-being at this territorial level and analysis of similarities and differences with the results of the model applied at national level.

6) Exploring the potentiality of big data

The analysis just described was reiterated by approximating TCH with a new indicator derived from the observed TripAdvisor reviews. This Big data source has been applied experimentally both at a national level and on a subset of regions (steps 6a-6d in Figure 3.1).

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[1] The analysis at country level involved 31 European countries (EU27, Iceland, Norway, Switzerland, United Kingdom), while the estimation exercise at NUTS2 level presented in section 2.5 covers only 84 regions, due to data availability mainly on Life satisfaction.

[2] Two of the indicators used in the model, "Online purchases, download or accessed from websites or apps: e-book, e-magazines / e-newspapers" and "Online purchases: film / music, delivered or upgraded on line", refer to 2019.

Figure 2.1. A summary of the methodological approach

1a. Identification at national level of the list of indicators that define the multiple dimensions of LS/ SW (Quality of life, Societal cohesion, Material conditions) and the impacts Cultural and Creative Sector	1b. Identification of TCH proxies at national level	6a. Identification of TCH proxy at national level using **BIG DATA TripAdvisor source**
2 Selection of the main drives of LS/SWB. Reduction of the list of indicators by applying multivariate analysis and iterative regression		
3. Regression model using the main drivers of LS/SWB and the TCH proxies to identify, at national level, the impacts on LS/SWB		6b. Regression model using the main drivers of LS/SWB and the TCH (TripAdvisor proxy) to identify, at national level, the impacts on LS/SWB
	4b Identification of TCH proxy (ratio of pre-1919 dwellings) at regional level	6c. Identification of TCH endowments (using TripAdvisor source) for the regions of Austria, France, Italy and Spain
4a. Selection of the main drives of LS/SWB at regional level		
	5. Regression model at regional level exploring the differences with the results at national level	6d. Regression model at regional level (Austria, France, Italy and Spain) exploring the differences with the results at national level

Source: HERIWELL Consortium

This Annex aims at illustrating the details of all the results related to the methodology steps: the correlation analysis, the Principal Components analysis, and the automatic selection algorithm running on a regression equation. All these steps have been jointly used to identify the main socio-economic and tangible heritage drivers able to explain differences in the level of life satisfaction across the 31 ESPON countries (EU27, Iceland, Norway, Switzerland, United Kingdom).

Following the identification of the main socio-economic drivers, the analysis has been extended along three directions: assessing the robustness of the drivers over time using a cross section on 2013 together with the cross-section on 2018; testing the relevance of Tangible Cultural Heritage (TCH) measures in affecting life satisfaction at NUTS2 level; exploring the potentiality of TripAdvisor data.

Considering the SWB and cultural indicators and the three measures on TCH proposed, our methodology strategy has been organised along two main analytical steps for which the results are jointly analysed.

In the first (Fig. 3.1 point 2 and 4a), the drives of LS/SWB have been detected based on descriptive correlations across the indicators together with the application of the Principal Component Analysis that returns the main relationship among the indicators selected[3]. This approach has been firstly applied including the

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[3] Principal components are run together with cluster analysis or clustering that is the task of grouping a set of objects in such a way that objects in the same group (called a cluster) are more similar (in some sense) to each other than to those in other groups (clusters). The cluster is then a way to classify a set of objects so that observations within each group are similar to each other with respect to variables or attributes of interest, and the groups themselves stand apart from each other. The concept of homogeneity is specified in terms of distance and there are several criteria to define it. For details in the methodology see for example Everitt et al., (2011, p. 9).

SDGs indicators and LS/SWB, then using only the Culture indicators and LS/SWB, and finally including all these indicators together.

In the second, an iterative approach based on a regression analysis was used.

Identification of the regression and the iterative approach

Concerning the functional form of the relationship, two different hypotheses have been tested. The first one refers to the traditional linear regression model while the second belongs to the class of beta regression models. These models are frequently used by researchers to model variables that assume values in the standard unit interval between 0 and 1. The main assumption of beta regression models is that the dependent variable is beta-distributed and that its mean is related to a set of regressors through a linear predictor with unknown coefficients and a link function. In the model it is also included a precision parameter which may be constant or depend on a (potentially different) set of regressors through a link function as well. Within this approach it is possible then to consider some data characteristics such as heteroskedasticity or skewness which are commonly observed when working with data intake values in the standard unit interval, such as rates or proportions. In the empirical application of the regression both the functional forms have been tested and compared.

Once the functional form has been identified, an automatic search algorithm has been implemented to select the indicators for which the regression with LS/SWB shows the best performance. Performance is measured using both the sign of the parameter (in line with the expectations), the value of the information criteria (the Bayesian Information Criterion-BIC in this case, a criterion for model selection among a finite set of models), a measure of the closeness of the estimated value to the observed LS/SWB values, the value of the t-test on the parameter estimated. In the first run we have compared the results of 12 different equations searching for the best one and identifying the related variable. The selected variable is then included in a new set of 11 regressions now referring to two indicators, while the second is, in turn, one of the remaining 11. After selecting the second variable, we have run 10 regressions of three indicators where two are the selected ones in the previous steps.

The distribution of LS/SWB appears different considering the data at National or NUTS2 level.

At the national level the empirical distribution of LS/SWB supports the use of a linear regression model

To illustrate how the iterative approach based on a regression analysis works, let's consider the analysis carried out on the subset of 12 indicators related to SDGs (for simplicity we refer to these indicators as SDG1, …, SDG12) using overall Life Satisfaction (LS/SWB) as the dependent variable. In the first step, we run the following 12 regressions using the traditional linear regression model[4]:

$$
\begin{cases}
LS/SWB_i = f(SDG1_i) \\
LS/SWB_i = f(SDG2_i) \\
\ldots\ldots \\
LS/SWB_i = f(SDG12_i)
\end{cases}
$$

where i=1,…,31 refers to the countries.

---

[4] We provide the same approach also using the linear regression model. However, at national level the results are not very different while the distribution of LS/SWB is quite different from the normal one at NUTS2 level required for a beta regression specification.

As anticipated, for each regression we observe the sign of the parameter (it should be in line with the expectations), the value of the information criteria (BIC in this case), a measure of the closeness of the estimated value to the observed LS/SWB values, the value of the t-test on the parameter estimated. For simplicity, suppose that according to all these criteria the regression with the best performance is the one having the indicator SDG1 as the best single regressor for LW/SWB.

In the second step the following 11 regressions are run:

$SDG2_i$)

$SDG3_i$)

$,SDG12_i$)

$LS/SWB_i = f(SDG1_i$

$LS/SWB_i = f(SDG1_i$

……

$LS/SWB_i = f(SDG1_i$

The second step returns the selection of the second most informative SDG's indicator related to LS/SWB. Then, the procedure moves on the identification of the third more informative indicator.

Running this procedure, we have to keep in mind that, as reported by Hendry (2005), "all statistics for selecting models and evaluating their specifications have interdependent distributions, which are different under null and alternative, and altered by every modelling decision".

To overcome this issue, our proposal stems from a comprehensive analysis of the results from Principal Component analysis and the searching algorithms. Reading together the results, we identify the main SDG drivers of the LS/SWB.

Once the most influential SDGs indicators for LS/SWB have been selected, the same methodology has been applied to a different set of indicators all related to the culture flow (Tab. 2.2) aiming to identify the most important one in the relationship with LS/SWB.

After selecting the main SWB and cultural drivers for the LS/SWB, we have considered the impact of the TCH indicators, including the experimental ones drawn from the TripAdvisor big data source and the ERDF allocations to TCH.

Finally, the relationship of the main drivers of the LS/SWB has been tested, together with the relevance of the CH indicators, at NUTS2 level for those indicators available at this disaggregation level.

3   The selected indicators

The analysis has considered Life Satisfaction (LS/SWB) as the target variable assuming it as a proxy of the subjectively perceived SWB[5].

Besides the life satisfaction indicator, the considered indicators are grouped into three categories: those related to SWB (Table 3.1), culture flow indicators (Table 3.2)[6] and three indicators used to monitor TCH, generally difficult to measure because the objects that compose TCH are selected according to different community identity values.

Concerning the subset of indicators referred to SWB and Culture, these are drawn from 3 different platforms available on Eurostat's database: Sustainable Development Goals (SDGs), Culture, and the ad hoc module of the EU-SILC survey that, every 5 years, is devoted to monitoring Quality of Life (Eurostat, 2018).

Table 3.1. Dimensions of SWB, indicators and sources at national and regional level

DIMENSIONS	INDICATOR	SOURCE	NUTS2	Acron
Quality of life	Overall life satisfaction (Rating 0-10; Population age 16 years or r; All educational attainment)	Eurostat-EU-SILC	X (Source: Gallup-World Poll)	Life
	Frequency of being happy: Being satisfied most of time (%; Population age 16 years or older; All educational attainment)	Eurostat-EU-SILC		Hap
	Satisfaction with personal relationships (%; Population age 16 years or older; All educational attainment)	Eurostat-EU-SILC		Rel
	Job satisfaction (Rating 0-10; Population age 16 years or older; All educational attainment)	Eurostat-EU-SILC		Job
	Percentage of good health; Population age 16 years or older; All educational attainment)	Eurostat-EU-SILC		Soc2
	Leaving school early (%; Population: age 18-24)	Eurostat - Labour Force Survey (LFS)	X	Soc3
	Tertiary education (level 5-8) (Percentage; Population age 25-34 years)	Eurostat - Labour Force Survey (LFS)	X	Soc4
	Adult participation in learning (Percentage, Population age 25-64 years)	Eurostat - Labour Force Survey (LFS)	X	Soc5

---

[5] "Life satisfaction represents how a respondent evaluates or appraises his or her life taken as a whole. It is intended to cover a broad, reflective appraisal the person makes of his or her life. The term 'life' is intended here as all areas of a person's existence. The variable therefore refers to the respondent's opinion/feeling about the degree of satisfaction with his/her life. It focuses on how people are feeling 'these days' rather than specifying a longer or shorter time period. The intent is not to obtain the current emotional state of the respondent but to receive a reflective judgement on their level of satisfaction" (Eurostat 2015, p. 236).

[6] The culture flow indicators account for policies, investments and innovations in cultural production and consumption and refer to the Cultural and Creative Sector (CCS) as defined by Eurostat.

DIMENSIONS	INDICATOR	SOURCE	NUTS2	Acron
	Share of renewable energy in gross final energy consumption by sector (Percentage)	Eurostat - European Statistical System (ESS)		Env1
	Greenhouse gas emissions by source sector (Tonnes per capita)	Eurostat- European Environment Agency (EEA)		Env2
Societal cohesion	Trust in the political system (Rating 0-10; Population age 16 years and older; All educational attainment)	Eurostat-EU-SILC	X	Tpol
	Trust in others (Rating 0-10; Population age 16 years or over; All educational attainment)	Eurostat-EU-SILC	X	Toth
	Persons having someone to rely on in case of need (%; Population age 16 years or over; All educational attainment)	Eurostat-EU-SILC		Some
	Poverty risk (Percentage; Total population)	Eurostat-EU-SILC	X	Soc1
	Young people (aged 15-29) neither in employment nor in education and training (NEET rate; Percentage)	Eurostat - Labour Force Survey (LFS)	X	Eco3
	Gender employment gap (difference between the employment rates of men and women aged 20 to 64)	Eurostat - Labour Force Survey (LFS)		Eco1
Material conditions	GDP per capita in PPS (Purchasing power standard)	Eurostat-National Account	X	Eco2
	Public investment in R&D (Percentage of GDP)	Eurostat-National Account		Eco4
	Adjusted gross disposable income of households per capita in PPS (Purchasing power standard)	Eurostat-National Account		Eco5

Source: HERIWELL Consortium

Indicators related to Culture Flow Indicators (CCS) are explored in relation to LS/SWB, before investigating the interplay with the selected TCH indicators.

Table 3.2. Culture flow indicators

INDICATOR	SOURCE	NUTS2	Acron.
Employment on CCS (Percentage of Total employment in CCS on Total employment)	Labour Force Survey (LFS)	X	Emp1
Share of young employment (age 15-29) on CCS total employment (Percentage)	Labour Force Survey (LFS)		Emp2
Tertiary education (levels 5-8) employment in CCS (Percentage of total Cultural employment)	Labour Force Survey (LFS)		Emp3
Number of enterprises on CCS (Percentage of total enterprises)	Structural Business Statistics		Firm0A

INDICATOR	SOURCE	NUTS2	Acron.
Persons employed per enterprise (number)	Structural Business Statistics		Firm0B
2-year survival rate of enterprises operating in libraries, archives, museums	Structural Business Statistics		Firm1
2-year survival rate of enterprises operating in specialised design activities	Structural Business Statistics		Firm2
Import of cultural activity (Percentage of EU27 - total)	International Trade		Imp
Export of cultural activity (Percentage of EU27 - total)	International Trade		Exp
Online purchases, downloaded or accessed from websites or apps: e-books, e-magazines/e-newspapers (Percentage of individuals)	Use of ICT in Households and by individuals		IBook
Online purchases: film/music, delivered or upgraded on line (Percentage of individuals)	Use of ICT in Households and by Individuals		Film
Public expenditure on culture (Percentage of total expenditure)	National Account		Pexp

Source: HERIWELL Consortium

The 3 indicators for Tangible Cultural Heritage are: the "Historical building stock" approximated by the ratio between the number of dwellings built before 1919 and the total number of dwellings[7]; the share of European Regional Development Fund (ERDF) allocated on cultural heritage[8]; new indicators elaborated from TripAdvisor, illustrated in §7.

All indicators relate to 2018 and 2013, the two years for which data from EU-SILC on quality of life are available.

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[7] The share of dwellings built before 1919, proposed as a proxy for tangible cultural heritage (TCH) or material cultural heritage (MCH) in ESPON 2019, is used in the quantitative model because it is: a) comparable across all countries / regions; b) available at NUTS2 level; c) inclusive of part of the "listed and protected immovable MCH". However, the data do not capture changes in the stock (it is therefore not applicable in panel models) and present a "low reliability" for some regions: for example, in France (Eurostat Census Hub). The ESPON Working Paper 2020 proposes another TCH (or MCH) indicator: the "listed heritage", the number of objects having heritage value and legally protected in the different countries. This proxy is not considered for two reasons. The first is that the criteria for inclusion in the listed category changes from country to country and, therefore, the dimensions are not homogeneous and comparable at territorial level. The second derives from the data only being available for some countries and regions.

[8] See section 8.1 in the final report for a detailed illustration of the ERDF indicator and its limits. ERDF is an indicator that underestimates TCH expenditure because it only considers a specific source of funding. Other sources do not cover all countries and, above all, the data are not comparable at a territorial level (e.g., Compendium on cultural heritage and trends). Other sources overestimate the expenditure as they also consider activities not immediately connected to the heritage. This is for example the case of Eurostat data on "public expenditure for cultural services", that, together with expenditure destined for TCH (those for 'operation or support of facilities for cultural pursuits (libraries, museums, art galleries, theatres, exhibition LS/SWB, monuments, historic houses and sites, zoological and botanical gardens, aquaria, arboreta, and so on') embraces others intended for cultural services (events, etc.). The "Public expenditure on culture" was considered among the indicators concerning culture as a flow, but its correlation with LS/SWB / SWB is insignificant. An indicator of monetary nature is proposed by UNESCO to approximate CH. It is the indicator relating to Target 11.4: the "total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional and local / municipal) ". The Target 11.4 indicator, however, cannot be used because it is only available for a few European countries: Belarus, Finland, and Poland for 2019; Portugal, Spain (partially), Sweden, for 2018. (UIS Statistics (unesco.org)).

# 4 The relationship between TCH and SWB at national level: results of the econometric analysis

4.1 The SWB drivers of LS/SWB

The methodology previously described has been applied to 3 different subsets of data: the SWB indicators taken from the SDGs + LS/SWB; Culture indicators + LS/SWB; all the indicators together. In this way it is possible to identify the main drivers of LS/SWB looking separately at each dimension.

The correlations among the SDGs indicators and LS/SWB (Figure 4.1a), show high and positive correlations between LS/SWB and Adjusted gross disposable income of households per capita (Eco5), GDP per capita (ECO2), Adult participation in learning (SOC5) and Good health (SOC2); while significant negative correlation with poverty risk (SOC1) and Early school leaving (ECO3). The intensity and the sign of the correlation in Figure 4.1a (and in the other related graphs) is represented by the circles. The blue colour points to a positive correlation while the red to a negative one. The correlation goes from -1 (the max value for a negative correlation, represented as a full red circle) to +1 (the max value for a positive correlation, represented as a full blue circle). For example, the correlation between the indicator SOC1 with itself is equal to +1 (blue colour, full circle , while the correlation with the indicator ECO3 is strongly positive (blue colour with the circle ¾ full).

This evidence is in line with the results of the Principal components (Figure 4.1b) containing also the positions of the countries along the first two principal components. Difficulties in the socio-economic condition (Employment gap (ECO1) and NEET (ECO3)) emerge across the Mediterranean and Eastern countries (top right position in the graph), while better economic conditions (top-left), public investment in R&D (ECO4) and Adult participation in learning (SOC5) (bottom-left) identify mainly the Northern countries. These results are in line with the evidence on the increasing dualism, the so-called core and periphery, among European countries as a consequence of the sovereign debt crisis of 2012-2013 (see Bacchini et al., 2020, Campos and Macchiarelli, 2021 and Cesaroni et al. 2019).

Figure 4.1a. Correlation of the SDGs and Quality of Life indicators
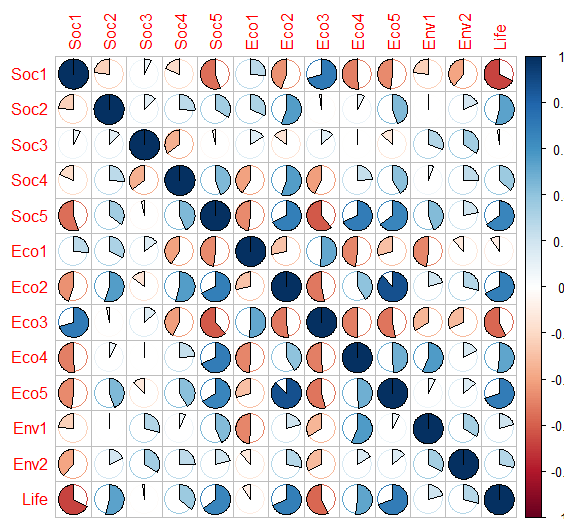
Legend: Soc1: Poverty risk; Soc2: Good health; Soc3: Early school leaving; Soc4: Tertiary education; Soc5: Adult participation in learning; Eco1: Employment gap; Eco2: GDP per capita; Eco3: NEET rate; Eco4: Public investment in R&D; Eco5: Adjusted gross disposable income of households per capita; Env1: Share of renewable energy in gross final energy consumption by sector; Env2: Greenhouse gas emissions by source sector; Life: Overall life satisfaction;

Source: HERIWELL Consortium on SDGs and EU-SILC data

Figure 4.1b. Principal component analysis using the LS/SWB and the 12 SDGs indicators
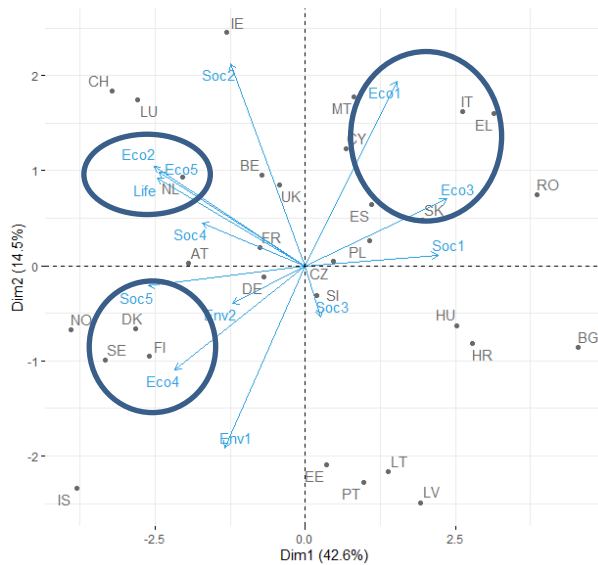
Source: HERIWELL Consortium on SDGs and EU-SILC data

The application of the algorithm for the selection of the SDGs indicators returns results that are in line with the correlation and principal component analysis.

In accordance with the procedure, the three main SDGs drivers for LS/SWB are: ECO5 (Adjusted gross disposable income of households per capita, with a positive coefficient), SOC1 (poverty risk, with a negative coefficient) and SOC2 (Good health, with a positive coefficient), as shown in table 4.1a. All the coefficients are statistically significative (standard errors in brackets) and with the expected sign.

Table 4.1a. Regression of the SDGs on Life satisfaction (dependent variable)

FUNCTIONAL FORM: BETA REGRESSION	
	LS/SWB
Constant	0.496* (0.292)
Eco5	0.00002*** (0.00001)
Soc1	-0.024*** (0.006)
Soc2	0.008** (0.003)
N	31
R2	0.701
Log Likelihood	61.516
Notes:	***Significant at the 1 percent level. **Significant at the 5 percent level. *Significant at the 10 percent level.
where:	
ECO5 is Adjusted gross disposable income of households per capita;	
SOC1 is poverty risk;	
SOC2 Good health	

Source: HERIWELL Consortium

These results are in line with those of Bjørnskov (2008) that includes, with a positive effect, measures of relative income (GDP per capita, disposable income), level of education (Leaving school early, adult participation in learning, tertiary education) and with a negative one poverty or unemployment (poverty risk, employment gap, NEET) as the main drivers of LS/SWB.

Concerning the functional form, due to the asymmetric distribution for some of the variables involved in the analysis we have checked the results of the beta regression against the linear regression. For the model reported in Table 4.1b there is a strong coherence between the two functional forms (see Table 4.1.a).

Table 4.1b. Regression of the SDGs on Life satisfaction (dependent variable)

```
              FUNCTIONAL FORM: LINEAR REGRESSION
                           LS/SWB
-------------------------------------------------------
Constant                         0.631***
                                 (0.064)

Eco5                             0.0000004**
                                 (0.0000001)

Soc1                            -0.005***
                                 (0.001)

Soc2                             0.002**
                                 (0.001)

N                                  31
R2                                0.696
Adjusted R2                       0.662
Residual Std. Error          0.037 (df = 27)
F Statistic             20.603*** (df = 3; 27)
-------------------------------------------------------
where:

ECO5 is Adjusted gross disposable income of households per capita;

SOC1 is poverty risk;

SOC2 Good health
```

Source: HERIWELL Consortium

Similar to this comparison are the results for the functional forms related to the other specification illustrated below. Remarkable differences among the functional forms arise either when TCH indicators are included in the model or when TripAdvisor data are considered.

The iterative approach: an example

According to the methodological description, the identification of the indicators has been carried out in an iterative way. To give an example of the methods, we present the results of the second step of the selection process, starting from the selection of SOC1 indicator in the first step, that is the one with the highest correlation with the dependent variable (LS/SWB).

Table 4.1c illustrates the main results of all the regression based on two indicators, the first fixed as SOC1.

The results have been ordered by the BIC (Bayesian Information Criteria) value in the last column, an indicator that measures the quality of the regression. The first column refers to the second indicators (ECO5 in the first regression, ECO2, in the second regression, and so on…) that has been included in the regression together with SOC1, while the third column refers to the p-value of the estimated value of SOC1. The fourth column refers to the estimate value of the beta parameter for the indicator mentioned in the first column while the fifth to its p-value.

According to this procedure in the second step we select the indicator ECO5 that has the minimum value of BIC together with the correct sign of the estimated beta regressors.

Table 4.1c. Iterative process for the selection of the indicators

FUNCTIONAL FORM: LINEAR REGRESSION

LS/SWB

Indicator	beta_SOC1	p-value(beta_SOC1)	beta_indicator	p-value(beta_indicator)	BIC
Eco5	-0.00503475	0.001739595	5.48523E-06	0.000927206	-101.585
Eco2	-0.00524165	0.001037226	1.57004E-06	0.000980979	-101.467
Soc2	-0.00657126	4.52703E-05	0.002551253	0.002859942	-99.2511
Soc5	-0.0051346	0.004592681	0.003012939	0.011846843	-96.3669
Soc4	-0.00710352	5.74902E-05	0.001840078	0.081100215	-92.6597
Eco4	-0.00626112	0.001210742	0.067110308	0.136992712	-91.723
Emp3	-0.00901381	2.59925E-05	-0.012464371	0.164739231	-91.4061
Eco3	-0.00618591	0.008142831	-0.002650834	0.359745495	-90.1762
Emp1	-0.00666716	0.001223871	0.010674575	0.368419442	-90.1426
Eco1	-0.00787897	3.51121E-05	0.001109162	0.540556588	-89.6529
Env1	-0.00749038	6.6235E-05	0.000174556	0.74046681	-89.3545
Soc3	-0.00764726	3.63309E-05	0.000511634	0.804146263	-89.3002
Env2	-0.00750087	0.00012897	0.000234445	0.861079202	-89.2654
Emp2	-0.00756323	6.85483E-05	0.001312209	0.904479661	-89.2471

Legend: Soc1: Poverty risk ; Soc2: Good health ; Soc3: Early school leaving ; Soc4: Tertiary education ; Soc5: Adult participation in learning ; Eco1: Employment gap; Eco2: GDP per capita ; Eco3: NEET rate; Eco4: Public investment in R&D; Eco5: Adjusted gross disposable income of households per capita;Env1: Share of renewable energy in gross final energy consumption by sector;Env2: Greenhouse gas emissions by source sector;Emp1: Total employment on CCS (%);Emp2: Share of young employment on CCS;Emp3: High level of education employment in CCS (%);

Source: HERIWELL Consortium

The iterative procedure stops when the inclusion of a new indicators does not imply better results in terms of the performance of the equation.

4.2   The Culture drivers of LS/SWB

Using the same approach, we have found the main cultural drivers for LS/SWB using the subset of 12 indicators on the different dimensions of cultural statistics. LS/SWB shows a positive correlation with all the selected indicators with higher values both for cultural participation, measured by the Online purchases, downloaded or accessed from websites or apps: e-books, e-magazines/e-newspapers (Ibook) and Online purchases: films/music, delivered or upgraded online (Film), and the share of CCS employees (Figure 4.2a)

Figure 4.2a. Correlation of the Culture and Quality of Life indicators – 2018 (mainly)
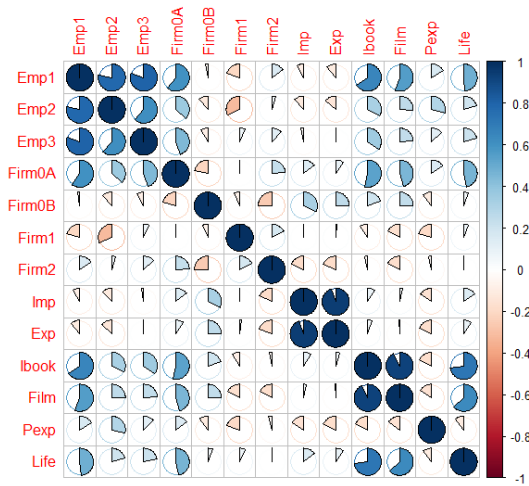

Legend: Emp1: Total employment on CCS (%);Emp2: Share of young employment on CCS;Emp3: High level of education employment in CCS (%);Firm0A: Enterprise on CCS (%);Firm0B: Persons employed per enterprise (number);Firm1: Survival rate in 2 years of enterprises operating in libraries, archives, museums;Firm2: Survival rate in 2 years of enterprises operating in specialised design activities;Exp: Export of cultural activity;Imp: Import of cultural activity;Book: Online purchases, download or acceded from websites or apps: e-book, e-magazines/e-newspapers;Film: Online purchases: film/music, delivered or upgraded on line;Pexp: Public expenditure on culture;Life: Overall life satisfaction;

Source: HERIWELL Consortium

The principal component adds some more details underlining how Ibook and film are strongly related to LS/SWB mainly in the Northern countries (bottom-left) while the export of cultural activity and the number of persons employed in CCS enterprises characterising Italy and France (bottom-centre, Figure 4.2b). Looking at the variance explained by the first principal component is important to note that cultural indicators show a lower degree of commonality across countries than the SDGs indicators.

Figure 4.2b. Principal component analysis using Culture and quality of life - 2018 (mainly)
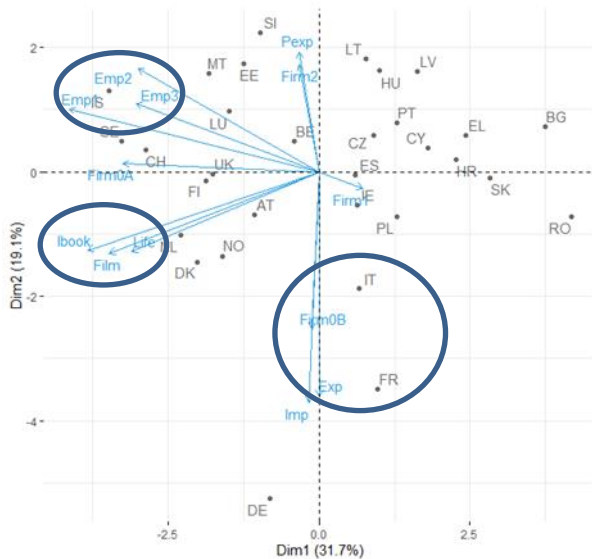
Source: HERIWELL Consortium

The selection algorithm stresses the importance of the cultural participation measured by Ibook while the persistence of the CCS enterprises captured by the survival rate in two years (Firm1) has a slight impact on LS/SWB and no other indicators seem to improve the regression (Table 4.2).

Table 4.2 Regression of the cultural indicators on Life satisfaction (dependent variable)

```
              FUNCTIONAL FORM: BETA REGRESSION


                                    LS/SWB
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Const ant                        0. 559***
                                 ( 0. 134)

I book                           0. 034***
                                 ( 0. 005)

Fi r m1                            0. 002
                                 ( 0. 002)

N                                    31
R2                                0. 560
Log  Li kel i hood                55. 706
```

where:

FIRM1 is Survival rate in 2 years of enterprises operating in libraries, archives, museums;

Ibook is Online purchases, download or accessed from websites or apps: e-book, e-magazines/e-newspapers
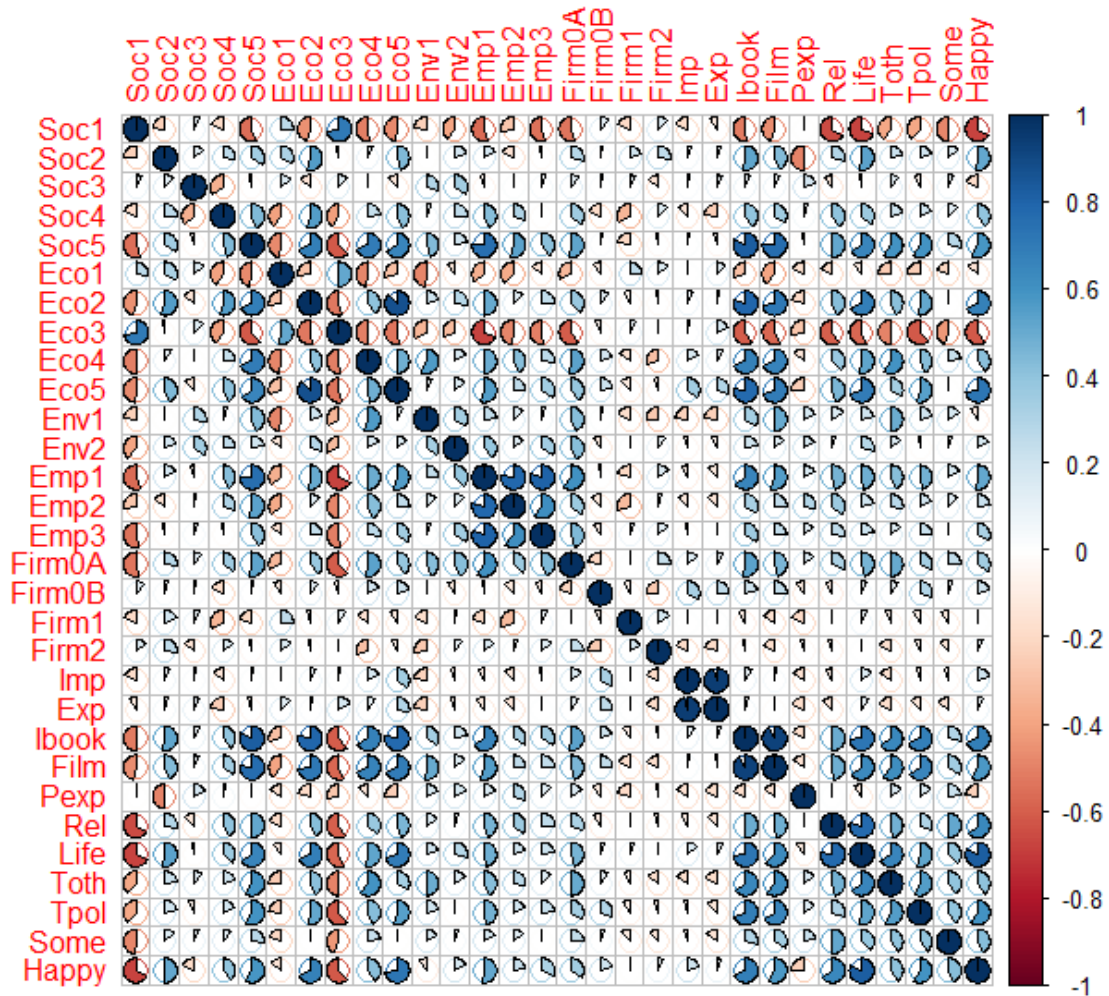
Source: HERIWELL Consortium

4.3   The SWB and Cultural drivers of LS/SWB

Once the main drivers of Life satisfaction have been separately determined for SDGs and Cultural indicators, the methodology has been applied to all the 30 indicators together in such a way to explore the interaction among the SWB and culture flow. As mentioned before 'all statistics for selecting model LS/SWB and evaluating their specifications have interdependent distributions', so even a different set of indicators might allow for different drivers' identification.

Figure 4.3a reports the correlation of all the SDGs and Cultural indicators identifying a close positive relationship among these and Life Satisfaction while the other results confirm the previous analysis.

Figure 4.3a. Cluster analysis using all the indicators and quality of life - 2018 (mainly)
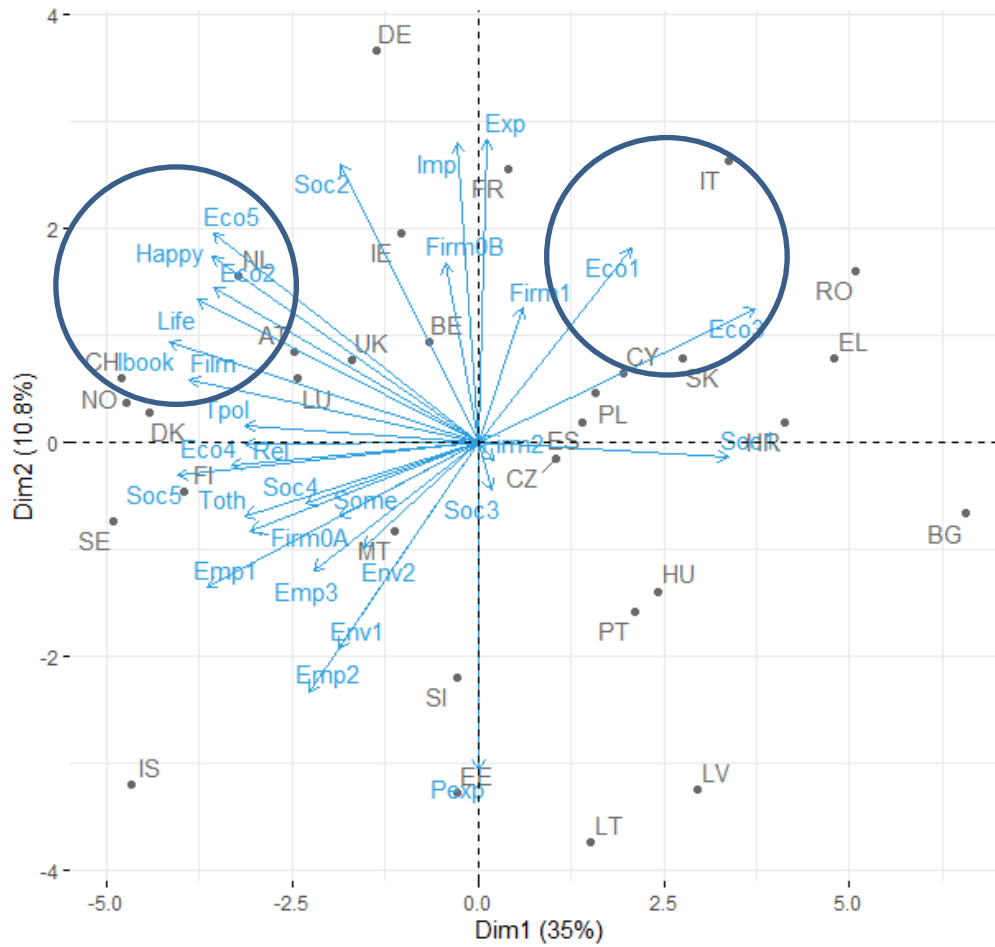

Source: HERIWELL Consortium

Legend: Soc1: Poverty risk ; Soc2: Good health ; Soc3: Early school leaving ; Soc4: Tertiary education ; Soc5: Adult participation in learning ; Eco1: Employment gap; Eco2: GDP per capita ; Eco3: NEET rate; Eco4: Public investment in R&D; Eco5: Adjusted gross disposable income of households per capita;Env1: Share of renewable energy in gross final energy consumption by sector;Env2: Greenhouse gas emissions by source sector;Life: Overall life satisfaction;Emp1: Total employment on CCS (%);Emp2: Share of young employment on CCS;Emp3: High level of education employment in CCS (%);Firm0A: Enterprise on CCS (%);Firm0B: Persons employed per enterprise (number);Firm1: Survival rate in 2 years of enterprises operating in libraries, archives, museums;Firm2: Survival rate in 2 years of enterprises operating in specialised design activities;Exp: Export of cultural activity;Imp: Import of cultural activity;Book: Online purchases, download or acceded from websites or apps: e-book, e-magazines/e-newspapers;Film: Online purchases: film/music, delivered or upgraded on line;Pexp: Public expenditure on culture;Life: Overall life satisfaction;Rel: Satisfaction with personal relationships ;Life: Overall life satisfaction; Toth: Trust in others ; Tpol: Trust in political system ; Some: Persons having someone to rely on in case of need ;Hap: Be satisfy most of time.

The principal component analysis extends the positive association among LS/SWB and ECO2, ECO5 to the indicators on cultural participation, Ibook and Film (Top-left, Figure 4.3b) in the Northern countries while the worst socio-economic conditions still characterise, for example Italy, but now the negative impact is mitigated by the import and export of cultural activity.

Figure 4.3b. Principal component analysis using all the indicators and quality of life - 2018 (mainly)

Source: HERIWELL Consortium

The positive impact of Ibook offsets ECO2 and ECO5, so the selection algorithm identifies Ibook, Soc1 and Soc2 as the main drivers of LS/SWB (Table 4.3).

Table 4.3. Regression of all indicators on Life satisfaction (dependent variable)

```
            FUNCTIONAL FORM: BETA REGRESSION


                          LS/SWB
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Const ant                 0. 823***
                          ( 0. 266)

I book                    0. 018***
                          ( 0. 006)

Soc1                    - 0. 023***
                          ( 0. 006)

Soc2                      0. 007**
                          ( 0. 004)

N                            31
R2                        0. 707
Log  Li kel i hood        61. 703
```

where:

Ibook is Online purchases, download or accessed from websites or apps: e-book, e-magazines/e-newspapers;

SOC1 poverty risk.

SOC2 Good health

Source: HERIWELL Consortium

4.4   The SDGs and Cultural drivers of LS/SWB – 2013 and panel 2013-2018

As mentioned, the indicators on Quality of Life drawn from the EU-SILC survey are available only every 5 years, as they are included in an hoc module.

To assess the stability of the drivers of LS/SWB the described methodology has been applied to the data of 2013 taking into account that, at the time, information on the on-line purchase of ebooks (Ibooks) was not available. We have estimated the model using the two years (2013 and 2018) including a dummy variable to account for difference in time.

The results of the correlation and principal components are in line with those reported using only data for 2018. Compared to Table 4.3c both the indicators selected as well as their intensity are in line. The only difference appears for Film instead of Ibooks (Table 4.4).

Table 4.4. Regression of all indicators on Life satisfaction (dependent variable) – 2013, 2018

```
                 FUNCTIONAL FORM: BETA REGRESSION


                            LS/SWB
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Const ant                  0. 866***
                           ( 0. 190)

Fi l m                     0. 009***
                           ( 0. 003)

Soc1                      - 0. 024***
                           ( 0. 004)

Soc2                       0. 008***
                           ( 0. 002)

N                             62
R2                          0. 717
Log  Li kel i hood        118. 417
```

where :

FILM is Online purchases: film/music, delivered or upgraded on line,

SOC1 is poverty risk

SOC2 Good health

Source: HERIWELL Consortium

5   The estimated impact of TCH

Once the main drivers of LS/SWB have been identified and their importance assessed over time, the analysis has focussed on the impact of the TCH on LS/SWB, approximated by:

i)   Historic buildings, measured as the share of dwellings built before 1919, and indicators drawn from the information on the Census (Build is the label for this indicator);

ii)   ERDF allocations on CH which however do not produce any significant results, probably due to the limits of this indicator described above; and

iii)   the TripAdvisor Indicator based on the number of reviews of each historical site (museum, church, etc.…) described in section 7.1 below.

Due to the interdependent distributions among the new indicators of TCH with the main drivers of LS/SWB, it was not feasible to insert one of the three TCH indicators directly into the selected equation (Tables 4.3 and 4.4). We have re-run the estimation of all the feasible equations using the selected indicators. The introduction of the indicators on TCH changes the direction of the selection algorithm. According to it, the best equation, in terms of the expected sign of the coefficients and the R^2 and Log Likelihood parameters, is reported in Table 5.1.

Table 5.1. The impact of TCH on Life satisfaction (dependent variable) - 2018

FUNCTIONAL FORM: BETA REGRESSION	
	LS/SWB
Build	0.010**
	(0.005)
Soc2	0.017***
	(0.002)
Eco3	-0.031***
	(0.006)
Pexp	0.052*
	(0.026)
N	26
R2	0.745
Log Likelihood	56.966
where:	
Build is the ratio between the number of dwellings built before 1919 and the total number of dwellings,	
SOC2 is Good health,	
ECO3 is NEET rate	
Pexp is Public expenditure on culture	

Source: HERIWELL Consortium

Together with the positive contribution of good health (SOC2) and the negative impact of the socio-economic condition, represented here by the NEET rate (ECO3), the positive impact of Build is associated with a positive contribution of the public expenditure on culture (Pexp).

6 The analysis at NUTS2 level

Having identified the main drivers at national level, the analysis has been conducted at NUTS2 level. A specific data set has been created where LS/SWB, not available at regional level, has been replaced by the similar indicator provided by the OECD using information from the Gallup survey (see https://stats.oecd.org/Index.aspx?DataSetCode=REGION_DEMOGR).

Concerning the SWB indicators, the main indicators used at national level and available also at NUT2 level were considered. The source for all the indicators is the European statistical system (Eurostat), as recommended by the experts at the scientific seminar in September 2021 that expressed reservations about the use of the so-called EU-SPI data. After a preliminary exploration of the data available at NUTS2 level[9], the analysis has focused on the main drivers resulting from the analysis at national level.

The joint use of regional data drawn from different sources implied missing data for some countries. To avoid missing data, we have ended up considering 104 regions for which all the main indicators were available. The main difference with indicators available at national level relates to the indicator Tertiary education (SOC4) and Adult participation in learning (SOC5) now replaced by the indicators Participation rate in education and training (pc_part) and the Population by educational attainment level (pc_pop_by_educ). Concerning cultural statistics, we have used both the ratio of employment in CCS (Emp1_n) and the measure of the dwellings built before 1919 (Build_n). The use of the indicator Emp1_n drives a further reduction in the useful information that goes down to 77.

Correlation at NUTS2 are in line with the results observed on country data, with Build_n showing a positive correlation with LS/SWB and with the disposable income of households, while employment in CCS has always a positive relationship with the income level as well as on participation (Figure 6.1a)

---

[9] It is worthwhile to note that HERIWELL has realised a specific software that, using the standard for metadata exchange, is able to automatically recover the last data available every time it is run.

## Figure 6.1a. Correlation of the Culture and Quality of Life indicators at NUTS2 level
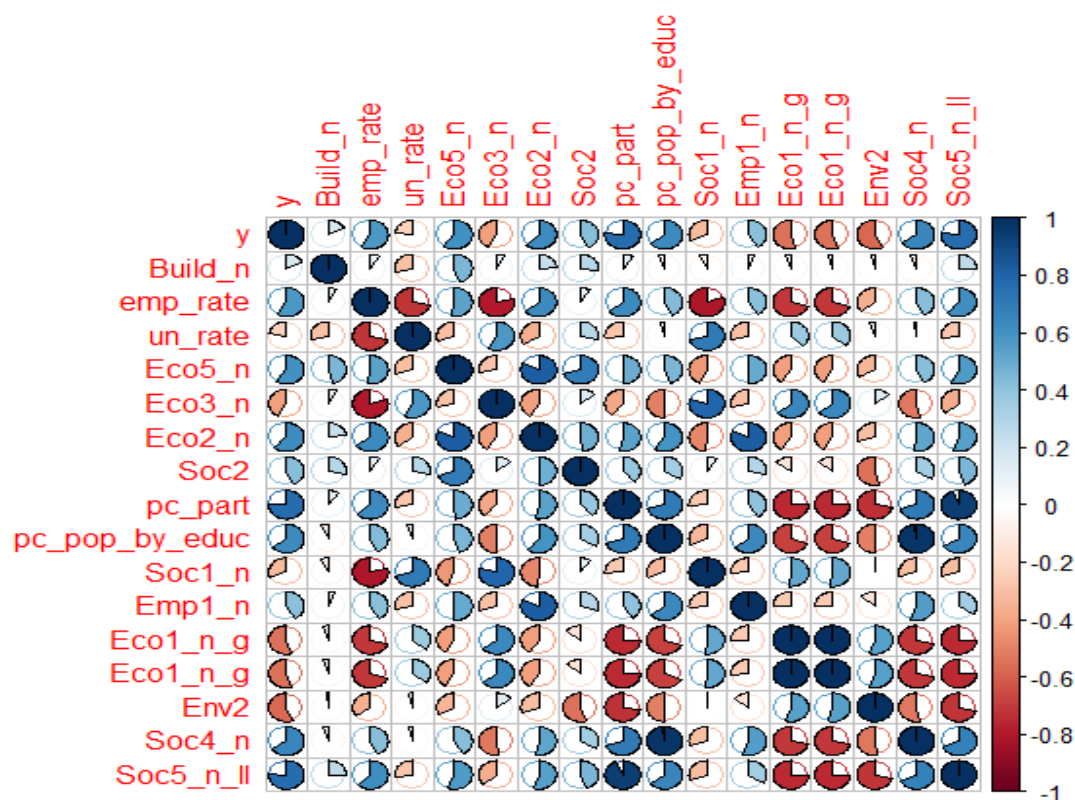
Legend. y: Life satisfaction; Build_n: 'historical building stock' approximated by the ratio between the number of dwellings built before 1919 and the total number of dwellings; emp_rate: employment rate; un_rate: unemployment rate; Eco5_n: Adjusted gross disposable income of households per capita; Eco3_n NEET rate; Eco2_n: GDP per capita; pc_part: Participation rate in education and training; pc_po_by_educ: Population by educational attainment level; Soc1_c: Poverty risk; Emp1_n: total employment on CCS(%); Eco1_n_g: Employment gap; Env2: Greenhouse gas emissions by source sector; Soc4_n: Tertiary education; Soc5_n_ll: Adult participation in learning;

Source: HERIWELL Consortium

Principal component analysis has reinforced the evidence from the country level, providing more evidence of the impact of the environment indicators (Figure 6.1b). The worst labour market conditions are the main characteristics of the Southern regions of Italy, while high values of greenhouse gas emissions characterised the Eastern countries. Northern countries show better living conditions and participation in education and learning than the other countries.

Figure 6.1b. Principal component analysis NUTS2 level - 2018
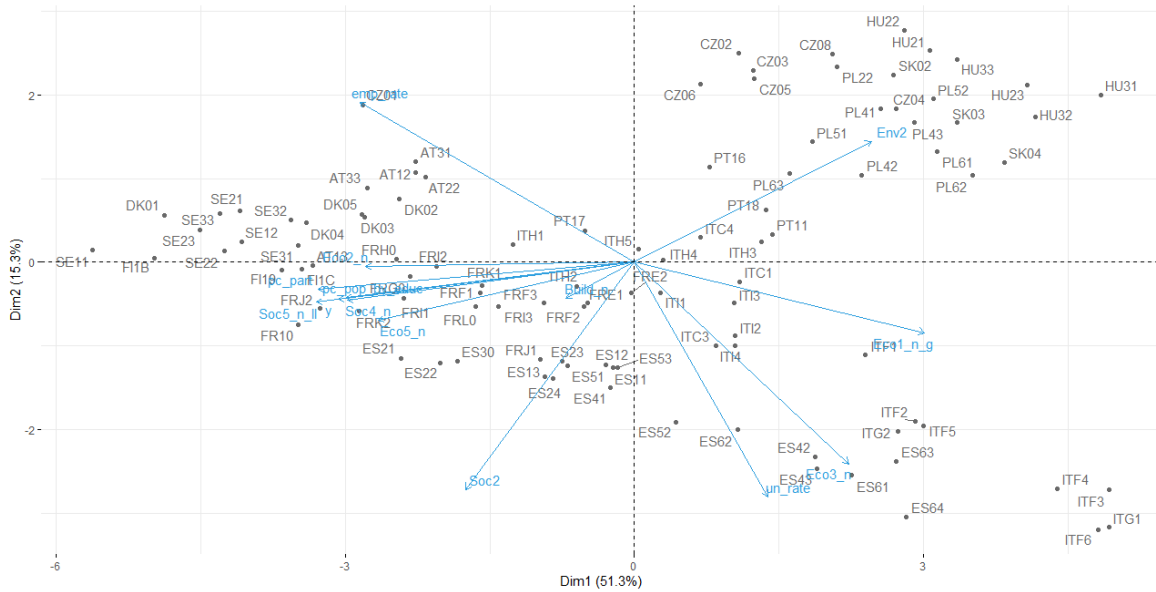
Source: HERIWELL Consortium

Applying the equation selected at the national level we have identified the interplay of TCH with the participation rate in education and training and with employment in CCS (Table 6.1, all the indicators with '_n' refers to NUTS2 indicator). All three indicators have a positive and significant impact on LS/SWB at NUTS2 level.

Table 6.1. The impact of TCH and all indicators on Life satisfaction (dependent variable) – 2018

```
                FUNCTIONAL FORM: LINEAR REGRESSION


                              LS/SWB
------------------------------------------------------------
pc_part                       0.012***
                              (0.002)

Emp1_n                        0.076***
                              (0.013)

Build_n                       0.012***
                              (0.002)

N                                77
R2                             0.932
Adjusted R2                    0.930
Residual Std. Error      0.173 (df = 74)
F Statistic           340.638*** (df = 3; 74)
```

Where:

pc_part is Participation rate in education and training,

Emp1_n is Total employment on CCS (%)

Build_n is the ratio between the number of dwellings built before 1919 and the total number of dwellings

Source: HERIWELL Consortium

7   The use of big data

The COVID-19 crisis has reinforced the importance for a real-time assessment of the current state of health, social and economic conditions. New dashboards have been released to monitor the evolution of the pandemic, such as the one proposed by OECD (https://www.oecd.org/coronavirus/en). Data timeliness has become a crucial point. To our knowledge, all this effort has partly spread out on research of the impact of the COVID-19 crisis on the culture and creative sector (CCS), when most of the activities were closed to contain the contagion. Impact on tourism has also been addressed (see for example Gössling et al., 2020), while CCS has been investigated looking at the precariousness of the labour market (Comunian, R., & England, L., 2020) or exploring the process of digitalisation (see for example Samaroudi et al., 2020).

In the HERIWELL study we explored two different big data sources, TripAdvisor and Wikipedia (see for example Bacchini et al. 2020), that are used in two different ways. Based on TripAdvisor we have created a new measure of TCH based on the number of reviews of each historical site (museum, church, …) in each country. The indicator, elaborated for all the 31 ESPON countries, has been tested in the regression analysis presented in the previous paragraphs to assess its contribution as a driver of Life Satisfaction.

The new indicator has been calculated also at regional level for a subset of countries: Austria, France, Italy and Spain.

7.1   A new TripAdvisor indicator for TCH at country level

The procedure for the use of information drawn from TripAdvisor was based on different steps. For each one of the 31 ESPON countries, the link to the TripAdvisor page for the things to do in the country has been identified. For each one of these pages the list of all the attractions in the region has been considered. In the following table for each country the number of attractions of the TripAdvisor Page is reported (Table 7.1).

Table 7.1. Number of site attractions for country – Jan 2022

Country Code	Country Name	Number of site attraction
AT	Austria	11.963
BE	Belgium	7.527
BG	Bulgaria	2.686
CH	Switzerland	9.828
CY	Cyprus	2.405
CZ	Czech Republic	8.819
DE	Germany	42.071
DK	Denmark	8.964
EE	Estonia	2.090
EL	Greece	17.232
ES	Spain	56.170
FI	Finland	4.800
FR	France	77.482
HR	Croatia	760
HU	Hungary	4.489
IE	Ireland	10.194
IS	Iceland	2.142
IT	Italy	128.102
LT	Lithuania	1.685
LU	Luxembourg	570
LV	Latvia	1.847
MT	Malta	1.560
NL	Netherlands	14.513
NO	Norway	7.247
PL	Poland	11.767
PT	Portugal	16.537
RO	Romania	5.146
SE	Sweden	7.477
SI	Slovenia	3.093
SK	Slovakia	3.222
UK	United Kingdom	82.435

Source: HERIWELL Consortium on TripAdvisor

In the second step the TripAdvisor website of each attraction has been explored in order to obtain the main information: the number of reviews, the ranking in the list of the other things to do in the same area, and the type of attraction classified according to the TripAdvisor classification (e.g Amusement & Theme Parks, Ancient Ruins, Architectural Buildings, Churches & Cathedrals, Religious Sites, Castles, Points of Interest & Landmarks, Museums, Scenic Walking Areas, …). The box-plot of the number of reviews for the first 300 attractions for each country is reported in Figure 7.1 [10]. The distributions are characterised by a strong asymmetry, with the median for DE, EL, ES, FR, IT, NL, PT and UK much higher compared to the other countries.

Figure 7.1. Box-plot of the number of reviews for country
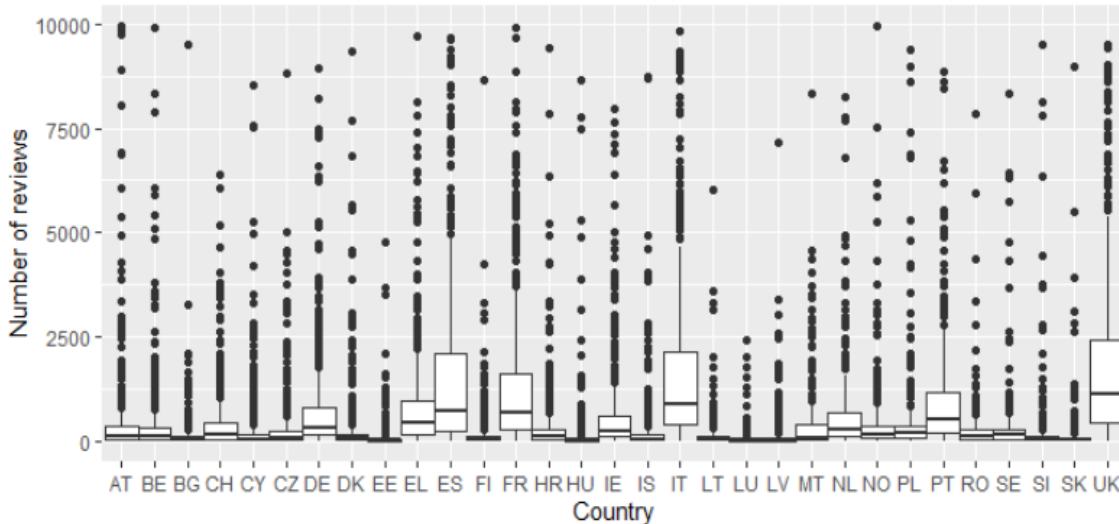
Source: HERIWELL Consortium on TripAdvisor

To test the usefulness of this new indicator as a proxy of the TCH use, we derived 4 different measures of the distribution of TCH across countries. These measures are related to the different quartiles of the distribution (q25, q50, q75 and max, i.e. the point that divides the observations into four defined intervals based on the values of the data). We have tested the statistical importance of four different measures of TCH on Life satisfaction founding that q25 has the highest impact. The reason for this selection is related to the heterogeneity in the distribution of the most important TCH across countries. We have tested two different measures to standardize the total number of the reviews either for the population in the countries or the number of tourists, but both measures fail to produce statistical improvements. The use of q25 allows for a sort of cut-off of the most important TCH which, using this approach, might be considered as outlier in the comparison across the considered countries. This point requires further investigation focused on a better exploration of the statistical characteristics of this new source. Even an approach based on the quantile regression (see Koenker, and Hallock, 2001 for an introduction) able to use the entire distribution of the reviews is planned for further investigation.

The new indicator derived from TripAdvisor (q25) shows a positive interaction with Life Satisfaction together with the other SDGs drivers (Table 7.2)

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[10] In the graph the values greater than 10,000 are omitted

Table 7.2. The impact of the new indicators (q25) based on TripAdvisor on LS/SWB

```
                    FUNCTIONAL FORM: BETA REGRESSION


                              LS/SWB


- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Constant                      1.786***
                              (0.152)

Soc1                          -0.028***
                              (0.010)

Eco3                           -0.021
                              (0.014)

q25                            0.001*
                              (0.0003)

N                                31
R2                             0.515
Log Likelihood                54.376
```

where SOC1 is poverty risk, ECO3 is NEET rate, q_25 is the first quartile of the distribution of the number of reviews in the country.

Source: HERIWELL Consortium

Moreover, the new indicator (q25) shows a positive and significant correlation both with the indicator of TCH (Build) as well as with the ratio of employees in CCS.

7.2   A new TripAdvisor indicator for TCH at NUTS2 level

The use of TripAdvisor has been also experimented using evidence available at NUTS2 level. We have focused on the regions for Austria, France, Italy and Spain, building up a measure for the number of available reviews from TripAdvisor.

Based on the results obtained at NUTS2 level and using TripAdvisor data for Austria, France, Italy and Spain we observe a high and positive correlation among indicators derived from TripAdvisor and the employment in CCS (Figure 7.2a).

Figure 7.2a. Cross-correlation at NUTS2 with distribution measure from TripAdvisor – Austria, France, Italy and Spain
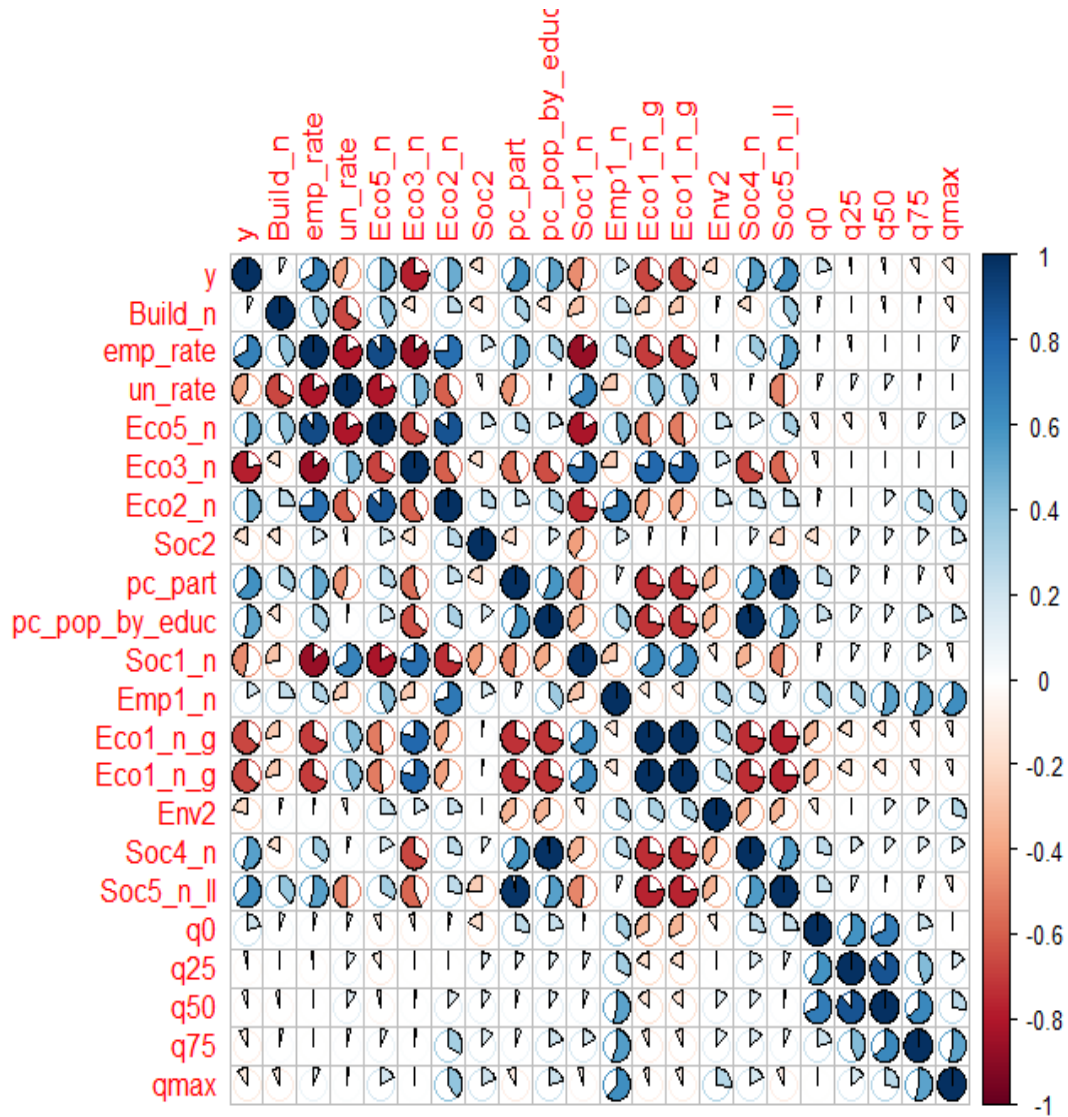
Source: HERIWELL Consortium on Eurostat and TripAdvisor

This important finding emerges also when using the principal components analysis (Figure 7.2b).

Figure 7.2b. Principal component analysis NUTS2 level with distribution measure from TripAdvisor – Austria, France, Italy and Spain
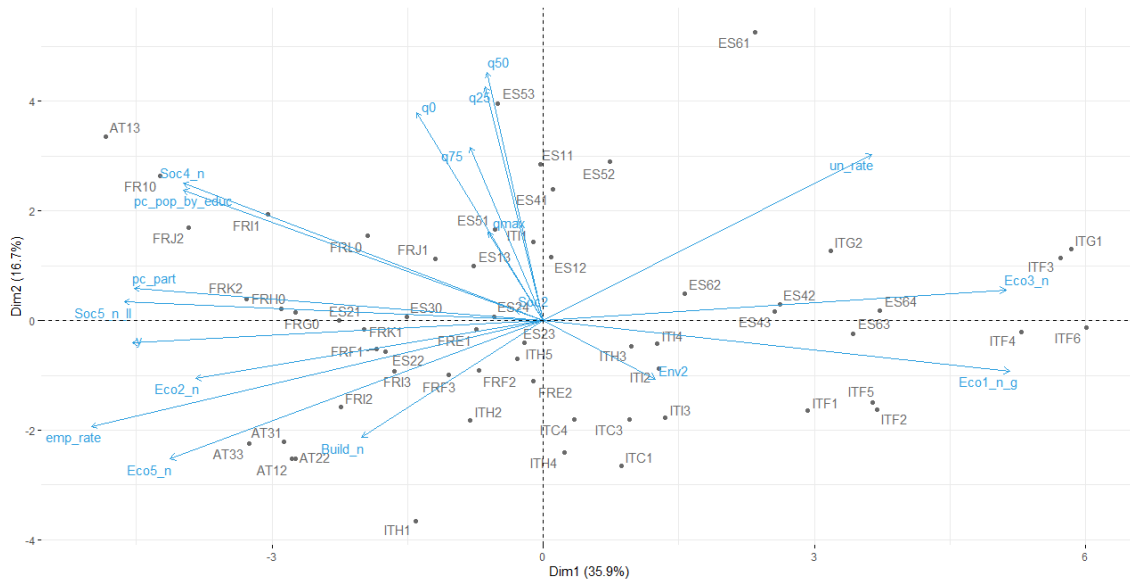
Source: HERIWELL Consortium on Eurostat and TripAdvisor

The regression confirms how a measure based on TripAdvisor has a positive impact on LS/SWB together with the traditional measure of TCH (Build_n).

Table 7.3. Impact of the new indicators (q25) based on TripAdvisor on LS/SWB at NUTS 2 for Austria, France, Italy and Spain

FUNCTIONAL FORM: LINEAR REGRESSION	
	LS/SWB
pc_part	0.030***
	(0.004)
Build_n	0.010***
	(0.003)
q25	0.0002**
	(0.0001)
N	59
R2	0.916
Adjusted R2	0.912
Residual Std. Error	0.193 (df = 56)
F Statistic	204.850*** (df = 3; 56)

where pc_part is Participation rate in education and training, Build_n is the ratio between the number of dwellings built before 1919 and the total number of dwellings and q_25 is the first quartile of the distribution of the number of reviews for NUT2 level

Source: HERIWELL Consortium

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