ESG in Real Estate: the map of Italy

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Abstract

We have carried out an analysis of the distribution of ESG values referring to properties (intended for residential use) in Italy. The model is based on two sources: (a) a database of approximately 90.000 appraisals and (b) a block of 27 'questions' (example ... *year of construction of the property* ... or ... *heating system supply* ...).

By combining the two sources we can calculate an ESG score for each property unit. Since the appraisals are georeferenced, it is possible to associate geographical information with the scores, as well as the characteristics of the property.

Key findings are:

- Geographic Influence: ESG scores vary geographically, with northeast and northwest areas generally scoring higher than central and southern regions. This trend is consistent across different property types.
- Cadastral Category Impact: The cadastral category of a property influences its ESG score, although the exact nature of this impact is complex.
- Market Value Correlation: Surprisingly, in some regions, there is no correlation between property market value and ESG score. In other areas, this correlation varies, being either positive or negative.
- Temporal Patterns: From 2019 to 2023, distinct temporal patterns in ESG scores were observed in different geographical areas, including a general rise in ESG scores in 2023.

1 ESG Framework

The concept of ESG, which stands for Environmental, Social, and Governance, has become a cornerstone in assessing the sustainability and ethical impact of investments and business practices. This framework allows investors, companies, and regulatory bodies to evaluate the extent to which an organization addresses critical environmental challenges, manages relationships with employees, suppliers, customers, and communities, and upholds robust governance practices.

The environmental component of ESG is directly linked to the issue of global warming, as it focuses on a company's performance as a steward of the natural environment. This includes how the organization mitigates its environmental footprint, particularly in terms of greenhouse gas emissions, resource depletion, waste management, and the preservation of natural habitats. As global warming represents one of the most pressing environmental challenges today, the manner in which businesses respond to this crisis is a significant aspect of their environmental responsibility. In the context of

global warming, the environmental criteria within the ESG framework encourage companies to adopt strategies that reduce their carbon footprint, enhance energy efficiency, and transition to renewable energy sources. Such measures not only contribute to mitigating the company's direct impact on the climate but also set a precedent for industry-wide practices, promoting a broader shift towards sustainability.

Moreover, the ESG framework underscores the interconnections of environmental sustainability with social equity and effective governance. The social aspect examines how companies support social justice, employee relations, diversity, and inclusion, all of which can be influenced by the broader environmental policies a company adopts. Effective governance, on the other hand, ensures that companies are making decisions in a manner that is accountable and transparent, with long-term environmental sustainability being a key consideration. The relevance of ESG to global warming lies in its holistic approach, which recognizes that the fight against global warming requires concerted efforts across all sectors of society. By integrating ESG principles, companies not only contribute to environmental preservation but also support a sustainable economic model that values social well-being and ethical governance. This alignment underscores the critical role of the corporate sector in addressing global warming and highlights the importance of ESG in steering both investments and business practices towards a more sustainable and equitable future.

2 ESG for Real Estate

2.1 ESG in Real Estate: Navigating a Sustainable Future

In recent years, the real estate industry, has seen a significant shift towards ESG compliance, driven by a growing awareness of sustainability issues, investor preferences, and regulatory pressures. This report examines the state-of-the-art of the ESG framework within the real estate sector, exploring current trends, challenges, and opportunities.

The 'E' in ESG, focusing on environmental sustainability, is particularly pertinent in real estate. The industry is a major consumer of energy and a significant contributor to greenhouse gas emissions. In response, there has been a marked shift towards energy-efficient and green building practices. Features like sustainable building materials, energy-efficient heating and cooling systems, and renewable energy sources are increasingly common.

The 'S' in ESG emphasizes social responsibility. In real estate, this translates into community engagement and development. Developers and investors are increasingly aware of their impact on communities, striving for projects that offer social benefits such as affordable housing, community spaces, and local employment opportunities. Further, the focus on health and safety standards in buildings has intensified, especially in the wake of the COVID-19 pandemic. Features that promote well-being, such as improved air quality, natural lighting, and green spaces, are becoming standards in modern buildings.

Governance, the 'G' in ESG, involves ensuring ethical practices, transparency, and accountability in operations. In real estate, this includes fair dealing in property development and management, compliance with regulations, and transparent reporting to stakeholders. Additionally, there's an increasing focus on diversity and inclusion within organizations, promoting equal opportunities irrespective of gender, ethnicity, or background.

One of the significant challenges in implementing ESG in real estate is the lack of standardized, accessible data. Measuring and reporting ESG metrics can be complex, given the diverse nature of real estate assets. There's a growing need for standardized reporting frameworks to ensure compa-

rability and transparency. The integration of technology offers both a challenge and an opportunity. Smart building technologies and data analytics can significantly enhance ESG performance, but they require substantial investments and expertise. The integration of ESG criteria into the real estate sector is not just a trend but a fundamental shift in how properties are developed, managed, and valued. While challenges exist, particularly in terms of standardization and technology integration, the opportunities for growth, resilience, and sustainability are substantial. As stakeholders continue to prioritize ESG, the real estate industry is poised to play a crucial role in building a sustainable future.

While on the one hand the ESG framework lists the environmental, social and governance principles to be referred to in order to be compliant , on the other hand it does not indicate the objective metrics for evaluating the asset. These metrics are entrusted to the various internationally recognized certifications, whose measurements, for the main certifications, are:

GRESB (Global Real Estate Sustainability Benchmark): is a global platform that evaluates and compares the ESG performance of real estate funds and companies, based on indicators such as energy efficiency, greenhouse gas emissions, water management, water quality indoor air, occupant health and well-being, diversity and inclusion, transparency and ethics;

BREEAM (Building Research Establishment Environmental Assessment Method): it is an international standard that certifies the sustainability of buildings, based on criteria such as management, health and well-being, energy, transport, water, materials, waste, land use and ecology, pollution and innovation;

LEED (Leadership in Energy and Environmental Design): is a voluntary certification system that evaluates the sustainability of buildings, based on aspects such as location and transportation, sustainable sites, water efficiency, energy and atmosphere, materials and resources, internal environmental quality, innovation and regional design;

WELL: is an international standard that evaluates the performance of a building in terms of the health and well-being of its occupants. It is based on ten concepts: air, water, nutrition, light, movement, thermal comfort, sound, materials, mind and community.

On newly built properties it is possible to activate an ESG compliant process right from the early design stages, while on already built assets it becomes more difficult to start this type of process.

The main financial operators in the Real Estate industry (investors, banks and asset management companies) obtain various advantages from operations linked to ESG compliant assets, in detail (see figure 1):

- complete and transparent vision of the quality and value of real estate portfolios;
- evaluability of the risk/return profile that can be integrated with credit analyses;
- measurability and communication of the ESG performance of assets are able to differentiate the offer of financial services to compete on the market.

Technology can offer various solutions in building an ESG compliant path , including:

- Tools for monitoring and managing energy consumption and CO2 emissions, which allow you to detect the environmental impacts of the property and optimize energy performance, reducing costs and sources of pollution.

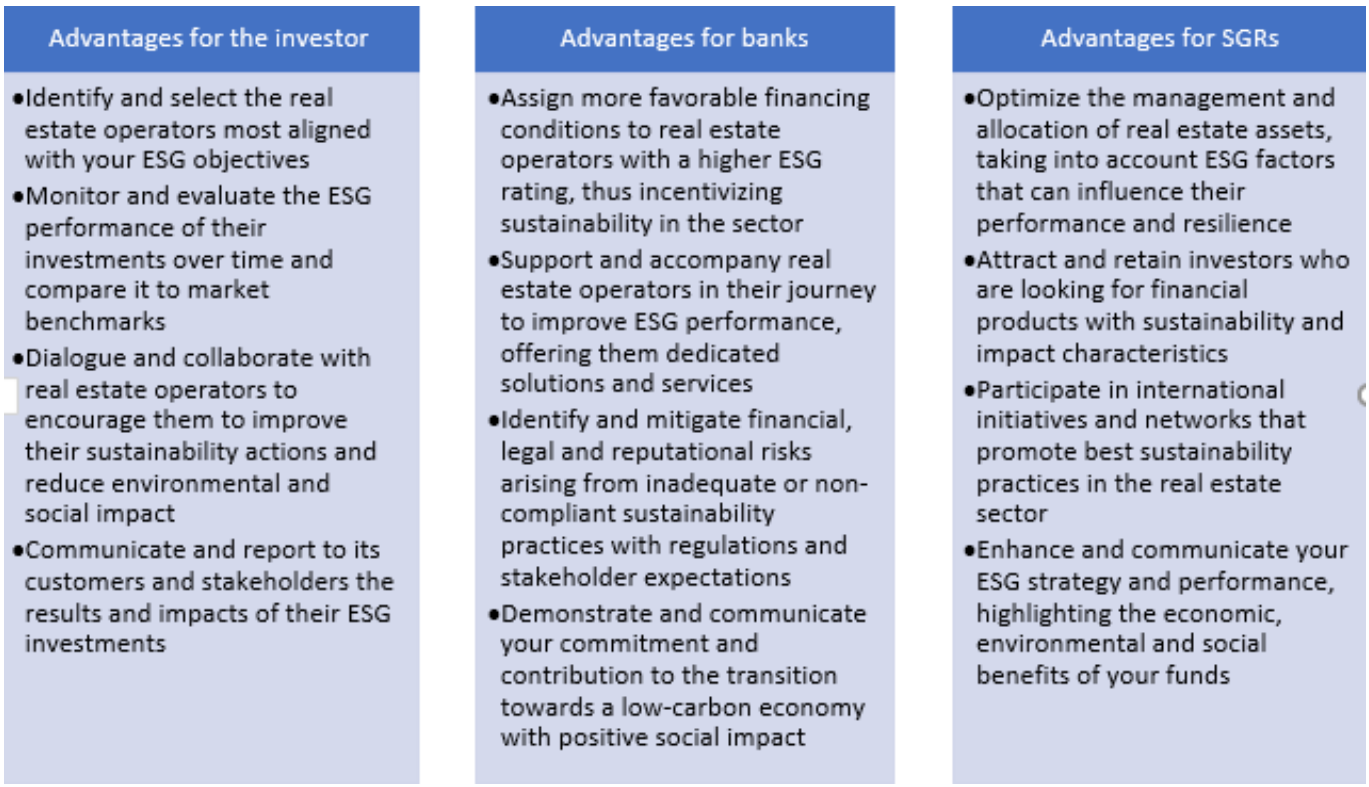

Figure 1: Advantages for stakeholders.

- Home automation and smart building systems, which integrate the functions and services of the property, improving the comfort, safety, accessibility and quality of spaces for occupants and visitors, promoting people's well-being and productivity.
- Digital platforms and applications, which facilitate communication and collaboration between stakeholders, the sharing of information and documents, the collection and analysis of data, the transparency and reporting of ESG performance, the creation of an active and aware community.

Technology, therefore, can be an enabling and differentiating factor for the ESG certification of a property, helping to create added value and competitive advantage for investors, owners, managers and users of the property.

2.2 ESG in real Estate: the ESGMap model

Given the complexity of analysis, monitoring and planning of an asset improvement path towards ESG objectives, our algorithm aims to provide the first indications necessary to objectively guarantee the state of an asset at time 0 and give at the same time, the intervention inputs towards a possible certification path.

The objective is to calculate the ESG of a real estate unit starting from some of its characteristics (for example the presence of a garden, an efficient heating system, a stable mechanism for condominium meetings etc.. etc..).

The calculation methodology is based on an algorithm that has been developed so as to be able to make different check list structures applicable even in customized mode using the same evaluation metric.

Pilar	YES	Partially	NO	N/A
Environment	8	1	4	1
Social	5	0	0	2
Governance	1	1	1	1

Table 1: An example of answers.

Factors	Weight%	N. Factors	N/A	Valid reply	Score	Fact. Score	Adj Weight%	Adj Score
Environment	33,33	14	1	13	17	1,31	-2,38	75,17
Social	33,33	7	2	5	10	2,00	-9,52	100,38
Governance	33,33	4	1	3	3	1,00	-8,33	41,33
	100,00	25	4	21	30	4,30		72,29
								A

Table 2: The ESG Model.

The (pilar) factors taken into consideration are the following:

- Environment (E)
- Social (S)
- Governance (G)

The information acquired through the questionnaire generates a score based on the characteristics (4 types of answers with relative rating - YES - NO -N/A - PARTIALLY).

The score is parameterized based on the number of questions present in the questionnaire and the type of answers provided by the interlocutor (in particular N/A answers are counted and the calculation is reweighted). The result obtained is parametrized on a 124 scale and determines the final ESG value and a value for each individual class.

A non-modifiable characteristic (by law) of the ESG calculation is the value of the responses, where YES is equal to 2, PARTIALLY is equal to 1, NO is equal to 0 and N/A (response not available, or not usable in the context) is managed differently from the other. The way to interpret the questions is always the same, regardless of the context. The result is a score (from 0 to 124), which we define as ESG VALUE, which can be expressed both as a number and as a rating, from the rating A - up to the maximum rating A5 , with 10 progressive scales (A-, A, A1, A1+, A2 ... etc.) No rating is issued up to a score of 62. The maximum score of 124 corresponds to the A5 rating.

The method is the same used in other solutions where the ESG value is calculated, for example of a company. The input is always responses such as YES, NO, PARTIALLY and N/A. We start by dividing the answers according to the three pillars of the evaluation, namely E, S and G (see Table 1). In this case we have a total of 25 answers, divided into: 17 answers relating to pilar E, 10 relating to pilar S and 3 relating to pilar G. The answers are analyzed for each pilar separately, according to this algorithm.

Considering the pilar (E):

$Wieigth \leftarrow 1/3$ of the total
$N.factors \leftarrow$ the number of questions for E

0	NO SCORE
63	A-
69	A
75	A1
81	A1+
87	A2
93	A2+
95	A3
100	A3+
105	A4
110	A4+
115	A5
120	A5+

Table 3: From Score to ESG Label.

$NA \leftarrow$ the number of NO or NA responses

$validReply \leftarrow$ the number of not NA responses
$S \leftarrow$ the number of YES answers
$N \leftarrow$ the number of NO answer

$Score \leftarrow 2S + N$

Now, the algorithm can compute a *positive* factor for the ESG score, $factScore$ is the weight of the sum compared to the number of questions, $factScore = Score/validReply$. Then, we can evaluate the *negative* factors, $AdjWeight$ the NA response rating, $AdjWeight = -(WeightNA)/(N.Factors)$

Finally, $AdjScore$ (the ESG score) is calculated by combining the positive factors ($factScore$) and the negative factors ($AdjWeight$) and normalizing by the overall number of questions. This normalization allows you to use the same metric regardless of the number of questions used. To obtain scores that can be easily converted into ratings, we have inserted a threshold of 62, so as to have a maximum score of 124 (questions is the total number of questions).

$AdjScore = (questions(factScore + AdjWeight))/62$
The overall score is the average of the scores of the three pilars. The conversion table between scores and ratings is table 3

2.3 How to calculate the ESG VALUE of a property perimeter

Once the problem of how to calculate an ESG score starting from ESG responses has been solved, let's see how to calculate this score for a property subjected to an appraisal. The process is divided into phases. Here I describe the process using a residential property perimeter, with 25 ESG characteristics , as an example . The number of ESG characteristics are property characteristics that we believe can be linked to the three ESG pillars. The process could be done with a different number of ESG characteristics, without changing the algorithm. Obviously a greater number of characteristics makes the evaluation more reliable.

Scopes of evaluation	E	S	G
Adaptation to climate change	X		
Environment and Biodiversity	X		
Energy supply	X		
Water supply	X		
Ability to adapt and transform the property	X		
Compliance with current regulations	X	X	X
Energy efficiency	X		
Water efficiency	X		
Waste management	X		
Risks related to natural factors	X		
Health and wellness	X	X	X
Safety of the property and the materials used	X	X	
Socioeconomic impact	X		
Impact on mobility	X		
Quality of interior spaces	X		

Table 4: Characteristics ESG relevant

2.3.1 Step 1: Identify the ESG characteristics of the property

Given a perimeter of properties (for example residential properties) it is necessary to identify a number of characteristics that are ESG relevant, using table like table 4 as a guideline

Obviously under the heading 'compliance with current regulations' there are numerous alternatives, or numerous measurable characteristics. On energy efficiency, on the other hand, we have few possible alternatives. Furthermore, it is not at all certain that every area has its own representation. As mentioned, in the example used here, we have 25 features (see table 5).

2.3.2 Step 2: Assign possible values for each characteristic, and code into ESG responses

For each property characteristic we must decide what the possible values are, and how these values are transformed into ESG responses (YES, NO...). For an example, see table 6

Note that the fact that the field is not populated in this case has been coded NA. If it had been written NOT PRESENT in the appraisal (from which the characteristics were extracted), it would have been deduced that it was a lack of a component, and therefore the answer, from an ESG point of view, is NO. At the bottom of the document there are coding tables for all features

2.3.3 Step 3: ESG calculation

For each property the YES, NO etc. answers are counted, for example the first property in our example we found these values

- Total features 25
- Total score for E 17
- Total score for S 8
- Total score for G 3

At this point, the calculation is performed as described in the previous paragraph

Disabled Accessibility	S
Power	E
Year Construction	E
Elevator	S
Condominium Assembly?	G
Box	E
Energy Class	E
Conditioning	E
Compliance of the systems	S
Building discrepancies	S
Complete documentation	G
Technological equipment	G
Garden	E
Water Sanitary	E
Noise Pollution	E
Materials Pollutants	E
Zona plans L167 62	S
Concierge?	G
Radiant	E
Regularity urban planning	5
Renovated	E
Conservative State	E
Maintenance Status	E
Type Heating	E
Constraints L47 85	S

Table 5: Our ESG features

CAST IRON RADIATORS	NO
ALUMINUM RADIATORS	YES
STEEL RADIATORS	NO
ON THE FLOOR	YES
FAN COIL	YES
NOT PRESENT	NO
NOT VERIFIABLE	NA
WITH ACCOUNTING	YES
WOOD-BURNING STOVE-FIREPLACE	NO
HEAT PUMP	YES
IN PROGRESS IN PROGRESS	PARTIALLY
TUBULAR STEEL RADIATORS	NO
DECORATIVE RADIATOR	YES
AIR	YES
METHANE	YES
FLOOR / CEILING	YES
HEAT PUMP	YES
RADIATORS	NO
Not populated	NA

Table 6: Radiant values

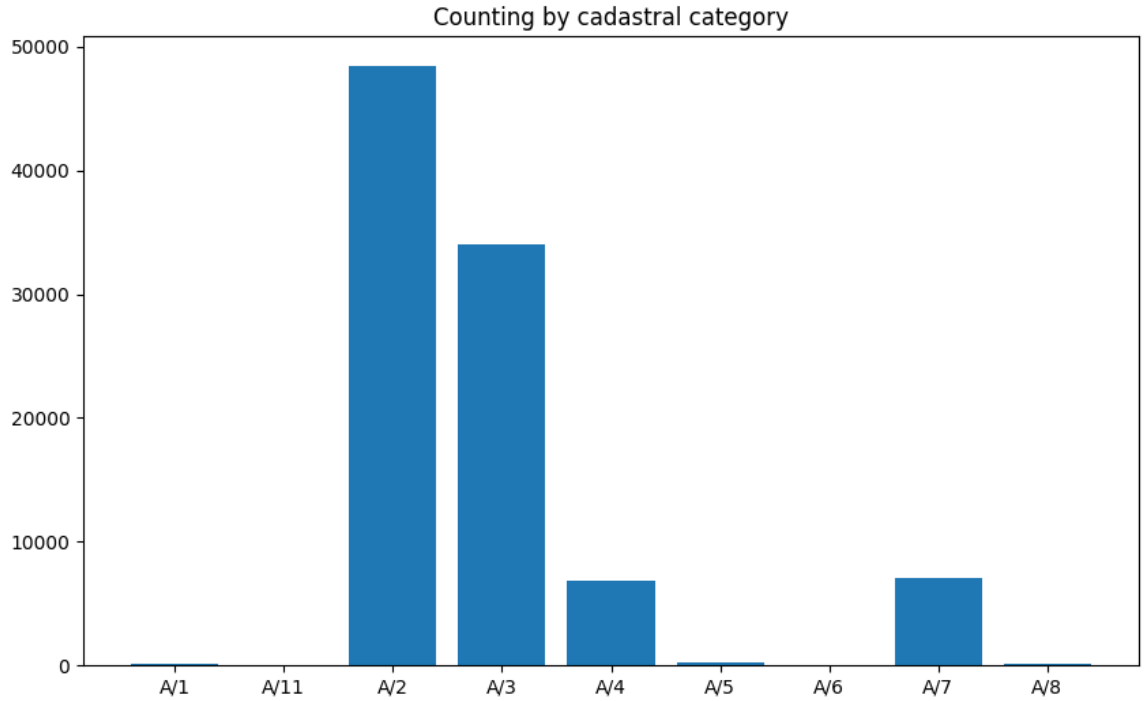

Figure 2: Sample size, divided by categories.

- The ESG score for E is 75
- The ESG score for S is 75
- The ESG score for G is 41
-

3 Results

The sample is made up of 96,832 records, divided as figure 2.

The figure 3 shows an ESG score map. The figure 4 shows an ESG map for the center of Rome.

The figure 5 and figure 6 show the average of the value of E divided by geographic area and cadestral category.

It is interesting to observe the distribution of the entire ESG in detail, see figure 7.

Finally, we carried out two different statistical analyses, to evaluate the significance of the differences observed: an analysis of variance to evaluate the significance of the geographical area on the distribution of ESG, and a regression to evaluate what correlation there was between market value and score ESG (see figures 8, 10, 9, 11, 12).

Figure 3: An ESG score map. The values represented range from 0.8 to 1, the maximum value. It is therefore the map of places in Italy with a high ESG score. The color scale goes from yellow (ESG score 0.8) to green (ESG score 1) .

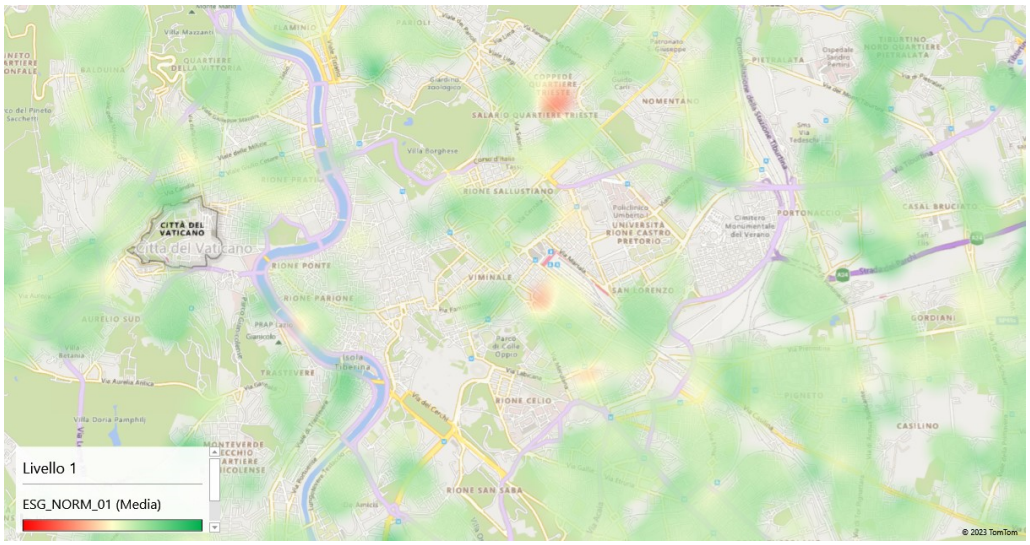

Figure 4: An ESG score map for the center of Rome

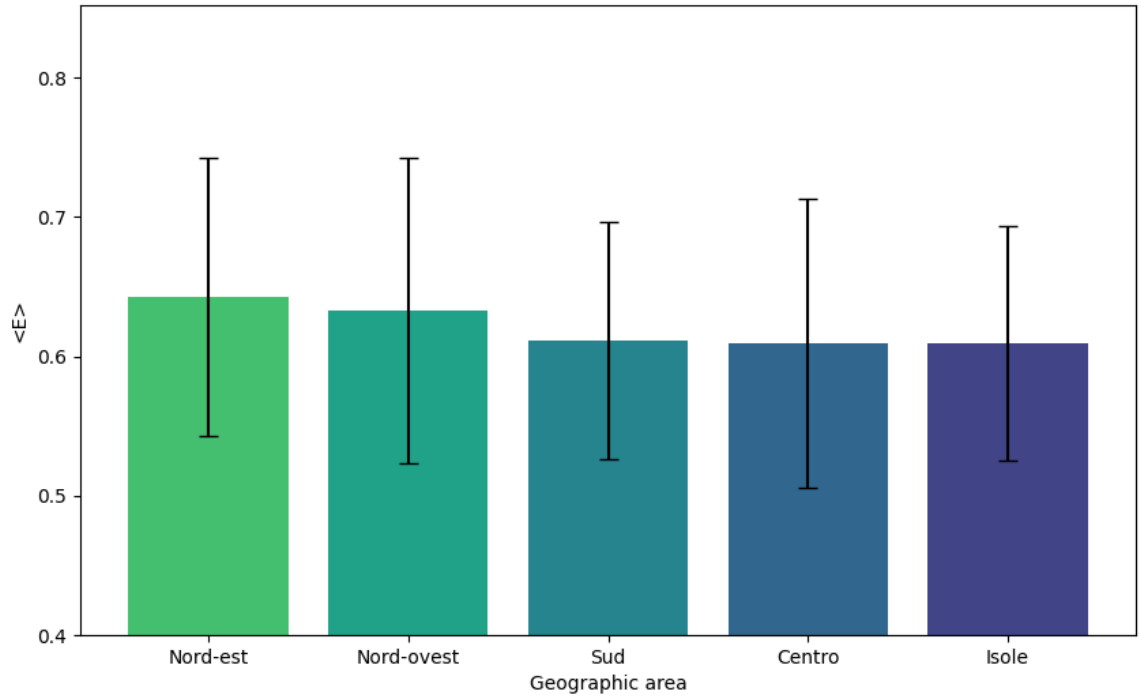

Figure 5: ESG score divided by geographical area. The vertical bar is the standard deviation.

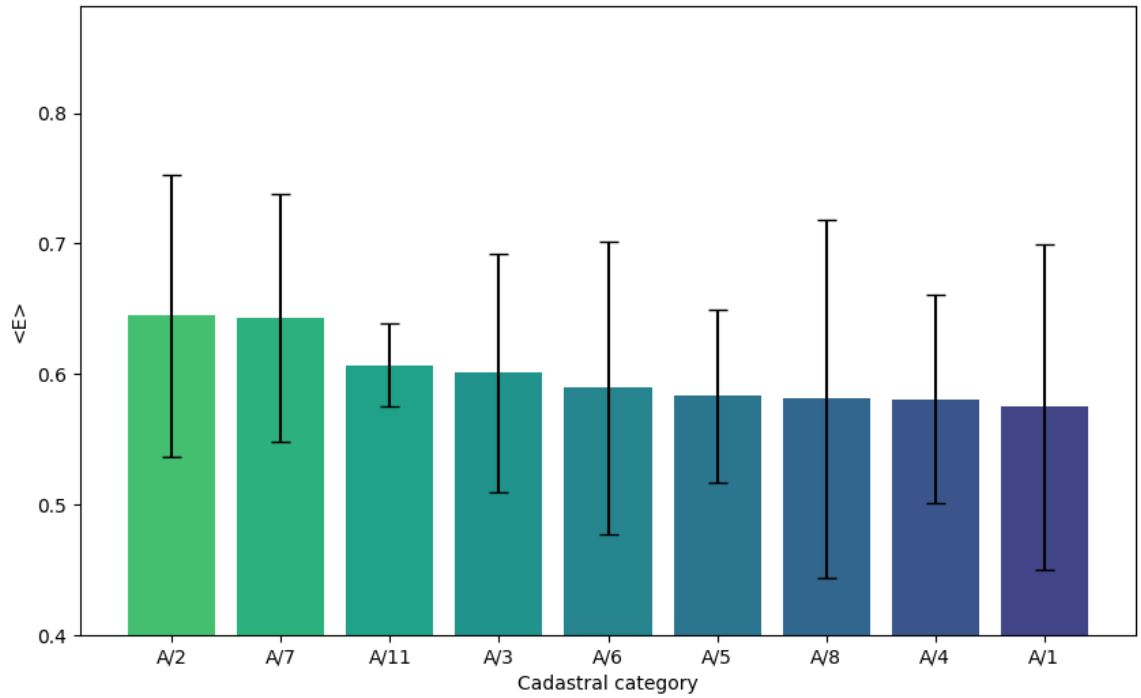

Figure 6: Average ESG score divided by cadastral category. The vertical bar is the standard deviation.

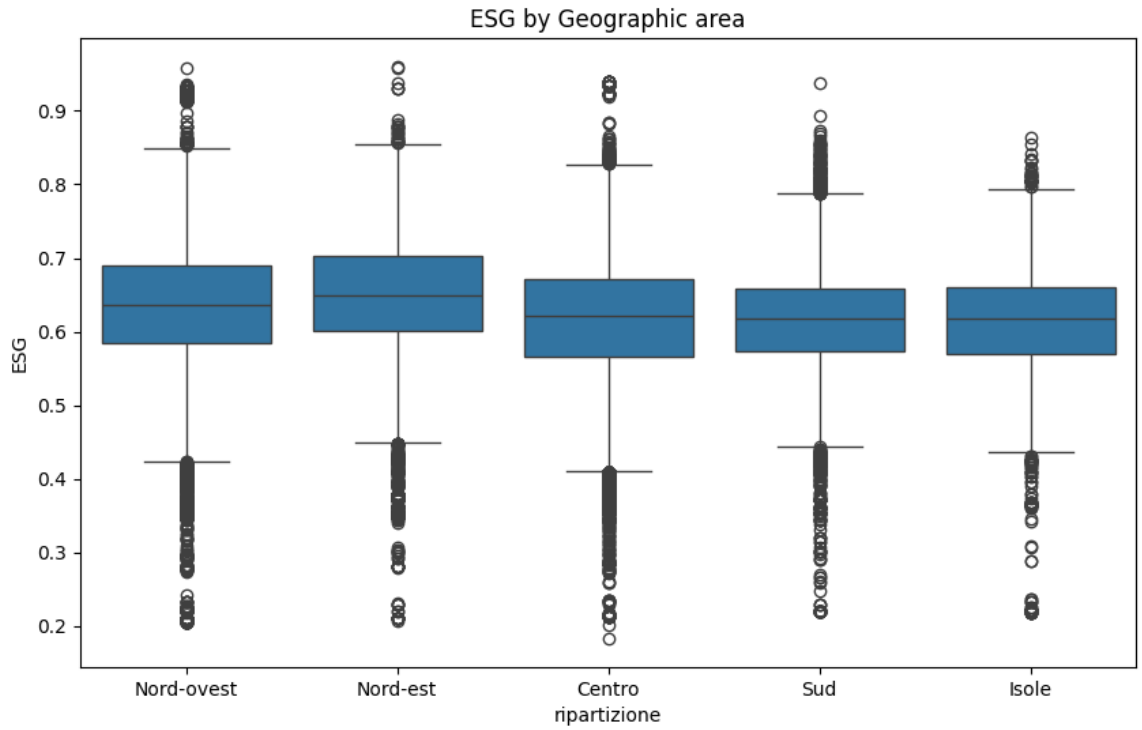

Figure 7: Distribution of the ESG score divided by geographical area. The horizontal bar is the median. This type of graph shows the three quartile values of the distribution along with the extreme values. The "whiskers" extend to points that are within 1.5 IQR of the lower quartile e higher, so observations that fall outside this range are displayed independently.

4 Discussion

In general we could say that the, in Italy, distribution of the ESG referring to residential properties:

- is affected by the geographical position of the property
- is sensitive to its cadastral category
- in some geographical areas (and not in others) it is affected by the market value
- it is possible to find a dynamic in the score over time 8see at the end of this paper)

The geographical area in which the property is located has an impact on the ESG score: the areas of the north-east and north-west have, on average, a better distribution of ESG scores than the areas of the central-south (on a from 0 to 1, a difference of about 0.15). This geographical effect is particularly relevant because it is not conditioned by the type of property: in particular by observing the average scores as the geographical area varies, we note how the impact of geography is equally present in some types of property rather than in others.

As mentioned, the cadastral category plays a role in determining the ESG score. The distribution of the categories according to the score is not easy to interpret (see the 'Analysis' paragraph for details). Then, one of the most surprising findings of the study is the absence of correlation, in some geographical areas, between the value of the property and the ESG score. Even in one area we observe an inverse correlation.

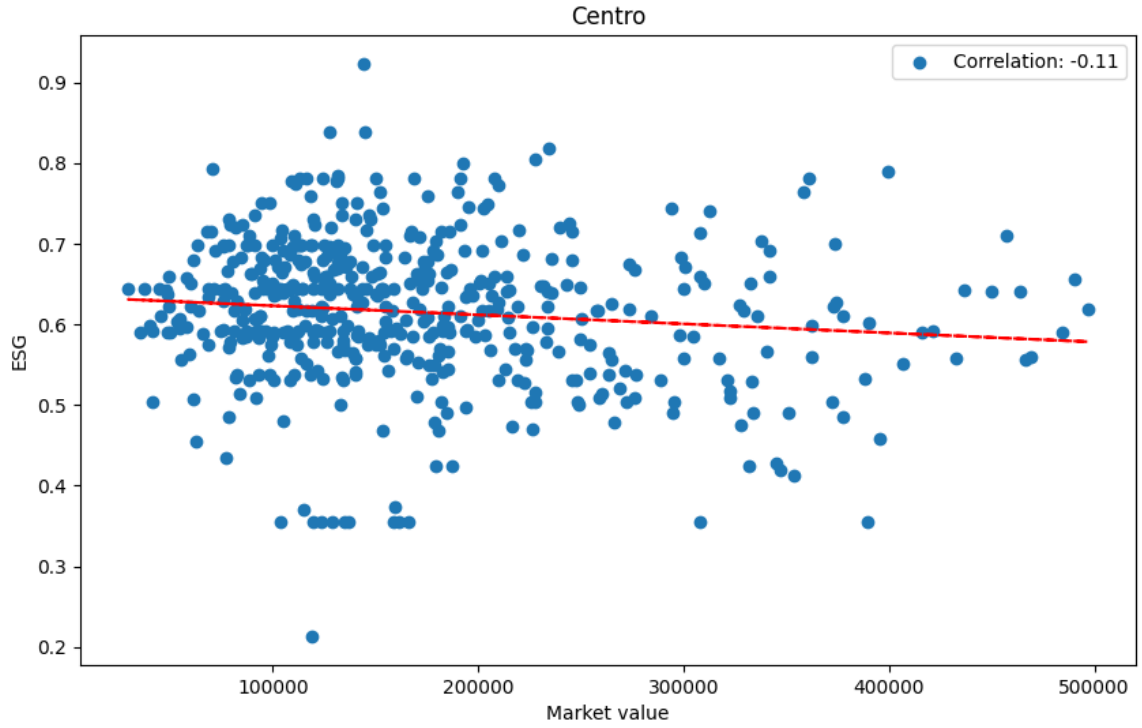

Figure 8: .

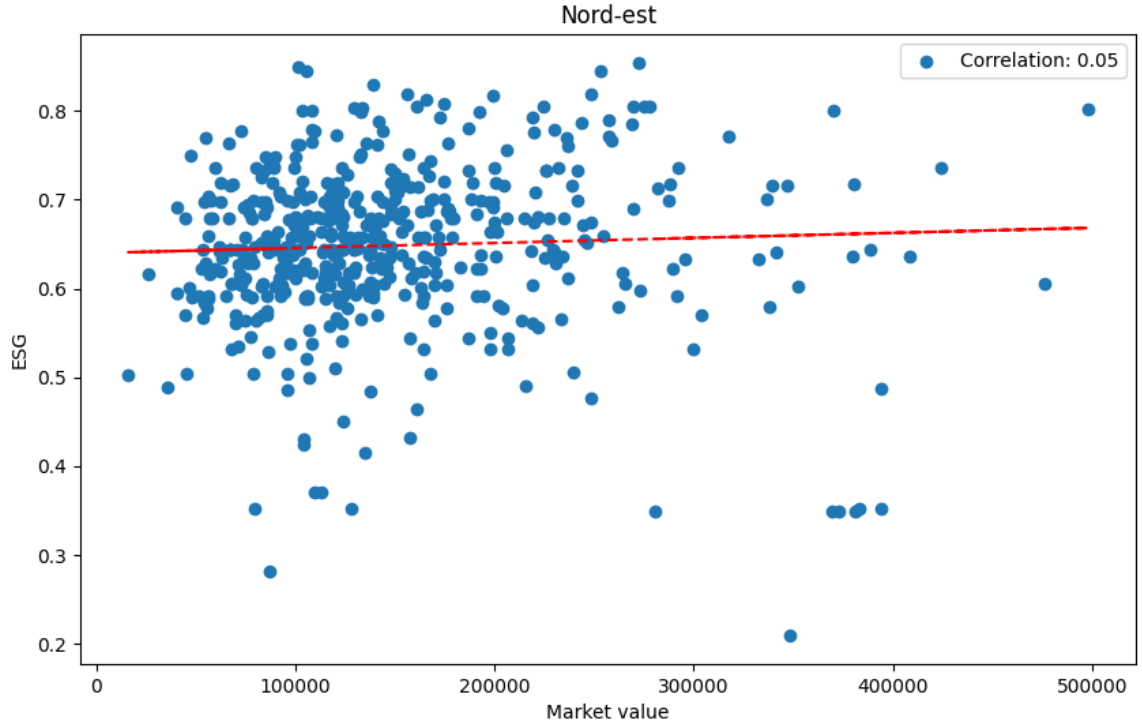

Figure 9: .

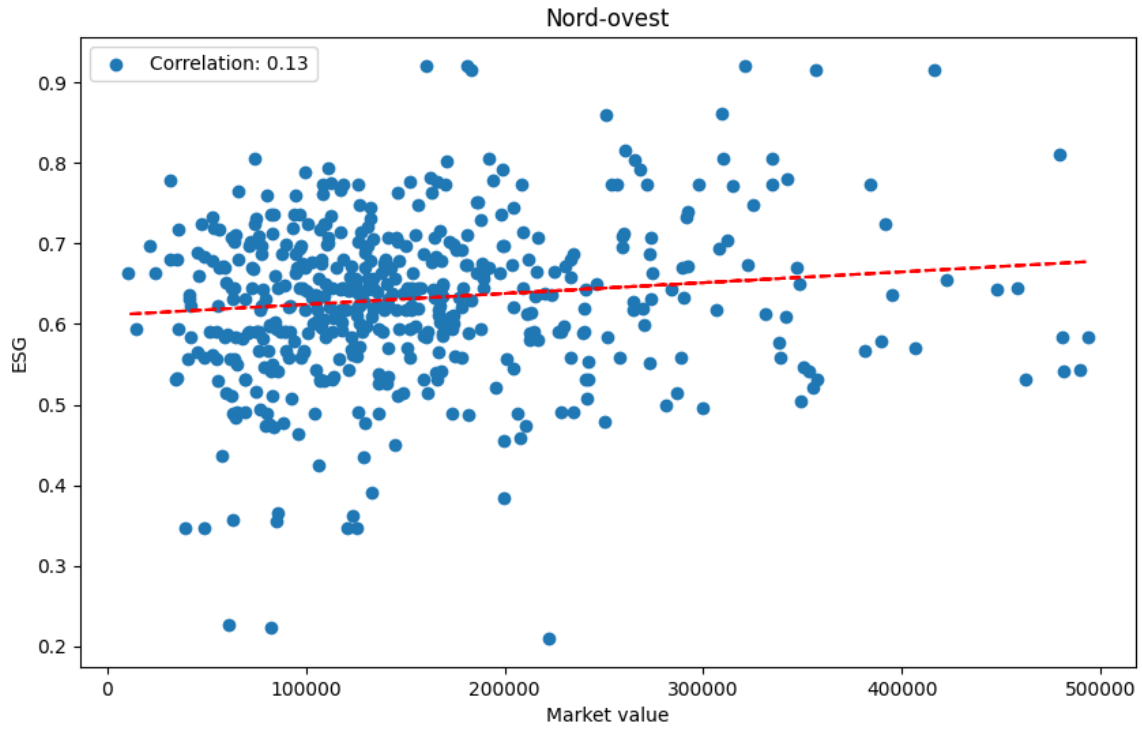

Figure 10: .

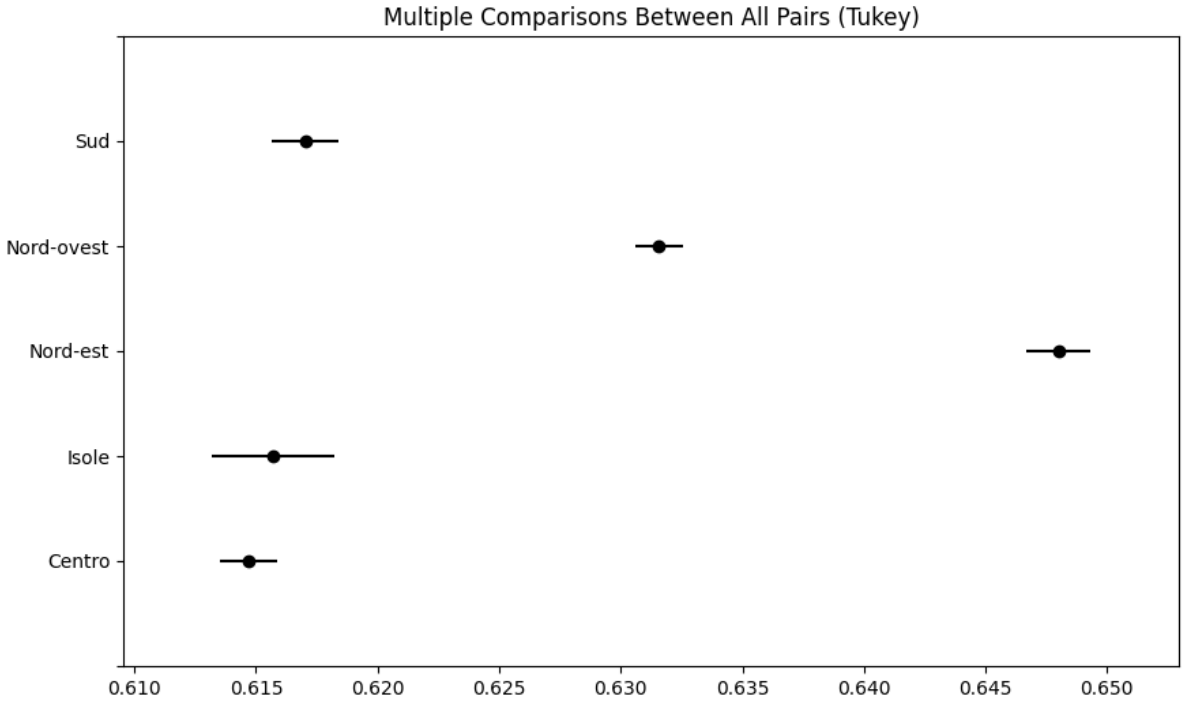

Figure 11: .

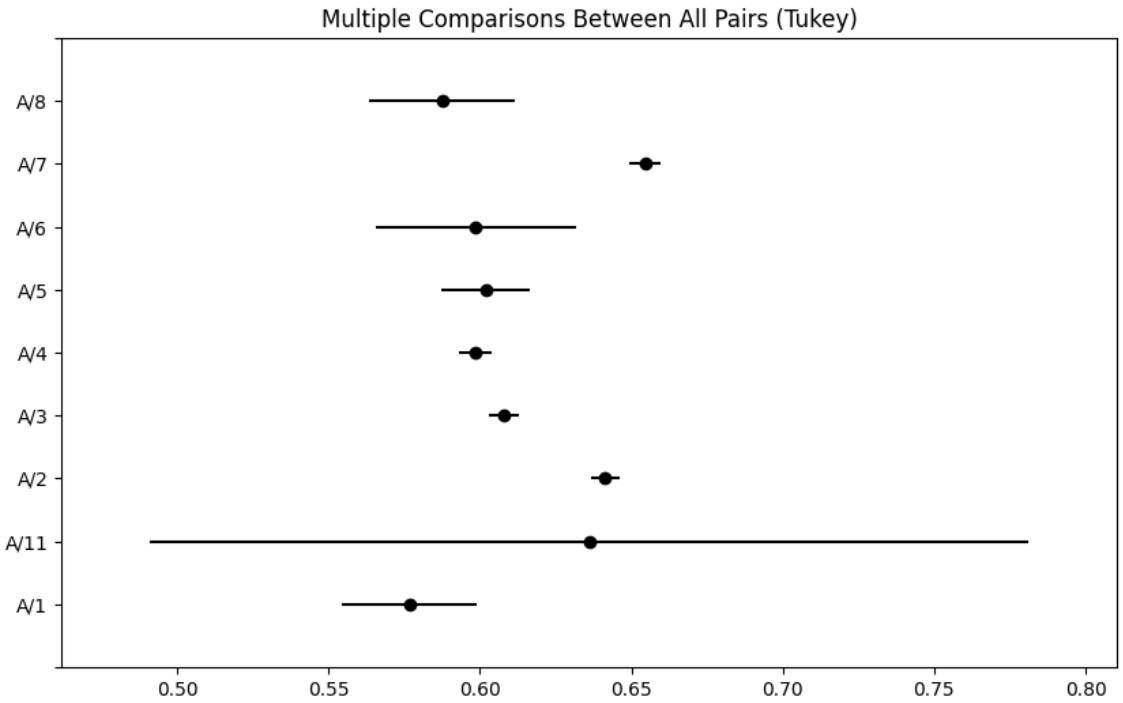

Figure 12: .

4.1 Geographical dependence

Let's try to go into more detail. The first topic we want to discuss is the geographical dependence of the ESG score. This dependence is statistically demonstrated by an analysis of variance and can essentially be traced back to a higher score in the north-east and north-west areas. By carrying out a further variance analysis (this time two-way), to verify whether the geographical factor was in some way conditioned by the cadastral category, the answer is very clear: there is no evidence that the cadastral category interferes with the geographical area in the formation of the ESG score . As we will see later, the cadastral category has its role in determining the score, but the two factors are independent of each other.

Looking the figures about *averages* and *distributions* we see how the difference is present both in terms of comparison between means and comparison between distributions. The distribution of the ESG score for the northern areas has a higher median than the others, but the real difference lies in the fact that the third quartile ends up around the value 0.85 (significantly higher than the others). This evidence, in more qualitative terms, means that there is a significant fraction of properties with high scores, a fraction that is larger than those we can find in the centre, or in the south or on the islands. In other words, it is the quality (in terms of ESG scores) of these properties that raises the median (and indirectly also the average). Given the unequal size of the sample (categories A/2 and A/3 are the most numerous) we can deduce that the policies (and individual choices) that led to a better ESG score in the north are applicable to buildings of medium/high quality. medium-low. That is, these are very widespread policies (and economic choices), even in housing conditions that we would define as 'normal'.

4.2 The cadastral category

Figure 6 shows how there is an effect of the cadastral category on the ESG score. this effect is demonstrated by an analysis of variance (see 12) The result is very clear: there is a statistically significant effect of the cadastral category

Figure 12 referring to the effect that the cadastral category has on the ESG score In particular, the A/7 and A/2 categories (which are also those with the highest average) are those that justify this effect. A problem arises when interpreting this result: while it is perfectly understandable that belonging to the A/7 category is a boost for the score (these are apartments in villas, therefore with a greater possibility of implementing ESG policies), the fact is less clear that the property is in cadastral category A/2 positively influences the ESG score. In any case, this result could be very important in evaluating policies: the data shows that there are features useful for maintaining a good ESG score in 'well finished' properties (A/2) rather than in the next one, A3, characterized by less valuable finishes and consequently a lower cadastral income.

4.3 Connection between value and ESG score

Figures 8, 9 and 10 indicate that for the northern and central areas there is a correlation between property value and ESG score (the south and the islands are not represented because the correlation is not significant).

The interesting point is the direction of this correlation: for the northern areas the correlation is positive, an increase in the value of the property corresponds to an increase in the ESG score. the correlation becomes negative for the center and is not present in the south and on the islands. And this is certainly a fact to take into consideration. In qualitative terms, we observe that only in the Northern areas do environmental redevelopment interventions increase the value of the property , or, reversing the reading, only properties with a good market value have good ESG scores.

4.4 Longitudinal study

The assessments start from 2019 and go up to 2023. In this period of time we observe the appearance of temporal 'patterns' in some geographical areas.

The figures 13 (*Centro* means zone in the middle of the Italy) and 14 show how there are two different temporal patterns. for the Center the situation corresponds to a decline in the ESG score corresponding to the two years characterized by the COVID epidemic. The same pattern is not present in the areas of southern Italy.

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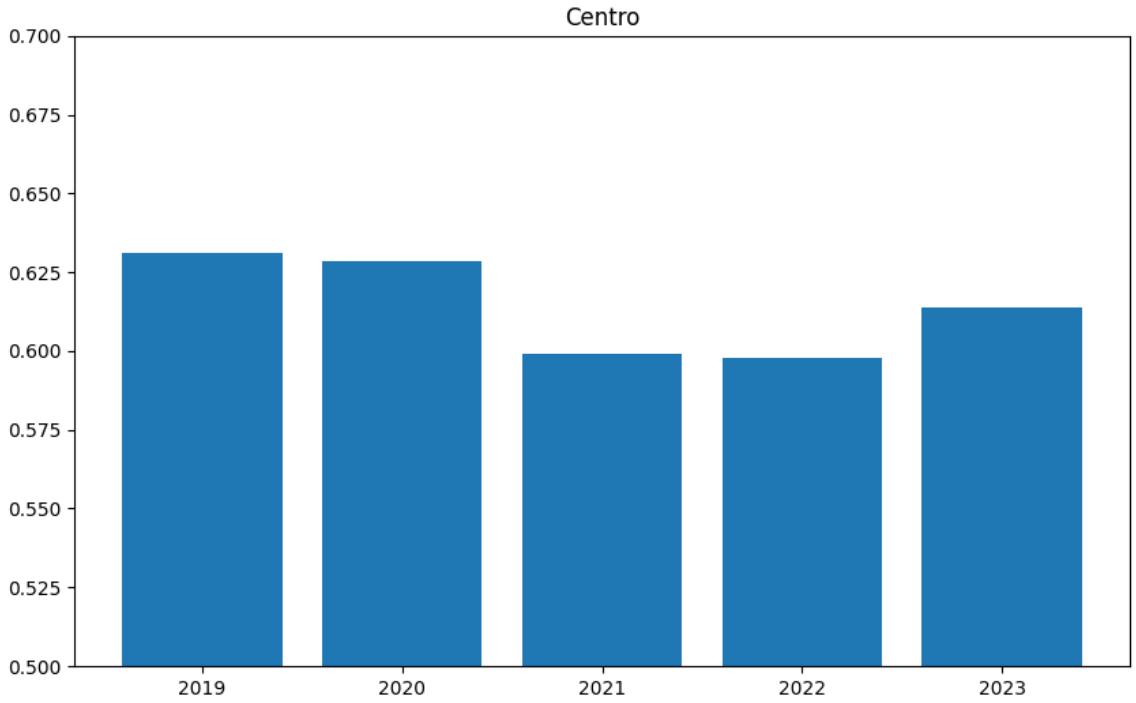

Figure 13: The assessments from 2019 and go up to 2023 (middle Italy).

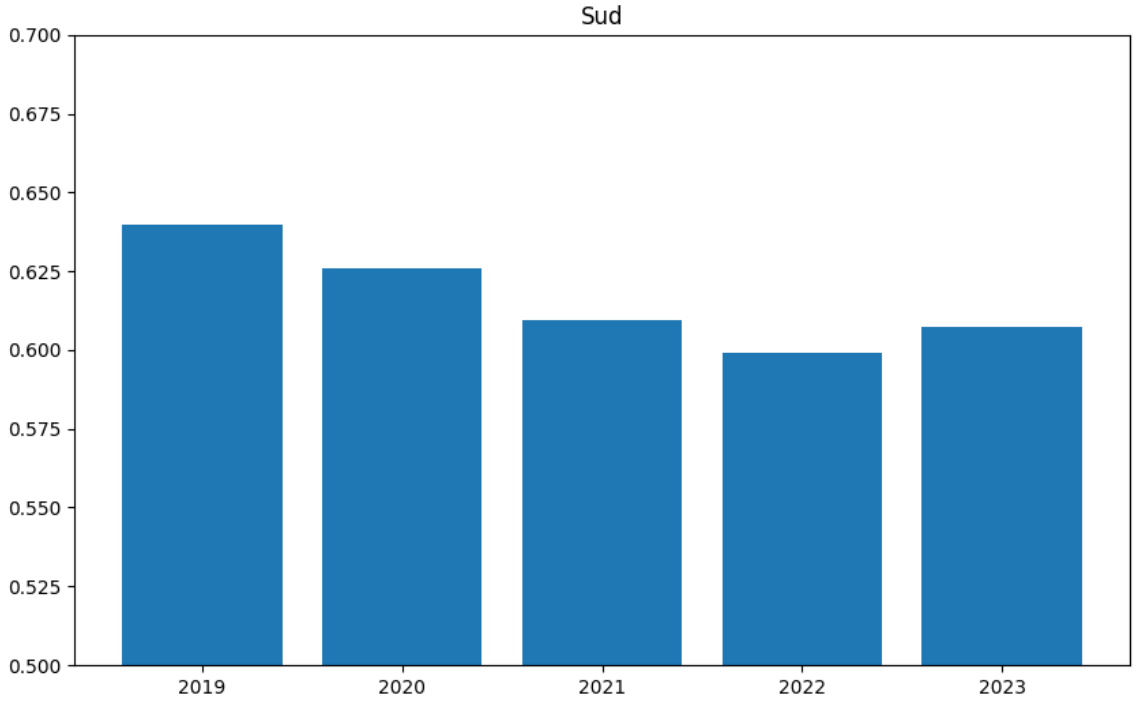

Figure 14: The assessments from 2019 and go up to 2023 (sud Italy).

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