The Determinants of Quality of Life in Rural Areas from a Geographic Perspective: The Case of Tuscany

Abstract

The quality of life of rural populations plays a key role in rural development policies. Starting from a capabilities approach, the aim of this work is to evaluate with a simultaneous quantile regression the heterogeneity of the determinants of quality of life by analysing opportunities addressed to rural populations. These opportunities are quantified as the availability of healthcare, education, economic opportunities, environmental conditions, human pressure and accessibility of the areas. The focus on capabilities represents a change from the prevailing setting which tends to assess levels of wellbeing by functioning as a proxy of capabilities. The results show that the availability of basic services, especially those used frequently, are essential elements for maintaining adequate levels of quality of life in rural areas.

Keywords: Quality of Life; Capabilities Approach; Rural Development; Quantile Regression

1 Introduction

According to the territorial approach, a rural development policy has to be implemented with actions that take into account an analysis of environment, society and quality of life in the rural areas in question. Indeed, the European Union has placed the living conditions of rural people as one of its priorities for the new rural development policy for 2014-2020.

Unfortunately, due to the multidimensionality of the concept of 'quality of life' there is still no complete convergence as to the determinants that should integrate economic indicators to make monitoring and evaluation procedures responsive to the needs of current societies. Indeed, the concepts of quality of life and wellbeing assume different connotations within the functions of time, space and assessment objectives.

In general, the concept of quality of life has expanded beyond the economic dimensions and monetary measurements embracing environmental and societal features. Therefore, a large set of indicators must be calculated and evaluated to take all of these features into account. However, as Boncinelli and Casini (2013) pointed out, the task of the assessment of the level of quality of life has to face not only the identification of a set of indicators, but also their aggregation. In this regard, the indicators could show contrasting signs or have incoherent patterns, making it difficult to understand the changes taking place.

Moreover, Foster (2010) stressed that several authors have focused their analysis more on results indicators, such as level of health or life expectancy, rather than dimensions that determine the level of quality of life, i.e. capabilities. This is a crucial gap because identification of the dimensions has a greater impact on the living standards of people made able to design effective rural development policies.

In particular, differences in terms of material and immaterial infrastructures between urban and rural areas suggest a need to address the goals and economic policy instruments specific to the two areas. Indeed, these differences are critical in determining levels of quality of life. Essential services in a territory, such as schools, hospitals, roads or courts, can be seen as opportunities for residents to achieve high living standards. Although the individual determinants are very important, such as civil status, age, and social relations, the analysis of regional 'endowments' can be thought of as a natural prerequisite towards achieving a satisfactory quality of life.

It must be stressed that evaluation of the impact of infrastructure in rural areas should be made not only in terms of their presence but also according to their accessibility. As pointed out by Ryashchenko (2008), geographical location is crucial to the realization of a satisfactory quality of life. In addition, natural and geographical factors are essential determinates of the

heterogeneity of rural areas in terms of quality of life. Therefore, a geographic perspective is essential when evaluating the real impacts of a given service on a territory.

The purpose of this paper is to identify and evaluate the most important territorial services, infrastructures and geographic factors in order to measure several dimensions of quality of life in rural areas. By identifying the ex-ante determinants of quality of life, the design, targeting, monitoring and evaluation of policies can be more effective. In this way we want to identify any critical issues, since a low quality of life may jeopardize any possibility of development (Kahsai et al., 2011; Nzaku and Bukenya, 2005).

This paper is organized as follows: section two presents the reference theory of quality of life and other studies that assess and measure quality of life in several contexts. Section three is devoted to the description of the analysis methodology adopted and the sources of the data used. The next two sections present the results and test hypotheses. Finally the article ends with some concluding remarks.

2 Quality of life: concepts and definition

The present work aims to evaluate how the availability of services supplied in a rural area is able to influence local residents' quality of life. The reference approach to wellbeing is the Sen's *Capabilities Theory* (1980, 1982, and 1988). According to Sen, individual quality of life does not depend on utilities, but on functioning and capabilities. The first represents a set of actions and conditions that characterize life (health status, education, nutrition, etc.). Instead, capabilities are referred to as the opportunities of the individual to be or to have what she or he wants. Where functioning is primarily imputable to living conditions, capabilities mainly refer to the notion of freedom in a positive sense — that is, not free from anything but free to do something. Sen's approach broadens the perspective from a single dimension to other aspects that can determine individual wellbeing such as leisure, non-market activities,

and personal security. Society, household features and environment are no longer considered as a context but they play a key role in individual and collective wellbeing, since they determine capabilities and functioning in a given society. This approach sees an increasing quantity and quality of options available to individuals as the ultimate goal of economic development.

The main methodological issue to be addressed is the measurement of the level and pattern of choice on a given set of capabilities, or how one can measure opportunities and freedom of choice. These types of issues have meant that most proposed welfare measures and analyses reflect functionings, which are more directly measurable, as a proxy for capabilities (Foster, 2010). The ability to use different combinations of functioning has given rise to numerous attempts to measure wellbeing (for a review on the subject see OECD, 2006).

There exists significant reference literature on the measurement of the quality of life. However, in the most recent thinking in regional science one can refer to Ballas and Tranmer (2012), who suggest a multilevel model to quantify the subjective wellbeing of households within regional clustering. Instead, Brereton et al. (2011) analyse functioning in rural areas, especially through environmental characteristics, the social environment and infrastructure. They build an index of quality of life. Buettner and Ebertz (2009) start from the potential of an area to build an index of quality of life for several German cities. Nuvolati (2003) however proposes adopting a quality of life evaluation based on the actual use of the basic services offered to a population quantified as hospital beds, police officers, and theatres.

An interesting methodological proposal to attempt to assess well-being through the point of view of capabilities was made by Casini et al. (2000, 2011). In these works they propose to measure the quality of life of Tuscan rural families by evaluating the real usage of services and opportunities offered by the territory. Amenities and opportunities were synthesized by indicators at the municipality level through distance functions and evaluated with a

multicriterial approach. In this way, it was possible to estimate the set of opportunities available to a certain territory.

3 Model and data source

Our hypothesis is that QoL_i, the i-th individual quality of life status can be written as:

$$QoL_i = f(\bar{y}_i, S(t_r)) \quad (1)$$

with

$$t_r = g(A_r) \quad (2)$$

Where $\bar{y}_i$ is the vector of the individual (not modifiable) determinants, such as age, gender etc. Instead S is the vector of individual status such as health, occupation, and education level. In turn S is a function of *tr;* representing the opportunities and features of area *r*-nth where an individual lives; t_r is also a function of services and amenity availability, A_r, supplied in *r*-th area, thus (1) and (2) can be rewritten as:

$$QoL_i = f(\bar{y}_i, S(A_r)) \quad (3)$$

Taking into account LAU 2 (Eurostat, 2011), the lower administrative level of the European Union (hence forth referred to as 'municipalities'), as an unit of analysis and considering vector $\bar{y}_i$ as endogenous to the model and interpreted as a constant, the contribution of a single service or amenity in a municipality A_{ri} to the level of quality of life is equal to:

$$\frac{\partial f}{\partial A_{ri}} = S'(A_r) \quad (4)$$

In summary, the 'amount' of the quality of life is a function of opportunities available in a given area. The aim of this paper is to verify if and how each element of vector A_r affects quality of life. Therefore, the elements of vector A_r will be placed in relation to an indicator — a proxy of quality of life within a certain area.

The share of the population aged between 18 and 35 years old in Tuscan municipalities is chosen as a proxy of the level of quality of life. The choice of this variable is motivated, even empirically, by the evidence that this age group is particularly sensitive to their level of quality of life (Easterlin et al., 1990; Warr, 1992; Clark and Oswald., 1996; Blanchflower and Oswald, 1997; Barber, 2009). In addition, the share of young people is pivotal in view of the rural development policy when one of the main targets for economic and environmental sustainability is to avoid the abandonment of rural areas (UNECE, 2012).

The share of young people regresses with respect to a list of variables that are clearly not exhaustive for an overall assessment of the level of quality of life. For example, factors essential for a complete evaluation of quality of life, such as crime or social exclusion, were not included in the analysis of the Tuscan municipalities because these features do not vary among the units of analysis. Moreover, these factors are useful for a subjective assessment of wellbeing, which is not within the scope of our analysis in this paper. However, the analysis also excludes some fundamental aspects such as cultural and recreational opportunities due to a lack of data at the municipal level.

Dimensions taken into account are the availability of health and social care, available funds, opportunities for education and accessibility to essential services, environmental health, human pressure, and the accessibility of the area. The variables of interest and the units of measurement are reported in Table 1.

The average distance that people must travel to access to essential services — social, health, and education — is the indicator of service availability in each municipality. The services included in the analysis are hospitals, kindergartens, middle school and high schools. Primary schools were excluded because this service is sufficiently safeguarded by the law and is therefore not a discriminating factor. Moreover, since the university students are not considered as residents even this kind of services are included in the analysis since have no effect on dependent variable.

Analytically, the distance indicator has been calculated taking into account the municipal housing units, defined by ISTAT (2012; p. 2): *'a group of adjacent houses and neighbours, with at least five families…*'For each unit within a municipality, the distance to access to the closer service is calculated. Then, in order to consider the average unit distance, we calculated the average of each housing unit distance in the municipality. In formula:

$$id_j = \frac{\sum_{i=1}^{N} \dim_{ij}}{N} \tag{5}$$

Id_j is the indicator of the average municipality distance with respect to the j-*th* service, such as hospital, kindergarten or school. The variable dim_{ij} is the minimum distance of the i-*th* housing unit to the j-*th* nearest service, calculated for all *N* housing units in the municipality.

The distances are not a Euclidian distance between map points but are calculated using network distances based on a road map of the case study (regional road network). This is planned using a PC-based GIS — Flowmap — that performs a network distance matrix, taking into account the kind of street and following the 'best way' with a private car from

each housing unit to each point (school, hospital, kindergarten). For origin and destination points that do not match perfectly with the road network, a multiplication factor was used.[1]

The number of bank branches is selected as the proxy of the economic wellbeing and economic opportunities of the area. The number of bank branches is related at the same time to the level of wealth and size of the municipalities. Therefore, the number of branches in a municipality is commensurate and strongly correlated with both the demographic weight and the amount of deposits. Instead, environmental health is considered using the 'population equivalent' (PE). This indicator is an estimate of pollutants produced by domestic business and economic activities in a determinant area. Then, the altitude, measured as the average number of metres of the municipality above sea level, is a factor of the geographical context of the territory.

Furthermore, to measure the accessibility of the area, a dummy variable is equal to one where the municipality has at least one railway station classified as silver. A silver railway station is a station with some services supplied to users and an average capacity of at least 2,500 users per day. This is a classification used by RFI[2], which is the public monopolist of railways in Italy. In this way, the availability of railway stations allows the model to control the commuting pattern in rural areas (Sakanishi, 2006). In addition, the presence of the silver railway station is one of the keys variable used by the Italian Ministry of Economy to classify areas with development concerns (DPS, 2012).

The distance of the municipalities with respect to provincial capitals is considered to be a raw indicator of the access to not centralized services (e.g. courts, chambers of commerce, tax offices). Obviously, the full range of public services cannot be supplied in rural areas.

[1]Flowmap finds the shortest airline distance between origin or destination and the network. In reality, it is not always possible to travel in a straight line. This is why a curve or route factor is sometimes used. This indicates approximately how much longer the road is compared to airline distances. By multiplying the calculated multiplication factor with the curve factor, this difference between airline travel and the real route is also taken into account.

[2] RFI is the public monopolist of railways in Italy.

Finally, we considered the average housing purchase prices in the last five years. Housing prices are one of the key determinants in choice of residence, particularly for young people (Dan Li et al., 2009; Harkness et al., 2009). Furthermore, housing prices incorporate a level of 'quality and service' supplied to residents that is not directly measurable (Rosen, 1979; Roback, 1982). In addition, Buettner and Ebertz (2009) argue that housing prices are highly correlated to quality of life levels.

In short, our model can be written as (Buchinsky, 1994):

$$sh_i = x'_i\beta_\Theta + u_{\Theta i} \qquad \text{with } \text{Quant}_\Theta(sh_i|\, x_i) = x'_i\beta_\Theta \qquad (6)$$

Where the share of young people, *sh*, of the i-*th* municipality, will be regressed to the covariates matrix listed in Table 1 and $\text{Quant}_\Theta(y_i|\, x_i)$ denotes the Θth conditional quantile. The model used to estimate β-parameters is the simultaneous quantile regression (Greene, 2008; Chapter 15; Cameron and Trivedi, 2005; Chapter 4).The underlining assumption of this statistical model is that the linear impact of the covariates varies across distribution. In other words, the importance of services is different when the share of young people is different. In particular this hypothesis is tested for a rural municipality with a level of young people in the first 25th quantile of distribution and the 75th quantile at the upper distribution. The simultaneous quantile regression enables us to make inference to the limits of the two parameters of each variable and thus to test statistically the differences between the results for the 25th and 75th quantile.

Indeed, with simultaneous estimation the coefficients are estimated separately, as in the case the two equations was estimated separately. However, the estimate of the variance-covariance matrix of the estimators is obtained simultaneously by bootstrapping and the variance-

covariance matrix includes between-quantile blocks. Thus, hypothesis tests concerning coefficients across equations can be performed (Cameron and Trivedi, 2010; chapter 7).

The model will be applied to rural municipalities, and classified according to the definition proposed by OECD (2010), which defines as rural the municipalities with a density of less than 150 inhabitants per square kilometre.

The analyses described in this paper are carried out within the municipalities in Tuscany. The position of this region respect to Italy is shown in Figure 1.

Figure 1 – The location of Tuscany respect to Italy

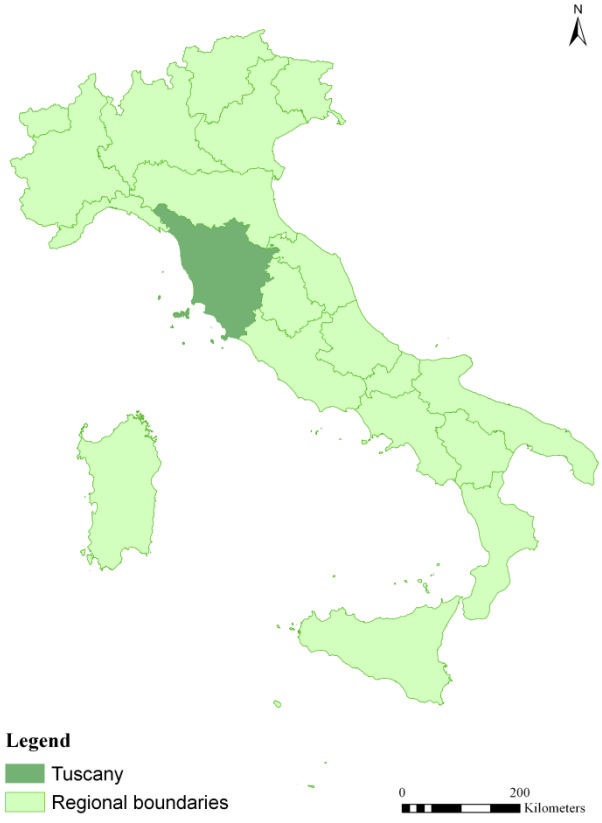


Table 1. List of variables included in the model and descriptive statistics

Variable	Unit of measurement	Data Source	Reporting Year	Mean	Standard deviation
Share of young population	# of inhabitants	ISTAT	2012	32.02	3.60
Distance from health services	Km	Our GIS processing	2011	19441.17	9125.54
Distance from kindergarten	Km	Our GIS processing	2011	5.84	1.63
Distance from middle schools	Km	Our GIS processing	2011	8.50	5.06
Distance from high schools	Km	Our GIS processing	2011	9.17	4.91
Average purchase housing price	€/m^2	Italian Housing Market Monitor	2007-2012	1437.69	515.17
Number of bank branches	Number	Bank of Italy	2012	3.023	2.64
Distance from provincial capital	Km	Our GIS processing	2012	30.60	12.80
Population equivalent (PE)	# of equivalent inhabitants	ISTAT	2009	15835.15	20617.72
Altitude	Metres above sea level	ISTAT	2012	397.12	201.46
Silver railway station	Dummy	RFI	2012	0.09	0.29

The case study area is a result of several motivations. First, the analysis needed a region with availability of raster data of services and roads (qualified by type) to make GIS elaboration possible. Second, Tuscany shows a fairly high range of geographic conditions (mountains, hills and plains), productive specialization and economic conditions. In addition the strong 'tourism appeal' of the region is homogenously distributed across all regional areas. This is an advantage because few areas are influenced by second housing effects. Therefore differences between infrastructure endowments are endogenous to the model.

4 Overview and results

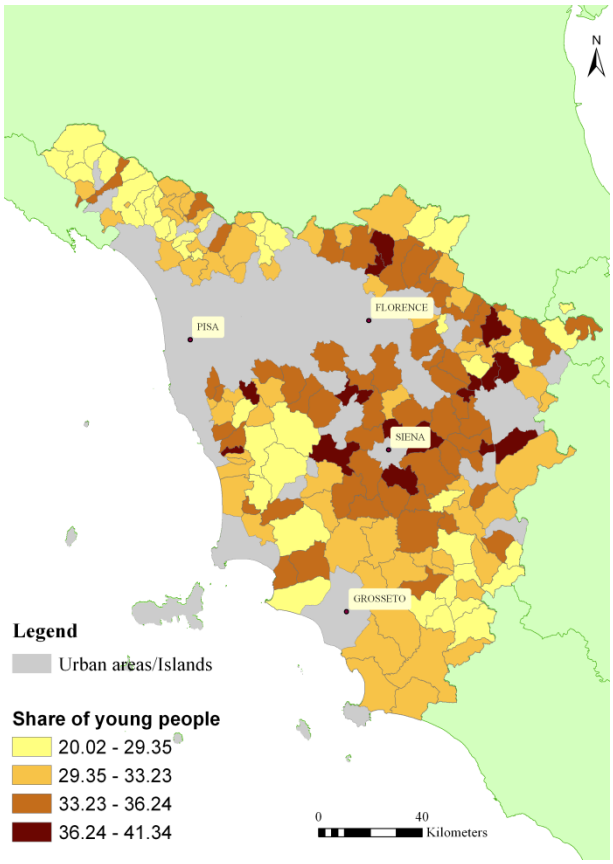
The differences between urban and rural municipalities in Tuscany are remarkable, both in terms of the presence of inhabitants and in terms of basic service provisions such as schools, hospitals and railway stations. Overall, 172 are rural municipalities, 105 are urban and ten are island municipalities. The islands have been excluded from the analysis due to their peculiar characteristics. Tuscany has a total population of 3.6 million inhabitants (ISTAT, 2012), of which 80% live in urban municipalities and the remaining 20% in rural ones.

In addition, the presence of basic services differs between rural and urban municipalities. On average those living in rural areas have to travel longer distances compared to urban ones to access basic services. Besides, services are present mostly in urban areas due to their higher concentration of resident populations.

The data show that bigger municipalities have a higher share of the young population, with an average of 34.8%. However, young people in rural municipalities make up 32% of the resident population but the share of young population in rural areas shows greater variability and a higher range than the urban areas as the Figure 2 shows. Hence, rural municipalities

have a higher level of heterogeneity in their population structure compared to urban municipalities.

Figure – 2 Geographical distribution of young in Tuscany in rural municipalities



In the urban municipalities there exists a greater availability of essential services such as hospitals, schools, banks and railway stations. This is evidenced by a decreasing average distance to access such services in urban compared to rural areas. Urban populations on average have about 9 kilometres fewer to access hospital care compared to rural populations, 3.8 kilometres fewer to access middle schools, and 4.1 kilometres fewer to access secondary schools. On the other hand, for kindergarten schools the situation is equal. Indeed, rural populations take on average 5.8 kilometres to access to nursery schools; similarly the urban ones take 5.7 kilometres. Also statistical tests for differences in average indicate that distances

for access to the nursery school are significantly equal, both in rural and in urban areas. There are 69 silver railway stations in Tuscany; they are mostly concentrated in urban areas. Only one-fifth of these are located in rural areas.

Regarding housing prices, areas with prices in the upper quartile of the distribution seem to be focused mainly in urban areas (Figure 3). Few rural areas are included in the upper quartile, although there are some municipalities in the province of Siena and coastal areas. On average, housing prices in urban areas are about twice that of the rural ones. Instead, areas with lower prices are concentrated in the mountain areas in the northern part of the region and across the eastern border.

Figure 3 – Distribution of housing price in rural areas

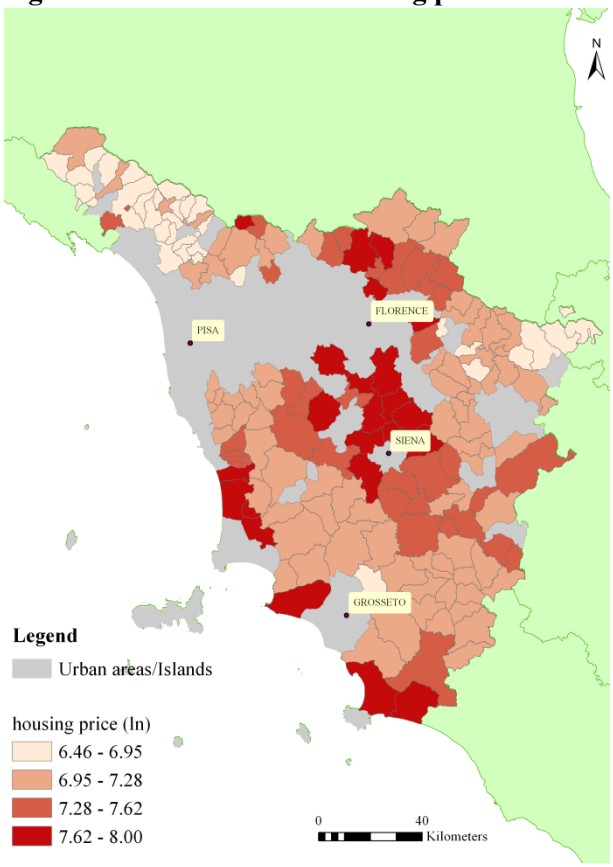


Table 2 shows the results of the model applied to rural municipalities. Standard errors are calculated using the bootstraps method with 100 repetitions (Cameron and Trivedi, 2005; Chapter 4).

A preliminary analysis shows the determinants of the level of quality of life in rural areas to be equal for the upper and lower quantiles of distribution. This is evident in the analysis by significance test of the model parameters.

More specifically, accessibility to health services is significant and negatively influences the share of young people. If the distance to these services increases by 1% the proportion of young people drops by 1% or 1.7%, for lower and upper quantiles, respectively. The same pattern occurs for the distance to kindergarten. This is the variable with the greatest burden between services. A reduction of 1% of the average distance to kindergarten increases the share of young people by almost 2% for the upper distribution but the parameter is almost double for the 25th percentile. However an F test demonstrates that the difference between the parameters is not significant. That is the distance to kindergarten has the same influence for the upper and lower tail of distribution.

Instead, the accessibility to secondary and high schools is not significant. This can be explained by the evidence that only a small proportion of young people between 18 and 35 years old have children who attend the upper level of school. This could be read as the evidence that the resident's decisions do not take into account the longer term, and so rural populations do not consider their future needs. The interpretation of this result could be that young people consider the residence in a rural area not to be a long-term solution and expect to move their residence to urban areas.

Table 2. Results of the quantile regression model

	25th percentile			75th percentile			OLS		
	Coef.	Bootstrap Std. Err.	P>t	Coef.	Bootstrap Std. Err.	P>t	Coef.	Bootstrap Std. Err.	P>t
ln(Distance from health services)	-1.099	0.836	0.039	-1.715	0.755	0.025	-1.305	0.528	0.015
ln(Distance from kindergarten schools)	-2.733	1.156	0.019	-1.865	0.726	0.011	-1.996	0.770	0.010
ln(Distance from secondary schools)	-0.438	0.621	0.481	0.089	0.484	0.854	-0.112	0.383	0.770
ln(Distance from high schools)	-0.342	0.693	0.622	-0.510	0.637	0.424	-0.644	0.431	0.138
ln(Average housing purchase price)	2.970	1.410	0.037	2.462	1.123	0.030	3.671	0.802	0.000
PE	$5.48*10^6$	$2.6*10^5$	0.834	$1.3*10^4$	$1.9*10^4$	0.499	$4.2*10^6$	$1.3*10^5$	0.759
Altitude	-0.003	0.002	0.075	-0.003	0.001	0.054	-0.003	0.001	0.003
Silver railway station (1=yes)	-0.283	1.142	0.805	-1.372	0.793	0.086	-0.402	0.853	0.638
Number of bank branches	0.116	0.221	0.599	-0.003	0.088	0.971	-0.010	0.114	0.930
Distance from provincial capital	$-4.28*10^8$	$3.1*10^8$	0.17	$-6*10^4$	$3.3*10^4$	0.097	$-4.38*10^8$	$1.9*10^8$	0.022
Constant	60.174	22.706	0.009	67.276	11.873	0.001	54.089	12.095	0.000
Number of obs = 175									
.10 Pseudo R2 = 0.2991									
.75 Pseudo R2 = 0.2133									

Note: bootstrap Standard Errors with 1000 repetitions

Another interesting phenomenon is the housing prices unexpected positive sign. In rural areas, if housing prices increase by 1% per m^2 the share of young people in rural areas increases by 2.9%. Instead, the share of young people for the 75^{th} percentile increases by 5% for the 25^{th} percentile. Once again an F test demonstrates that the difference between the parameters is casual. Thus, in rural areas the population prefers houses with higher average prices. Young people probably search for aspects embedded in housing prices such as landscape, security, proximity to services not decentralized and proximity to major urban areas. This choice confirms the results of Ebert and Better (2009).

However, the presence of silver railway stations is not a significant determinant in rural areas. The Italian government considers this variable a key determinant for the classification of under-developed areas. In this way, the classification proposed does not work. Thus, the presence of silver railways stations, or lack thereof, is not decisive.

The PE is not significant. Therefore, environmental conditions are not a directly influential factor on quality of life levels. It is likely that people cannot direct — at low cost— assessments quality of air, water and soil. Perceptions of environmental health are related to human senses, for example people might evaluate noise or smells to be worse than chemical air pollution.

Finally, the distance from the provincial capital is not significant, or at least not a factor that demonstrates an important impact. In fact, if we increase the distance from the provincial capital, the share of young people decreases by a few thousandths of a percentage point. Besides, the number of bank branches — the economic conditions proxy — is not significant. This result shows that economic conditions are more important than municipal territory. The analysis of economic determinants could be more interesting at the provincial level or local systems of work. Indeed, in this case it considers the ability to shift between municipalities.

5 Discussion and conclusions

The economic and social sustainability of rural areas over time is closely related to the maintenance of an adequate level of quality of life. Therefore, the presence and availability of basic services on a territory is a prerequisite to avoid the phenomena of territorial abandonment or senility. In general, our findings reject the hypothesis that the determinants of quality of life are different according to distribution level. The results of quantile regression and the test on the parameters undoubtedly demonstrate an equal pattern between the 25th and 75th percentile.

In general, the results of this paper confirm the Casini (2000, 2011) results, which indicate the availability of health and education services to be key factors in determining the levels of a rural population's wellbeing. Instead, contrary to Casini's research, environmental factors show no explicit influence on wellbeing levels.

However, the positive sign of the housing prices coefficient might suggest that location choice in rural areas is influenced by aspects embedded in house prices, for example landscape, green areas, places with low traffic congestion or low noise. These results are confirmed by Cho et al. (2004), which show that environmental attributes are valued more heavily in rural communities and that these additional values impacts on rural housing prices.

The presence of silver railway stations in rural municipalities does not affect the share of the youth population. A railway station classification that takes into account travel time, frequency of local trains, long-distance services, and quality of services would be more useful.

Moreover, the distances of rural and urban municipalities from the provincial capitals are only marginally influential. It is likely that not-decentralized services are used only occasionally. In this case, distances play a secondary factor in wellbeing levels.

Furthermore, economic factors are not territorial determinants. In fact, the municipal level of analysis does not seem suitable to cover this issue. Presumably, employment opportunities can be measured by the presence of industrial districts, shopping centres and administrative offices.

In conclusion, distances to essential services such as hospitals and schools in rural areas are especially influential on quality of life levels. In particular kindergarten schools are highly important in rural areas because they allow populations a better "lifetime management". Indeed, rural households tend to have a higher commuting time than urban areas. Policy makers should pay special attention to the problems of accessibility to these services and try to encourage maintenance of the whole territory. The high standards of quality of life in rural municipalities can be guaranteed only by the widespread availability of these services. The lack of services offered to rural populations leads to a widespread abandonment of these areas, starting with the most marginalized territories such as mountains. Indeed, our results show altitude to be a significant factor, with higher altitudes serving as less attractive residential areas for young people. Rural development policy should prevent the abandonment of rural areas by preserving the 'non-market' services that they supply to the population, such as hydrogeological protection, landscape conservation, and preservation of fragile areas from an environmental perspective.

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