From subjective objectivity to objective subjectivity: probabilistic preferences in regional development ranking

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The lucky person...

- Pretend you can freely decide in which city you want to live
- Probably, the first thing to do is to collect information about cities in the world and their quality of life

Monocle

- According to the magazine Monocle, the 2013 ranking of the 5 Most Liveable Cities in the world, in a descending order, is the following:

- Copenhagen
- Melbourne
- Helsinki
- Tokyo
- Vienna

The Economist Intelligence Unit

- However, before deciding to buy a house in Copenhagen, you might consider worth having some more information and for this reason you decide to have a look at the 2013 Liveability Ranking and Overview of The Economist Intelligence Unit (EIU), where the cities appear in the following (decreasing) order:

- Melbourne

- Vienna

- Vancouver

- Toronto

- Adelaide

- …

Mercer

- Being this new ranking different from the previous one, you decide to suspend for a moment the decision to buy a house in Copenhagen and proceed to collect further information consulting the Quality of Living Survey released by Mercer which is:

- Vienna

- Zürich

- Auckland

- Munich

- Vancouver

- …

So what?

- At this point, observing a new different ranking, you might deliberate to give up collecting the so inconsistent information supplied by the World's most liveable cities ranking

Monocle	EIU	Mercer
Copenhagen	Melbourne	Vienna
Melbourne	Vienna	Zürich
Helsinki	Vancouver	Auckland
Tokyo	Toronto	Munich
Vienna	Adelaide	Vancouver

Why The 'Livable Cities' Rankings Are "Wrong"?

- **Different attributes** are considered.

For example, while the Liveability Ranking and Overview of the **EIU** is based on over 30 qualitative and quantitative factors across **5** broad **categories**: stability; healthcare; culture and environment; education; and infrastructure, **Mercer** assesses and evaluates **10 key categories**, such as Political & Social Environment, Economic Environment, Socio-Cultural Environment.

- **Different weights** for the considered attributes could be used.

For example, the **EIU gives a weight of 10% to the education** dimension, while **Mercer** gives a much lower **3.4% to "School and education".** Thus, even assuming that EIU and Mercer use exactly the same dimensions, due to the different weight, one never can achieve the same results.

Should we give up?

- Thus, should we to conclude that it is hopeless to look for reasonable information about ranking of cities according to liveability?
- On the same premises, should we surrender to the impossibility to get reasonable, meaningful and useful information of any ranking exercise (from ranking university to ranking countries with respect to human development index or the alike)?

The big issue…

- We believe that there is still some space for such type of ranking, but one has to take explicitly and seriously into account the involved subjectivity

- Between the two above points, we believe that the most pernicious is the sensitivity of the outcome to the **different weight** that one can give to the considered dimensions.

- While it is always possible to enlarge the set of considered dimensions in order to include all the aspects being relevant for anybody interested to the ranking, it is very rare, or even impossible, achieving unanimity on the weights to be assigned to those dimensions, due to the obvious difference in personal preferences

Objective subjectivity

- We propose to deal with this problem using the Stochastic Multicriteria Acceptability Analysis (**SMAA**) (Lahdelma, Hokkanen and Salminen, 1988) which considers the whole set of possible weights

- We can determine the **probability** of each alternative to be the first, the second, the third and so on in the ranking

- Moreover, for each pair of alternatives we can define also the probability that one is better that the other or vice versa

- One can also determine which is (are) the vector(s) of weights for which an alternative is the best or the worst

- Considering the whole set of possible vectors of weights, amounts to take into account all the **sensibilities**, ranging from the extreme ones taking into account only one or few dimensions, to the more equilibrated, taking into account all the dimensions, but, in any case, with different sensitivities

Stochastic Multicriteria Acceptability Analysis (SMAA)

- Differently from the usual approach that considers a single vector of weights belonging to an abstract and unrealistic "representative agents", this approach allows to compute the **probability** that an alternative has a given ranking position for specific classes of individuals characterized by the relative importance that they gives to each considered dimension

Stochastic Multicriteria Acceptability Analysis (SMAA)

$$u(a_k, w) = \sum_{i=1}^{n} w_i g_i(a_k).$$

Stochastic Multicriteria Acceptability Analysis (SMAA)
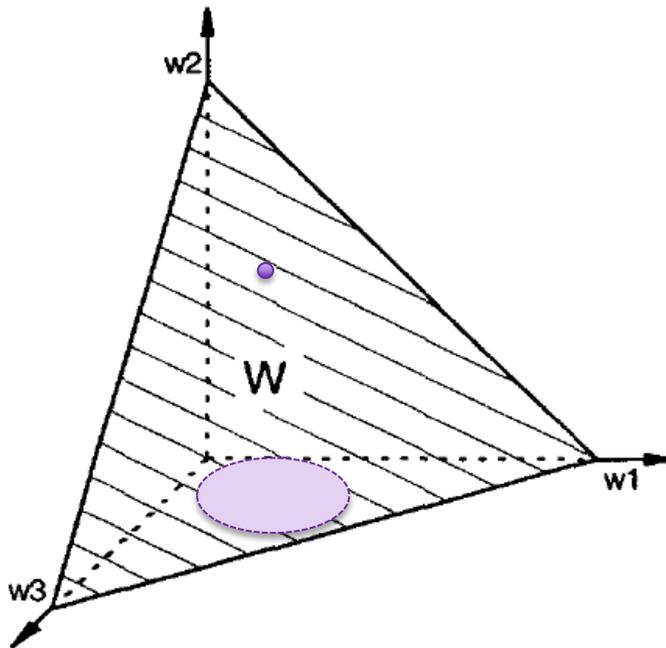
Fig. 1. The set of feasible weight vectors **W** in the three-criteria case.

$$u(a_k, w) = \sum_{i=1}^{n} w_i g_i(a_k).$$

Variables…

Variable	Description	year	Normalisation
Environment	Woodland (hectares)	2005	$\frac{x_i - x_{min}}{x_{max} - x_{min}}$
Culture	Share of Household Expenditure on Culture on total household expenditure	2005	$\frac{x_i - x_{min}}{x_{max} - x_{min}}$
Social Capital	Volunteering. People aged 14 and over who have done volunteer work in the total population aged 14 and over	2005	$\frac{x_i - x_{min}}{x_{max} - x_{min}}$
Competitiveness	Capital accumulation. Gross fixed capital formation as a percentage of GDP	2005	$\frac{x_i - x_{min}}{x_{max} - x_{min}}$
Energy	Gross domestic consumption of electricity. Gross production of electricity plus the balance of trade with other countries and with other regions (GWh)	2005	$\frac{x_i - x_{min}}{x_{max} - x_{min}}$
Social exclusion	Relative poverty index Share of population living in households below the poverty line (percent)	2005	$\frac{x_{max} - x_i}{x_{max} - x_{min}}$

Variables…

GDP	GDP per capita	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
Economic dependency	Net import share on GDP	2005	$\dfrac{x_{max} - x_i}{x_{max} - x_{min}}$
Unemployment	Unmployment rate (long term)	2005	$\dfrac{x_{max} - x_i}{x_{max} - x_{min}}$
Crime conditions	Violent crimes per capita	2005	$\dfrac{x_{max} - x_i}{x_{max} - x_{min}}$

Variables...

Variable	Description	year	Normalisation
R&D	R&D employees (per capita)	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
Waste	Recycling rate on total households waste	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
Care Services	Children 0-3 years who have used the services for children (kindergarten, crèche, or supplementary and innovative services)	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
IT	Proportion of people aged 6 and over who report having used the Internet in the last three months	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
Tourism	Attractiveness of tourism facilities. Presences (days) in the total accommodation establishments	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$
Financial Markets	Investment (expansion e replacement) as a percentage of GDP	2005	$\dfrac{x_i - x_{min}}{x_{max} - x_{min}}$

Rank Frequency

rank	PI	VA	LO	TR	VE	FR	LI	ER	TO	UM	MA	LA	AB	MO	CM	PU	BA	CA	SI	SA
1	17	288	1719	677919	6	0	0	320051	1	0	0	0	0	0	0	0	0	0	0	0
2	1067	15408	87215	258042	18320	147	0	619059	736	0	0	5	0	0	0	0	0	0	0	0
3	22349	67916	681490	50052	111260	2855	0	41999	21971	0	0	106	0	0	0	0	0	0	0	2
4	128215	58801	180969	8373	488080	27868	0	16046	90584	0	1	1062	0	0	0	0	0	0	0	2
5	287224	114651	42832	3768	212415	151666	0	2437	183123	0	23	1861	0	0	0	0	0	0	0	3
6	243387	89142	5413	1314	128724	258257	0	391	268160	0	176	5019	0	0	0	0	0	0	0	16
7	184229	127112	327	414	30415	385969	0	13	257159	0	2073	12244	0	0	0	0	0	0	0	43
8	124848	347765	35	110	9737	169390	0	4	174453	374	60452	112059	0	0	0	0	0	0	0	772
9	8252	111475	0	7	1040	3840	5	0	3805	33646	489362	339569	1	0	0	0	0	0	0	8999
10	400	40019	0	1	3	8	363	0	7	386040	344863	217588	17	0	0	0	0	0	0	10690
11	12	22279	0	0	0	0	31181	0	1	565188	91501	256532	2501	0	0	0	2	0	0	30803
12	0	3873	0	0	0	0	719681	0	0	14665	11358	44567	66202	0	0	0	20	0	0	139635
13	0	833	0	0	0	0	150063	0	0	87	186	6992	677888	0	0	0	116	0	0	163836
14	0	423	0	0	0	0	97686	0	0	0	5	2293	253390	352	0	0	4836	0	0	641013
15	0	15	0	0	0	0	959	0	0	0	0	102	1	98211	0	2	896770	0	0	3940
16	0	0	0	0	0	0	60	0	0	0	0	1	0	899151	45	1719	98233	545	0	246
17	0	0	0	0	0	0	2	0	0	0	0	0	0	2223	1682	848268	23	147796	6	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	56	70234	144859	0	744205	40646	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	7	275472	5075	0	88010	631436	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	652567	77	0	19444	327912	

Rank Acceptability Index

rank	PI	VA	LO	TR	VE	FR	LI	ER	TO	UM	MA	LA	AB	MO	CM	PU	BA	CA	SI	SA
1	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.02	0.09	0.26	0.02	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.02	0.07	0.68	0.05	0.11	0.00	0.00	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.13	0.06	0.18	0.01	0.49	0.03	0.00	0.02	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.29	0.11	0.04	0.00	0.21	0.15	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.24	0.09	0.01	0.00	0.13	0.26	0.00	0.00	0.27	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.18	0.13	0.00	0.00	0.03	0.39	0.00	0.00	0.26	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.12	0.35	0.00	0.00	0.01	0.17	0.00	0.00	0.17	0.00	0.06	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.01	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.49	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.34	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
11	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.57	0.09	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
12	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.01	0.01	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.14
13	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.01	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.16
14	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.64
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.90	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.10	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.15	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.14	0.00	0.74	0.04	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.01	0.00	0.09	0.63	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.02	0.33	0.00

Rank Acceptability Index
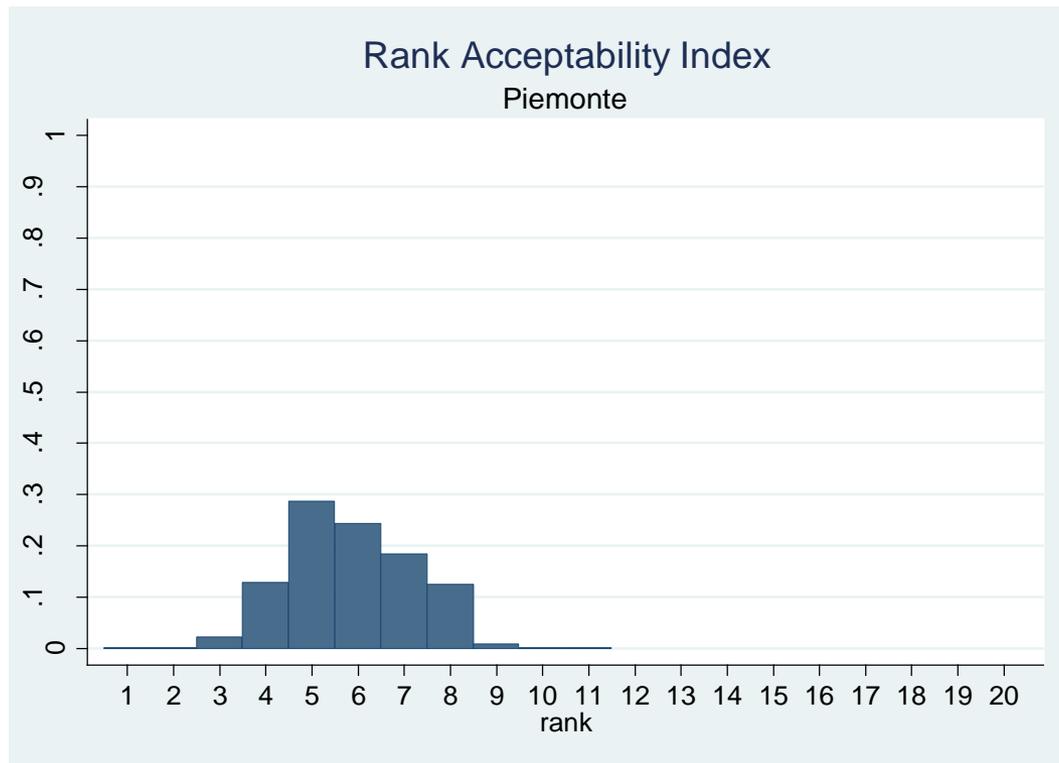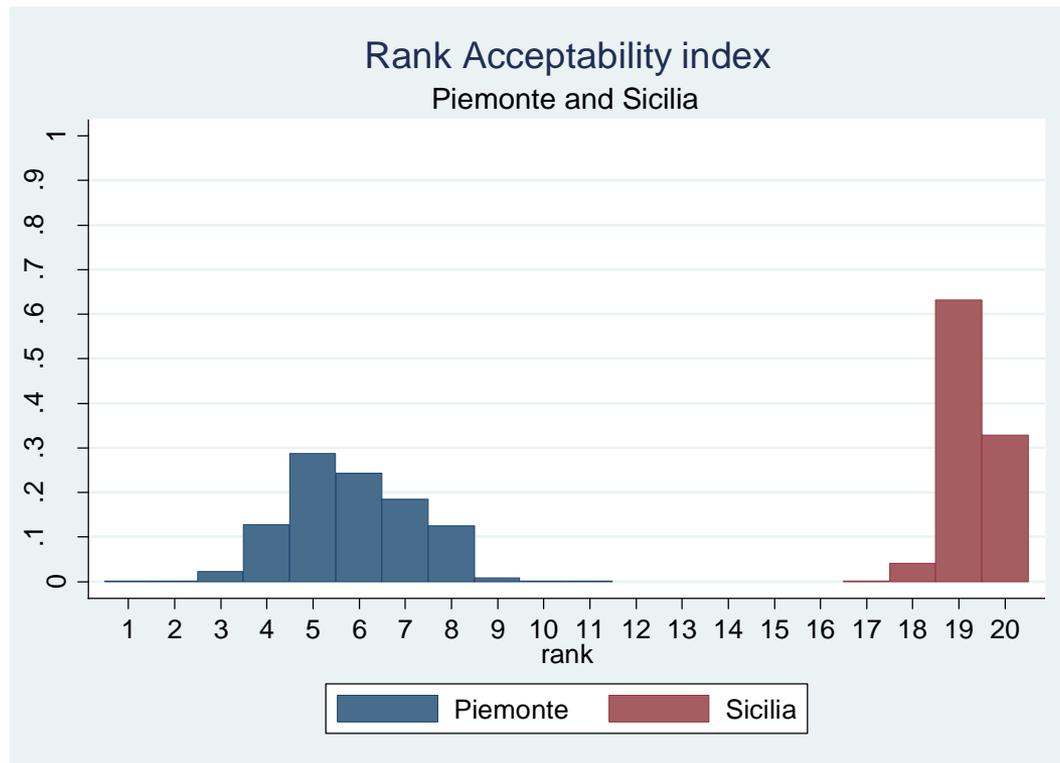
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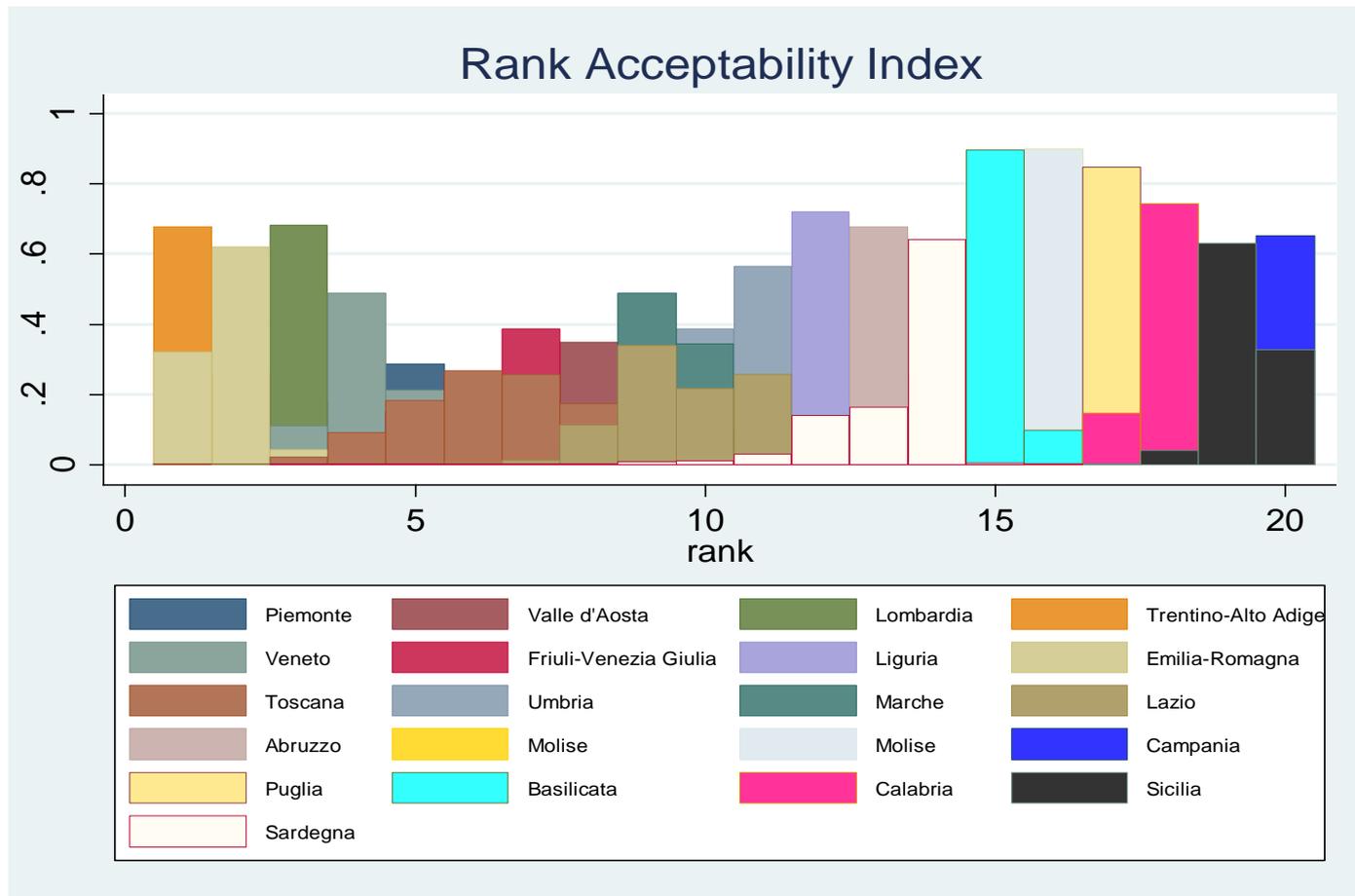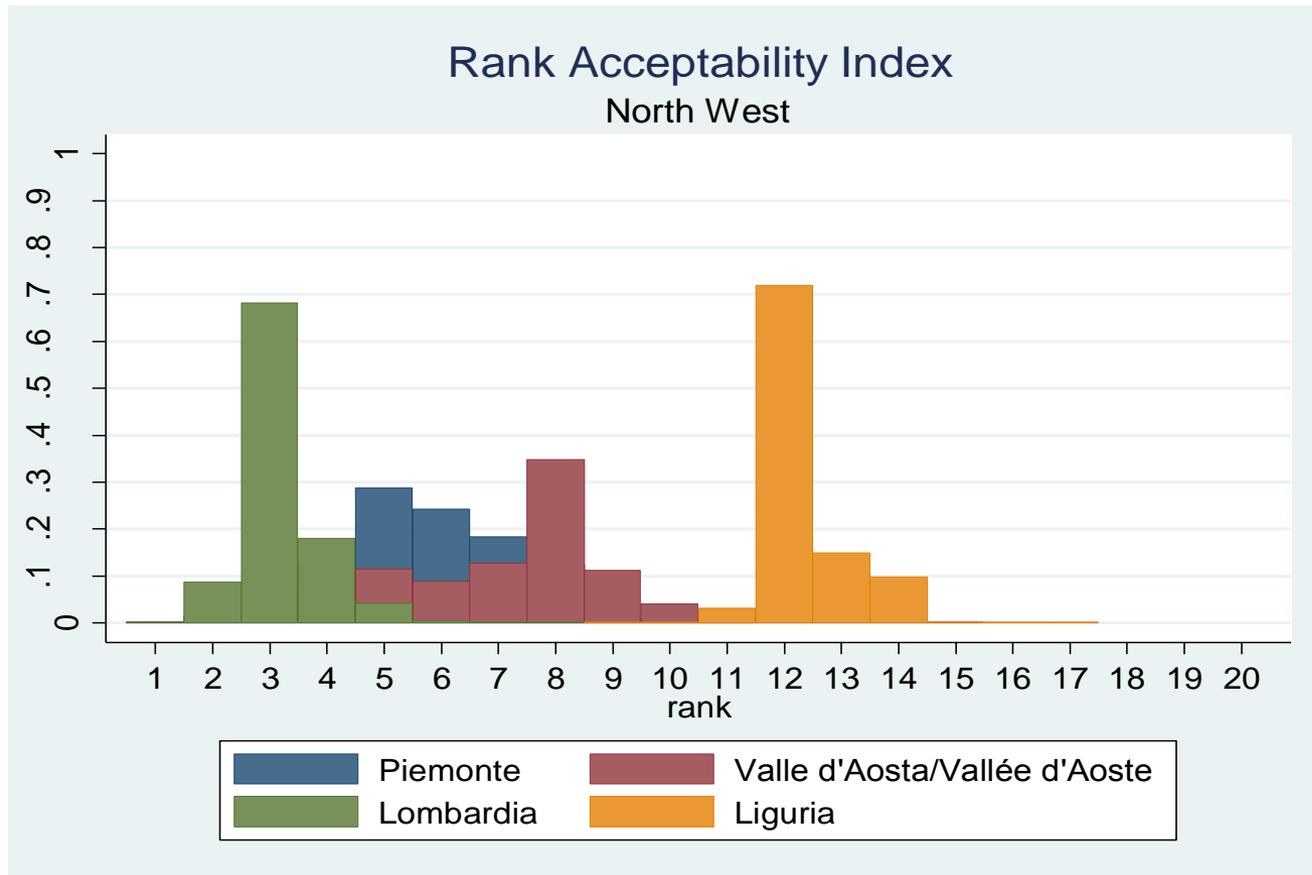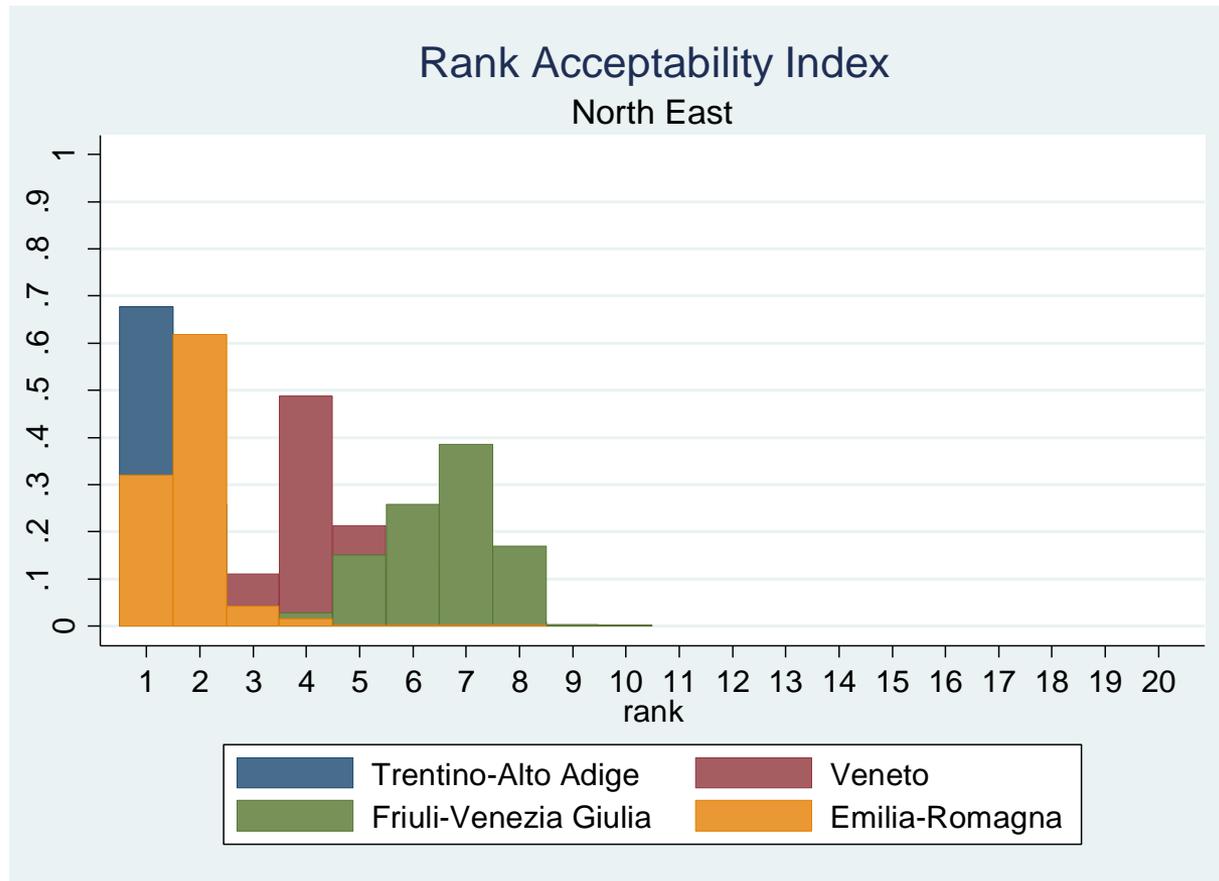
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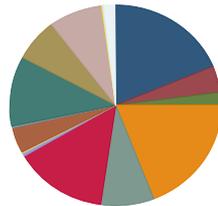
Rank Acceptability Index

Rank Acceptability Index
North East

Rank Acceptability Index

Rank Acceptability Index
Centre

Rank Acceptability Index

Rank Acceptability Index
South

Rank Acceptability Index
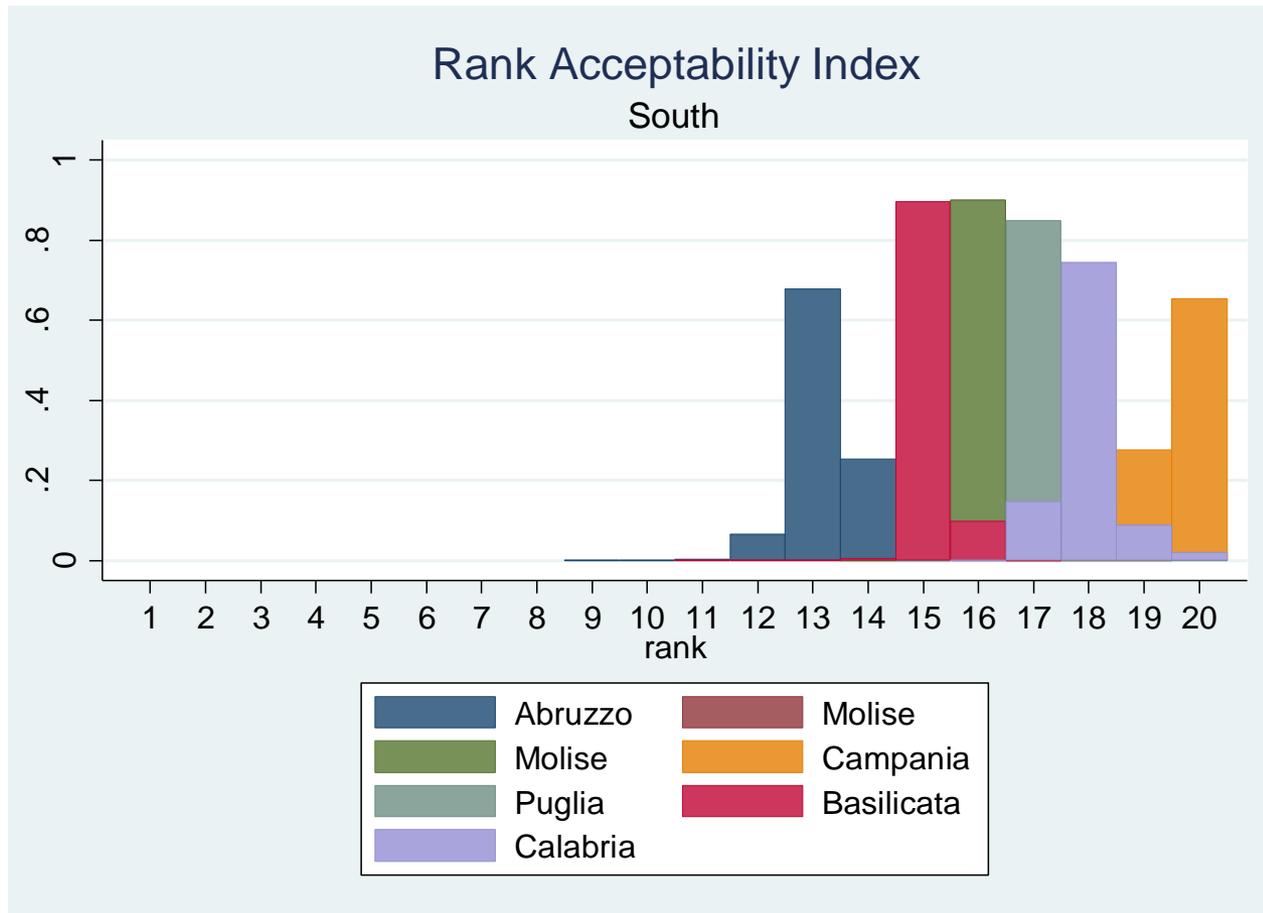
Rank Acceptability Index
Islands

Pairwise comparisons
Winning Frequency

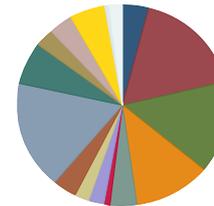|	Piemonte	Valle d'Aosta/Vallée d'Aoste	Lombardia	Trentino-Alto Adige	Veneto	Friuli-Venezia Giulia	Liguria	Emilia-Romagna	Toscana	Umbria	Marche	Lazio	Abruzzo	Molise	Campania	Puglia	Basilicata	Calabria	Sicilia	Sardegna
Piemonte	1.000	0.668	0.022	0.009	0.215	0.650	1.000	0.001	0.605	1.000	0.997	0.988	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Valle d'Aosta	0.332	1.000	0.092	0.002	0.155	0.370	0.996	0.017	0.353	0.969	0.898	0.857	0.999	1.000	1.000	1.000	1.000	1.000	1.000	0.996
Lombardia	0.978	0.908	1.000	0.064	0.855	0.993	1.000	0.037	0.971	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Trentino-Alto Adige	0.991	0.998	0.936	1.000	0.994	0.998	1.000	0.679	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Veneto	0.785	0.845	0.145	0.006	1.000	0.928	1.000	0.027	0.814	1.000	1.000	0.993	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Friuli-Venezia Giulia	0.350	0.630	0.007	0.002	0.072	1.000	1.000	0.001	0.435	1.000	0.997	0.987	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Liguria	0.000	0.004	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.007	0.000	0.025	0.854	1.000	1.000	1.000	0.999	1.000	1.000	0.795
Emilia-Romagna	0.999	0.983	0.963	0.321	0.973	0.999	1.000	1.000	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Toscana	0.395	0.647	0.029	0.005	0.186	0.565	1.000	0.001	1.000	1.000	0.999	0.989	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Umbria	0.000	0.031	0.000	0.000	0.000	0.000	0.993	0.000	0.000	1.000	0.121	0.318	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.977
Marche	0.003	0.102	0.000	0.000	0.000	0.003	1.000	0.000	0.001	0.879	1.000	0.536	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.979
Lazio	0.012	0.143	0.000	0.000	0.007	0.013	0.975	0.000	0.011	0.682	0.464	1.000	0.992	1.000	1.000	1.000	1.000	1.000	1.000	0.963
Abruzzo	0.000	0.001	0.000	0.000	0.000	0.000	0.146	0.000	0.000	0.000	0.000	0.008	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.662
Molise	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	0.998	0.098	0.999	1.000	0.001
Campania	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.006	0.000	0.074	0.341	0.000
Puglia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.994	1.000	0.000	0.851	1.000	0.000
Basilicata	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.902	1.000	1.000	1.000	1.000	0.004
Calabria	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.926	0.149	0.000	1.000	0.946	0.000
Sicilia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.659	0.000	0.000	0.054	1.000	0.000
Sardegna	0.000	0.004	0.000	0.000	0.000	0.000	0.205	0.000	0.000	0.023	0.021	0.037	0.338	0.999	1.000	1.000	0.996	1.000	1.000	1.000

Regional Weights
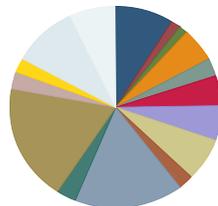

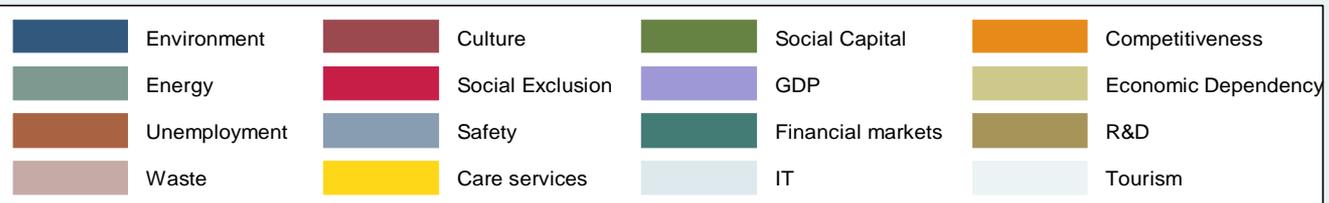Regional Weights — Best Rank
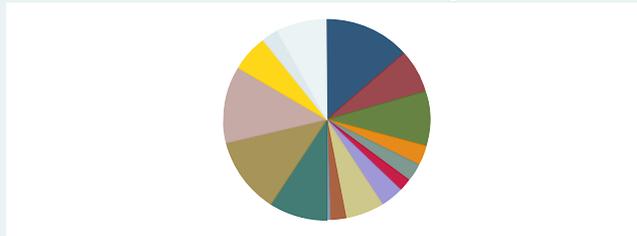
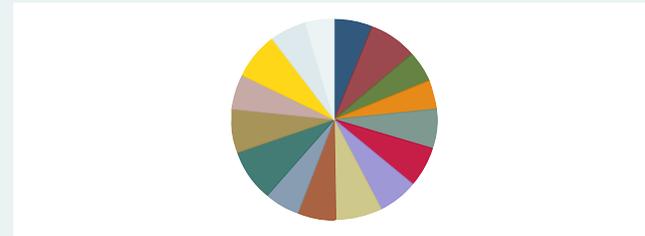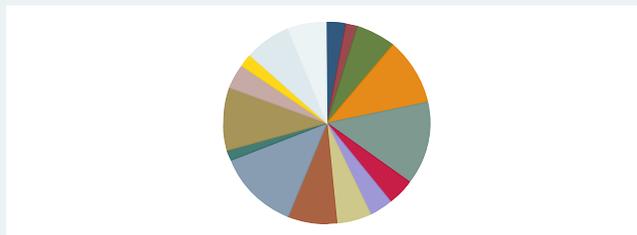# *Regional Weights*

Regional Weights
Best Rank, North-West

Piemonte

Valle d'Aosta

Liguria

Lombardia

■ Environment	■ Culture	■ Social Capital	■ Competitiveness
■ Energy	■ Social Exclusion	■ GDP	■ Economic Dependency
■ Unemployment	■ Safety	■ Financial markets	■ R&D
■ Waste	■ Care services	■ IT	■ Tourism
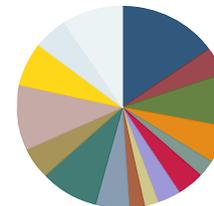
Regional Weights

Regional Weigths
Best Rank, North-East

Trentino-Alto Adige

Veneto

Friuli-Venezia Giulia

Emilia-Romagna

Environment	Culture	Social Capital	Competitiveness
Energy	Social Exclusion	GDP	Economic Dependency
Unemployment	Safety	Financial markets	R&D
Waste	Care services	IT	Tourism
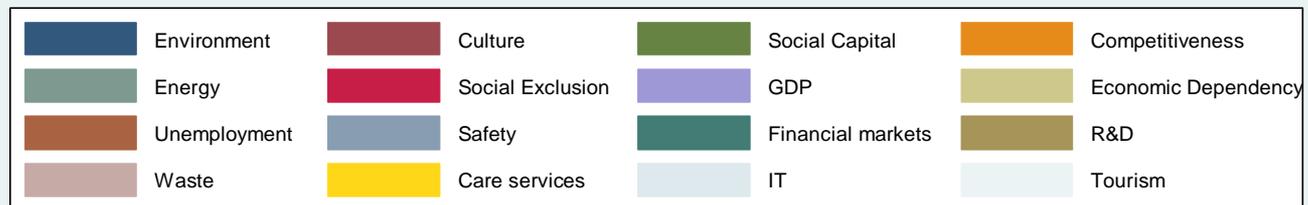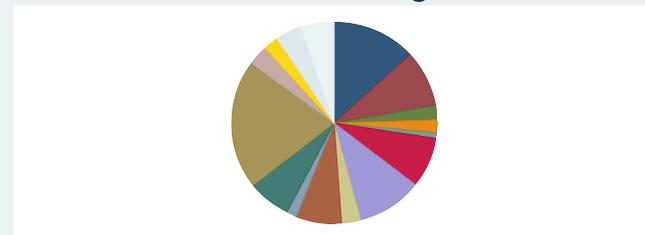
Regional Weights

Regional Weights
Best Rank, Centre
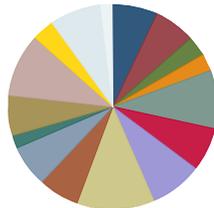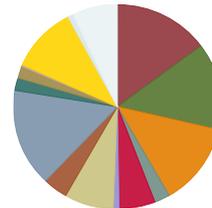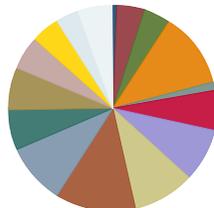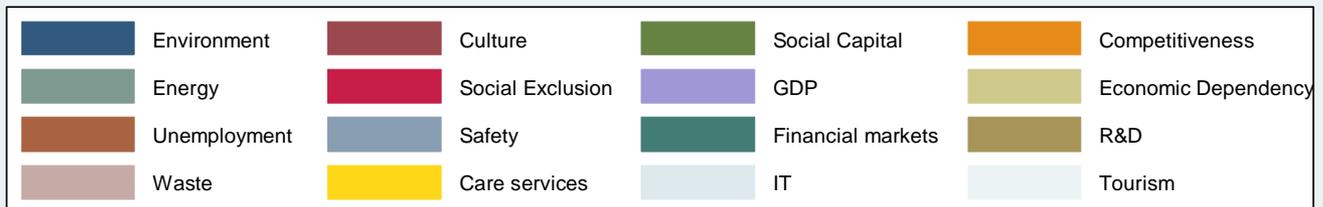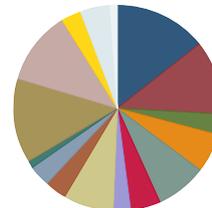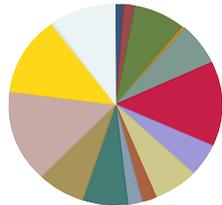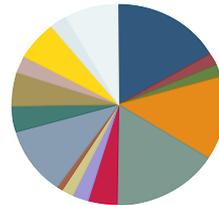
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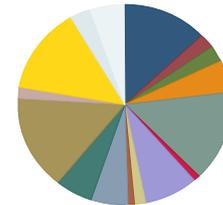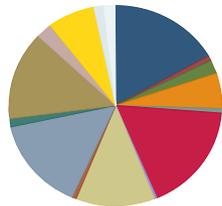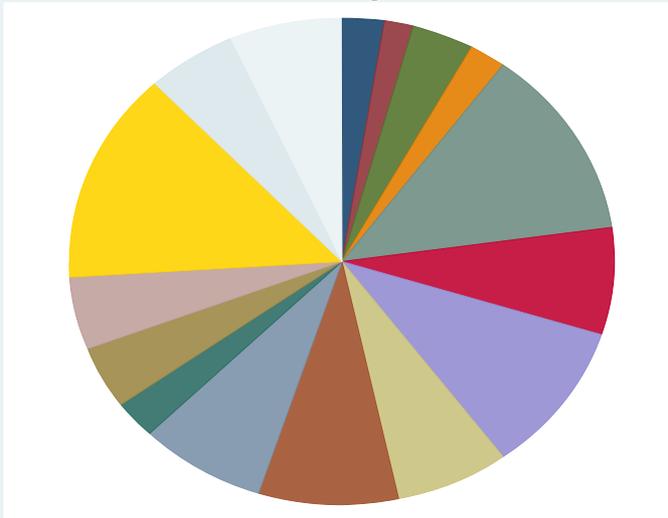

Regional Weights
Best Rank, South
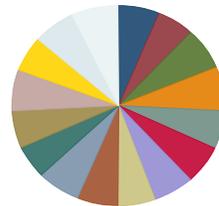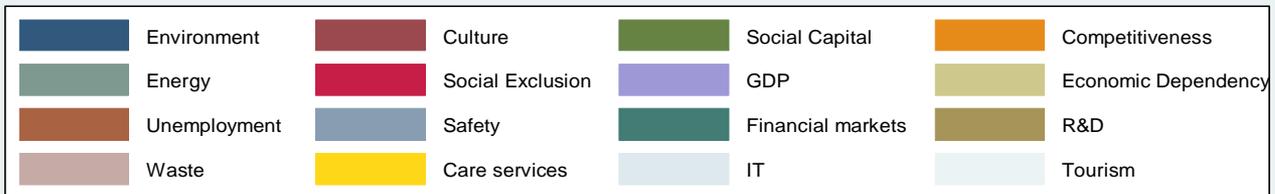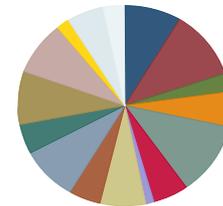
Regional Weights

Regional Weights
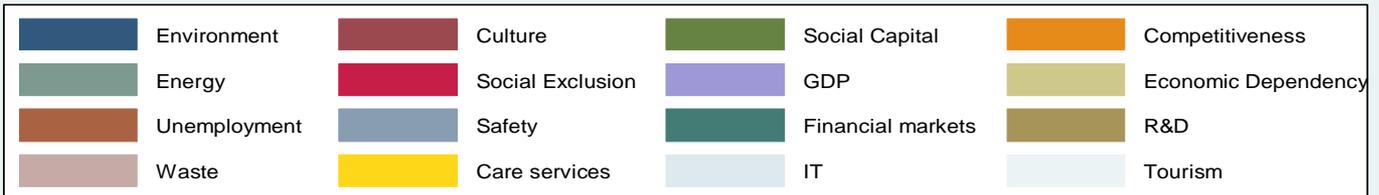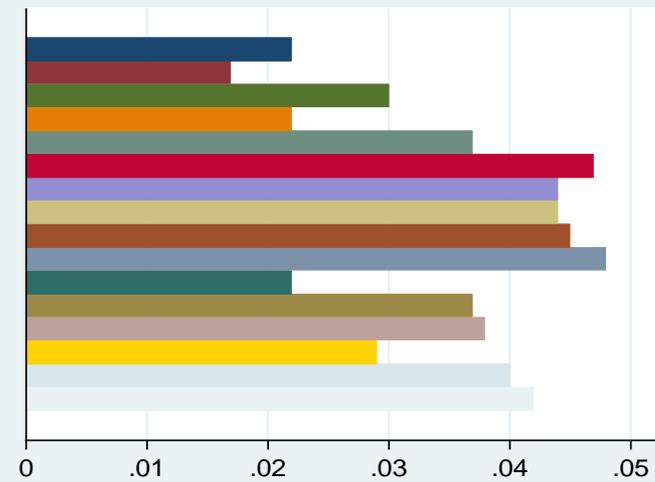Best Rank, Islands
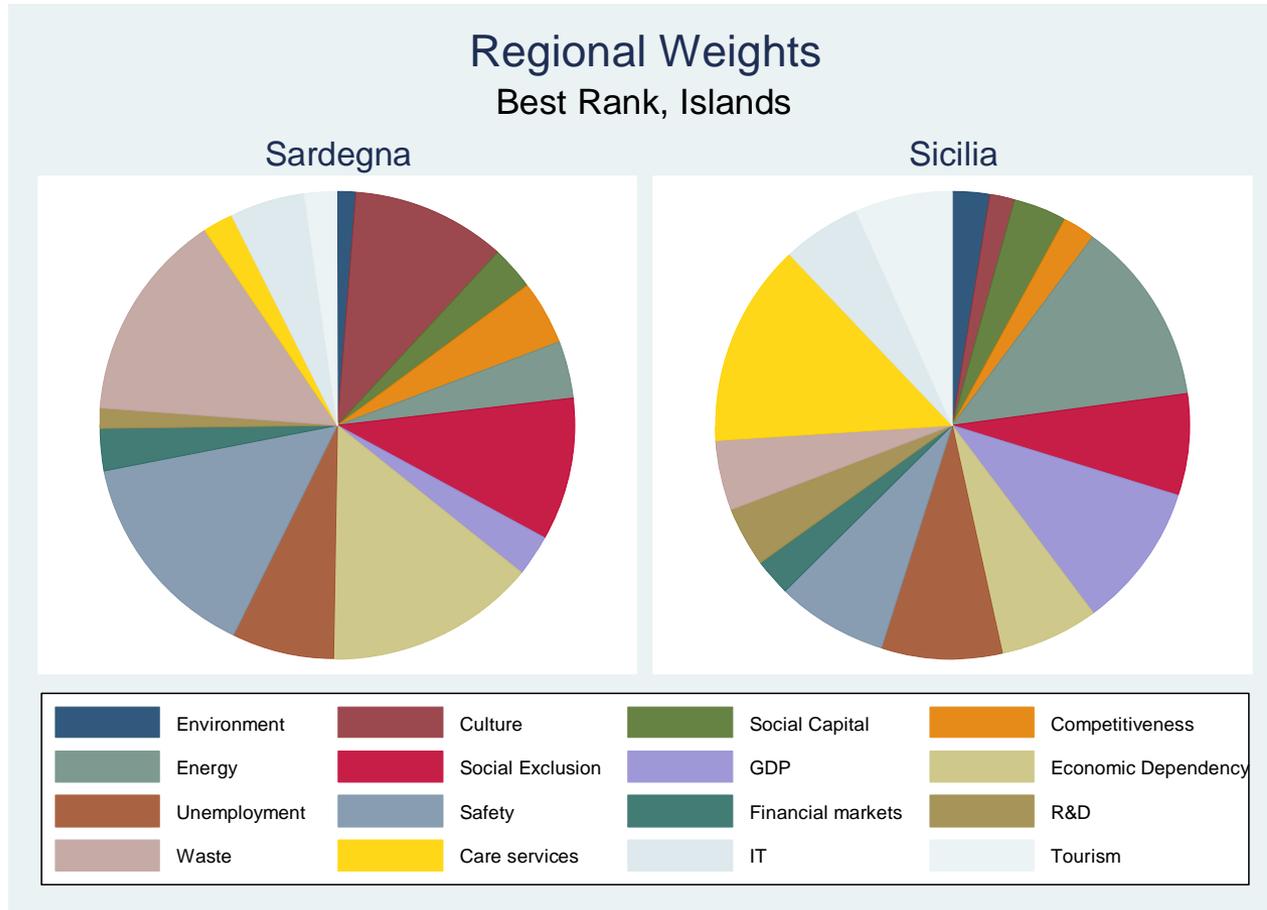
Concluding Remark

- Every ranking exrecise involves subjectivity, including those assigning equal weights – such as the simple arithmetic mean

- A good ranking should take into account differences in preferences (as reflected in the weights' system) rather than collapsing them to an hypothetical representative agent who might not exist

- Given a set of performance indicators, an information set wider than a unique simple ranking can be inferred

- The proposed methodology can be applied to different territorial units (levels)

- The ranking can be used as a policy tool both in the planning and in the policy evaluation phase (work in progress…)

Thank you

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