

Zoppi, Corrado

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## Consensus Assessment on a Metropolitan Railway Project in the Urban Area of Cagliari, Italy: A Case Study of Contingent Valuation

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CONSENSUS ASSESSMENT ON A METROPOLITAN RAILWAY PROJECT IN THE URBAN AREA OF  
CAGLIARI, ITALY: A CASE STUDY OF CONTINGENT VALUATION

Corrado ZOPPI

Dipartimento di Ingegneria del Territorio, Sezione di Urbanistica, Università di Cagliari, Piazza d'Armi 16, 09123  
Cagliari, Italy, tel.: Italy- (0)70- 6755216, fax: Italy- (0)70- 6755215, e- mail: zoppi@unica.it

ABSTRACT

Active participation of local civic communities in the planning process implementation not only is a necessary condition for the process effectiveness, but also, and mainly, a fundamental ethical reference point. In other words, a planning process that does not take account of public participation not only may be ineffective, but also it may fail to pursue general welfare.

A non-participated planning process usually implies either exclusion or misunderstanding of requirements and needs, particularly of those segments of the civic community whose power and voices are low, for either economic and social, or cultural reasons, during elections and decision-making struggles. Thus, favoring public participation in the planning process is primarily an ethical imperative and, secondly, a choice that aims to make the planning process effective.

Analysis, decision making, and implementation of planning processes must be built upon a research work that integrates proposals, needs, and expectations of local communities. The development of these processes should recognize and include what local communities express in terms of participation requirements. Recognition and inclusion not only need to be implemented on a case-by-case basis, but also they must be formally established in the planning codes as standard procedures of planning implementation. This positive and normative approach is fundamentally based on a sound, continuous, and productive dialectical relationship between public administration and public domain. This relationship must be particularly pursued in the Italian local contexts such as Sardinia, where civic communities are not educated in a culture of participation in public decision-making processes.

It is also evident that the outliving of planning as a discipline that aims to define and implement effective policies for the local communities' livable space organization is strictly connected to a radical change of the points of reference of the behavioral praxes of the different involved stakeholders. This is particularly important with reference to the public administrators, or, at least, to part of them, since there is no reason to believe that public administrators who aim to perpetuate their positions of political power may be interested to better public involvement in the planning process, either qualitatively or quantitatively.

Starting from this assumption, this essay summarizes some positions and experiences significant of the importance of radical changes of planning practices, and discusses a case study of consensus assessment on a metropolitan railway project in the urban area of Cagliari, Italy, by means of a contingent valuation methodology.

## 1. INTRODUCTION<sup>1</sup>

The meaning of *environmental frame* and *environmental planning* must be investigated by means of the conceptual and practical connection between these two and the category of *city*, since the city is an important icon of the complex plot of interactions that generate the system *territory-environment*. The structural organization of the city is a fundamental instrument to make the city a living object, and to provide the civic communities with general and sectoral proposals to properly organize and/or transform this object (Young, 1999). The planning context, that is territory-environment as the territory-environment of the city, expresses an interpretation problem that founds the meaning of *land planning*. This is the point of view that is assumed here to discuss and problematize the question of building methods to define environmental frames. A debate on this question has recently characterized, and is still characterizing, environmental planning and its crisis. This crisis does not derive so much from the fact that public planning practices may be considered obsolete, in a situation of widely diffused private competition where free market is often proposed as the general solution for all the economic and social problems, however serious they may be. Rather, this crisis has to be referred to the objectives of planning practices, that is the crisis of the city, the crisis of the territory of the city. This is a crisis of the meaning of environmental planning as interpretation of the on-going territorial processes.

Many case studies described by Europolis (INU and WWF, 1996) allow us to focus on a question which concerns the very nature of participation processes, one which is related to the quality of the environmental project of planning policies and their effectiveness: "How individual and collective subject participate?" or "How participation quality and quantity could be evaluated?". It is evident that quality and quantity depend on the level of information and number of people involved who are socially weak, poor, illiterate, and uncultured. For these reasons, they are hardly able to make their voices audible and to exercise a significant contractual power in the social arena. Children are certainly among these people, and Europolis reports several case studies concerning children-participated planning. As other non-audible social categories, children are often excluded from decision-making on the organization of the living space of the city. However, with their behavioral attitudes, their needs, and their expectations, they do exercise an important influence on the effectiveness of urban planning implementation, one which is often a determinant of its successes or failures, in terms of consistency of outcomes with respect to objectives, and of resulting territorial organization and transformation, in regard of the goals and images of the implemented planning policies. This is a position of several planning scholars, one of whom, Appleyard (1981) proposes a broad and pragmatic reflection on the meaning and goals of streets planning in densely-populated urban districts of the U.S. cities: "To children whose lives are threatened by traffic and to all those who suffer noise, vibration, fumes, dirt, ugliness, loneliness, alienation or some other impoverishment due to its presence" (p. vi). There is no doubt that people whose voices are difficult to be heard, who are less politically influent, are among those who most hardly suffer from the perverse consequences of the implementation of planning policies that fail to recognize their true, and often unexpressed, needs. Europolis puts in evidence that environmental urban planning activity should not recognize only needs and expectations coming from the most socially-strong categories of citizens, because the territorial processes which develop from the planning decisions and consequent implementation involve all citizens. So, urban planning effectiveness and success are strictly connected to all citizens' and social categories' participation and involvement in decision-making and implementation processes. This is an important standpoint from which the so-called *concerted urban planning*, which has recently developed in Italy, must be carefully qualified and

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<sup>1</sup> A first discussion of this case study is developed in the thesis of Giuseppina Melis, in the Program of the First Degree in Civil Engineering, at the Faculty of Engineering of the University of Cagliari, Italy. This thesis, titled "Politiche di riequilibrio del sistema dei trasporti nella conurbazione cagliaritano e consenso delle comunità insediative: valutazione del progetto della metropolitana leggera" (Planning Policies for the Transportation System of the Conurbation of Cagliari and Consensus of the Local Communities: Assessment of a Metropolitan Railway Project), was supervised by Corrado Zoppi. The thesis defense was held with the Graduation Committee of the First Degree Program in Civil Engineering at the Faculty of Engineering, in October 2000. The thesis is available for consultation at the Sezione di Urbanistica del Dipartimento di Ingegneria del Territorio at the University of Cagliari (Urban Planning Section of the Department of Territorial Engineering at the University of Cagliari).

The author is grateful to Marco Demuro, Paolo Pezzuoli and Ernesto Porcu, Engineers and Project Managers at Ferrovie della Sardegna, for the precious information on the project of the Metropolitan Railway of Cagliari. The Informational Report and Questionnaire utilized for the contingent valuation experiment discussed in this paper are available from the author, upon request.

The documentary research on the organization of the transportation system of the metropolitan area of Cagliari and the interviews for the contingent valuation experiment have been made by Giuseppina Melis. The author is grateful to Giuseppina for her precious cooperation.

evaluated. *Concertation* almost always develops as a top-down process conceived and implemented to by-pass the ordinary, cumbersome, procedures of the issuance of building and urban transformation permits. This is a process where the public administration of the city often deals with private “friend” entrepreneurs of the building trade almost completely outside of the democratic control. According to Borri, genuinely participated environmental planning processes may develop if and only if the most powerful voices become silent, since this is the only way low voices may be heard and be influential in some way<sup>2</sup>. The attempt to define long-run goals for urban planning processes in densely-populated urban areas moves from the recognition of the necessity of making only-temporarily-strong economies more powerful and balanced, that may become as marginal as those of the natural environment-dominated urban fabric. The structural weakness of these economies derives from the fact that they are not based on field processes that integrate the needs of the civic communities and the environmental identity of the territory.

So, the definition and implementation of planning policies should be based on a wide and progressive involvement of the local communities, which can generate a dynamic organization of the territory of the city mostly consistent with their behavioral attitudes, needs, and expectations.

Based on these conceptual assumptions, this essay discusses a case study of consensus assessment on a metropolitan railway project in the urban area of Cagliari, Italy, by means of a contingent valuation methodology. The goal of this contingent-valuation-based assessment is to evaluate a priori the supposed effectiveness, or ineffectiveness, of the railway project, assuming the degree of informed consensus (or disagreement) of the local civic community as a performance measure. Through contingent valuation (CV) it is also possible to evaluate the role of the quality of information on public consensus, that is the role of the involvement and participation of the local civic community to the definition and implementation of the planning process.

CV is a typically direct methodology that allows us, on the one side, to evaluate the degree of consensus on a public planning policy, and, on the other side, to enhance the quantity and quality of the information of the local civic community. Participation, interest, information, and consensus, are undoubtedly deeply connected to one another in the perspective of open planning forms-processes, which may produce outcomes that show consistency between general objectives and the expectations of the local communities concerning the spatial organization of the territory of the city.

## 2. BACKGROUND

The project of a metropolitan railway in the urban area of Cagliari was originally defined in the Sixties by the *Ferrovie della Sardegna* (F.d.S., the Company of the Railways of Sardinia, formerly named *Ferrovie Complementari della Sardegna*). The first version of the project defined a connection between the Station of Monserrato and the Square of the State Railways in the Neighborhood of San Paolo, with a line roughly parallel to the State Road 554.

The financial resources granted to the project implementation, which have presently made possible only partial works, have only recently become more adequate. So, the F.d.S. have realized an updated and more functional project version. In other words, the present situation of the public railway transportation of the metropolitan area of Cagliari is consistent with an almost unique and integrated planning project.

A fundamental element of the last version of the F.d.S. project is the realization of exchange parking lots at the intersections between the railway and the radial roads that convey traffic to and from the city center (*Ferrovie della Sardegna*, 1996). Here the bus stops of the Metropolitan Transportation Company (C.T.M., Consorzio Trasporti e Mobilità) of Cagliari and of the Sardinian Regional Road Transportation Company (A.R.S.T., Azienda Regionale Sarda Trasporti) should be located, in order to develop an efficient organization of the commuting transportation system to and from the city center through the new metropolitan railway. Moreover, exchange stops have been projected between the F.d.S. and the National Railway (F.S., *Ferrovie dello Stato*) lines, which will perform the distributive scheme of the metropolitan transportation system, hopefully with a unique pricing system.

The exchange parking lot of Piazza Matteotti has a significant importance among the projected parking lots, because of its vocation for intermodality, since it is located at the crossroad of the different lines (F.S., F.d.S., C.T.M., and A.R.S.T.) of the urban and extra-urban transportation systems, and of the future civic terminal of the commercial port and of the airport, that is connected to Matteotti Square through a bus shuttle.

The investment for the track section between Monserrato and San Paolo was financed through the funds granted by the National Law n. 211/92, article 10. This part of the metropolitan railway system would have completed the initial version of the project, which the Regional Administration financed in 1964. This version defined the displacement of the F.d.S. station from its former location, Bonaria Avenue in Cagliari, to its present location, in

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<sup>2</sup> This is drawn from a lecture of Dino Borri given at the 1999 Congress of the Istituto Nazionale di Urbanistica (the Italian Institute of Urban Planning), Sardinian Section.

the city of Monserrato. Unfortunately, works were not finished because funds were not enough, and the new station was realized in Repubblica Square in Cagliari, while the connection between Monserrato and the station of the F.S. in Matteotti Square, which would have been the new main penetration track section to the city center, was not completed, since there was no way of finding funds to finance the complementary works. Only by means of the funds granted by the Law n. 211/92 it was possible to finish the track section between Matteotti Square and the city of Monserrato. These grants made also feasible the realization of a new connection between the railway lines of the F.d.S. and F.S. through an extra-urban railway line, and an increase of the service capacity, mainly due to the rationalization of the whole transportation system of the metropolitan area (Ferrovie della Sardegna, 1999). Later, funds were made available through the European Regional Development Fund and through the National Law n. 402/94 (about 80 billion Italian lire in all), to build the metropolitan ring surrounding the area of the commune of Cagliari, that includes the connection between the railway lines of the F.d.S. and F.S.. A further source of funds was represented by an investment of 13.5 billion lire through the programs defined by the National Law n. 910/86 for interventions on the lines of the F.d.S..

The project draft of the metropolitan ring was approved by the Regional Administration and the Cities of the metropolitan area of Cagliari, and the F.d.S. defined a preliminary executive project in 1996, which was accepted by all the involved public administrations. Later, in 1997, the Cities of Cagliari and Monserrato required some minor modifications of the projected track sections with reference to crossing modalities of some delicate densely-populated urban areas, even though they recognized the general validity of the proposed project. The City of Cagliari indicated that the urban track section between Matteotti and Repubblica Squares should have passed through the port side of Rome Street, while the City of Monserrato demanded that a careful feasibility study be implemented, concerning the connection between the station of Monserrato and the Polyclinic of the University. In 1998 the Regional Administration has publicized a public competition to collect ideas on the Rome Street track section of the metropolitan railway, while negotiations have started between the Regional Administration and the F.d.S., and the City of Monserrato, to define a new executive project which may be suitable to all the parts. However, the City of Monserrato has not agreed upon a concerted proposal yet.

Although the present situation is characterized by a substantial uncertainty concerning the definition of the metropolitan ring, however the F.d.S. have recently realized a hopefully-almost-final version of a first part of the executive project, in order not to lose the financial grants of the Law n. 211/92 and the residual funds available from the Law n. 910/86. Moreover, the funds granted by the Law n. 402/94 are still available (about 40 billion lire). All these financial resources are going to be utilized to realize the West Ring, whose the executive project of the first part of the metropolitan ring is a portion. This portion, named *Line 1*, includes the track section whose nodes are Repubblica Square, Cagliari, and Gottardo Street, Monserrato. The part of this track section which develops in the commune of Monserrato has not been approved yet by the City of Monserrato.

In the near future, financial funds for the implementation of the metropolitan railway project in the urban area of Cagliari could come from the grants of the 2000-2006 Operational Plurifund Program of the Regional Administration, which defines proposals on the distribution of European structural funds with reference to financing requests coming from local administrations (Provinces, Cities, Mountain communities), private or non-profit companies, and single citizens. The total cost of the project is estimated at 450 billion lire. The final executive project of the track section between Repubblica Square and San Gottardo Street has been realized not to lose the financial resources already devoted to the metropolitan railway by the Laws n. 910/86 and n. 211/92 (Ministero dei Trasporti e della Navigazione, Dipartimento dei Trasporti Terrestri *et al.*, 1999; Massa, 1999). The Line 1 is very important and it not only is the starting point for the construction of the West Ring, but also it is the basis of an eventual East Ring as a common feature of two possible scenarios of expansion of the collective public transportation network. The Province of Cagliari has shown a significant interest for the realization of a second metropolitan ring. The Province has promoted the development of a detailed analysis and restructuring proposal of the present organization of the transportation system of the metropolitan area of Cagliari, through the Provincial Office of Public Works, Traffic and Transportation.

It is clear enough that the local public administrations are willing to implement works to realize this new metropolitan railway system. The Province is preparing the financing requests for the 2000-2006 financing program of the European Regional Development Fund. This European Union Fund should grant the railway project a substantial inflow of financial resources.

The present track sections between the Station of San Gottardo Street, in the commune of Monserrato, and the Station of the Neighborhood of San Paolo, in the commune of Cagliari, are more suitable than the first project proposal of the Sixties. Furthermore, if a new metropolitan railway line of the F.S. were realized along the path which includes the stations of Matteotti Square in Cagliari, and of the towns of Elmas, Assemmini, and Decimomannu, a system redundancy would be generated, at least along the portion of the track section from Matteotti Square to the stop of the Fangario Area, located at the boundary between the communes of Cagliari and Elmas.

The F.d.S. are projecting to interrupt their service in the Fangario Area, and to realize an exchange node between the two railway lines, in order to eliminate this redundancy. In this context, the connection between Repubblica Square and the Station of Monserrato takes a significant importance, since it presently not only is a railway service, but also a metropolitan service. The transportation demand is today of 900 passengers per day and direction in this track section, and the existing transportation system fulfills this demand. According to the forecasts of the F.d.S., the new metropolitan railway line would increase the transportation demand, since it should strengthen its urban service character. Moreover, although the new metropolitan rings were not activated in the short run, however the new track section could develop along the Northern direction of the province, up to the towns of Settimo San Pietro, Dolianova, and Senorbì. The supply of transportation services would be able to meet a demand of 2,500 passengers per day and direction, with the integration of bus shuttle services that connect the railway stops to the internal small towns of the province of Cagliari.

Figures 1 and 2 show some of the most important planning features of the metropolitan railway project.

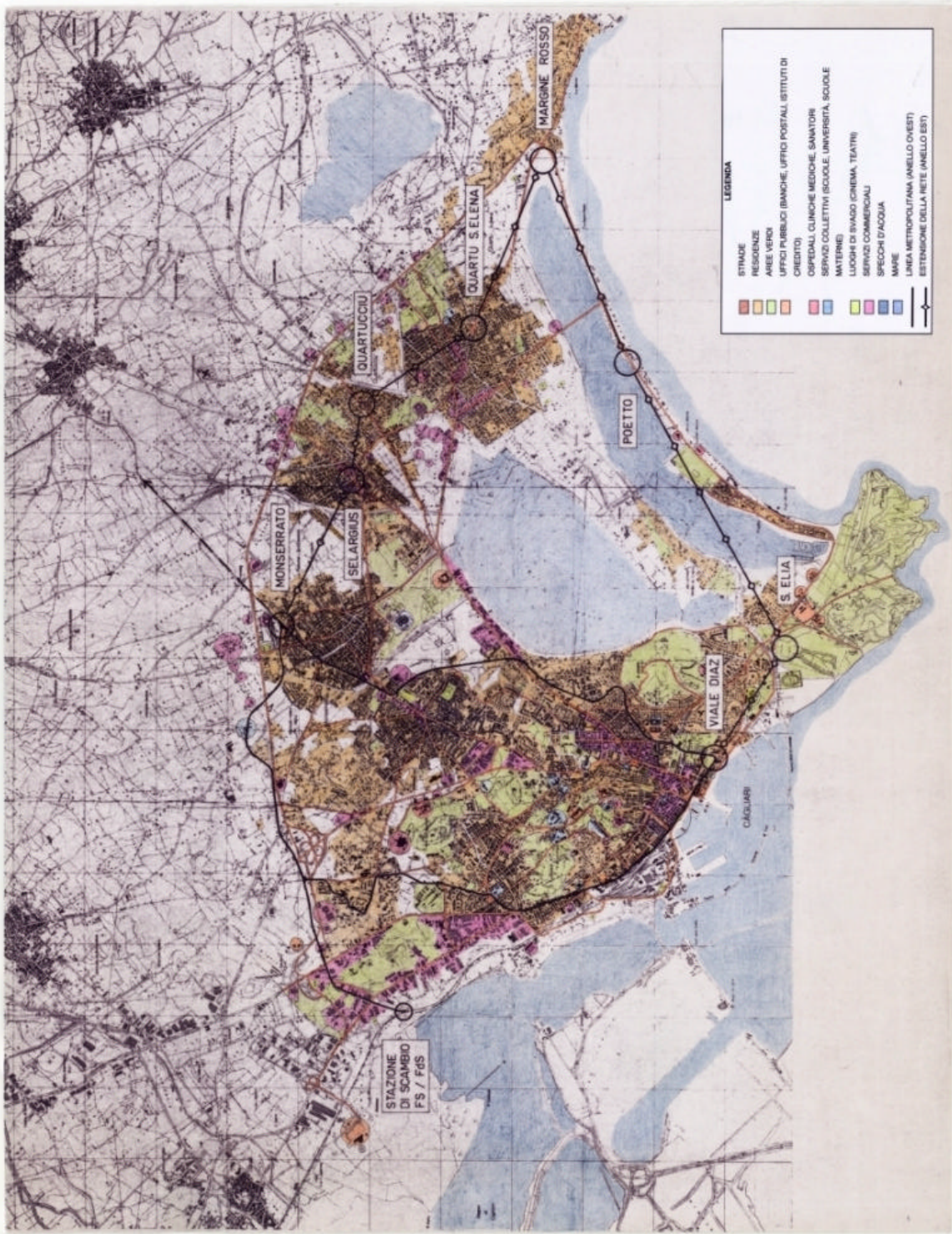
### 3. RESEARCH METHODOLOGY AND DESIGN

#### 3.1. Methodology

The contingent valuation methodology (CV) allows us to evaluate the degree of consensus of a community on the forecasted outcomes, and the implementation process, of public planning policies. CV case-studies, lots of which are reported in the current urban and environmental economics literature, are almost always based on empirical surveys whose aim is to investigate public consensus (or disagreement) through the preferences of the average citizen, who is considered representative of the local community. Since empirical surveys are referred to planning policies which will be implemented in the future, what is evaluated is a supposed consensus on these policies.

On the other hand, methods whose aim is to evaluate policies which have already been implemented, e.g.: hedonic methods, allows us to evaluate consensus (or disagreement) on policies whose outcomes are observable. In this case, what is evaluated is an observed consensus. As CV, these methods generally assume that the average citizen may suitably represent the preferences of the local community. Estimates are more reliable though, since they are based on direct observation of citizens' behavior, even if hedonic methods could hardly be utilized to assess policies whose outcomes cannot be observed yet. On the contrary, CV relies on what citizens declare without any experience of real outcomes.





**Figure 1:** Projected lay-out of the metropolitan railway in the urban area of Cagliari



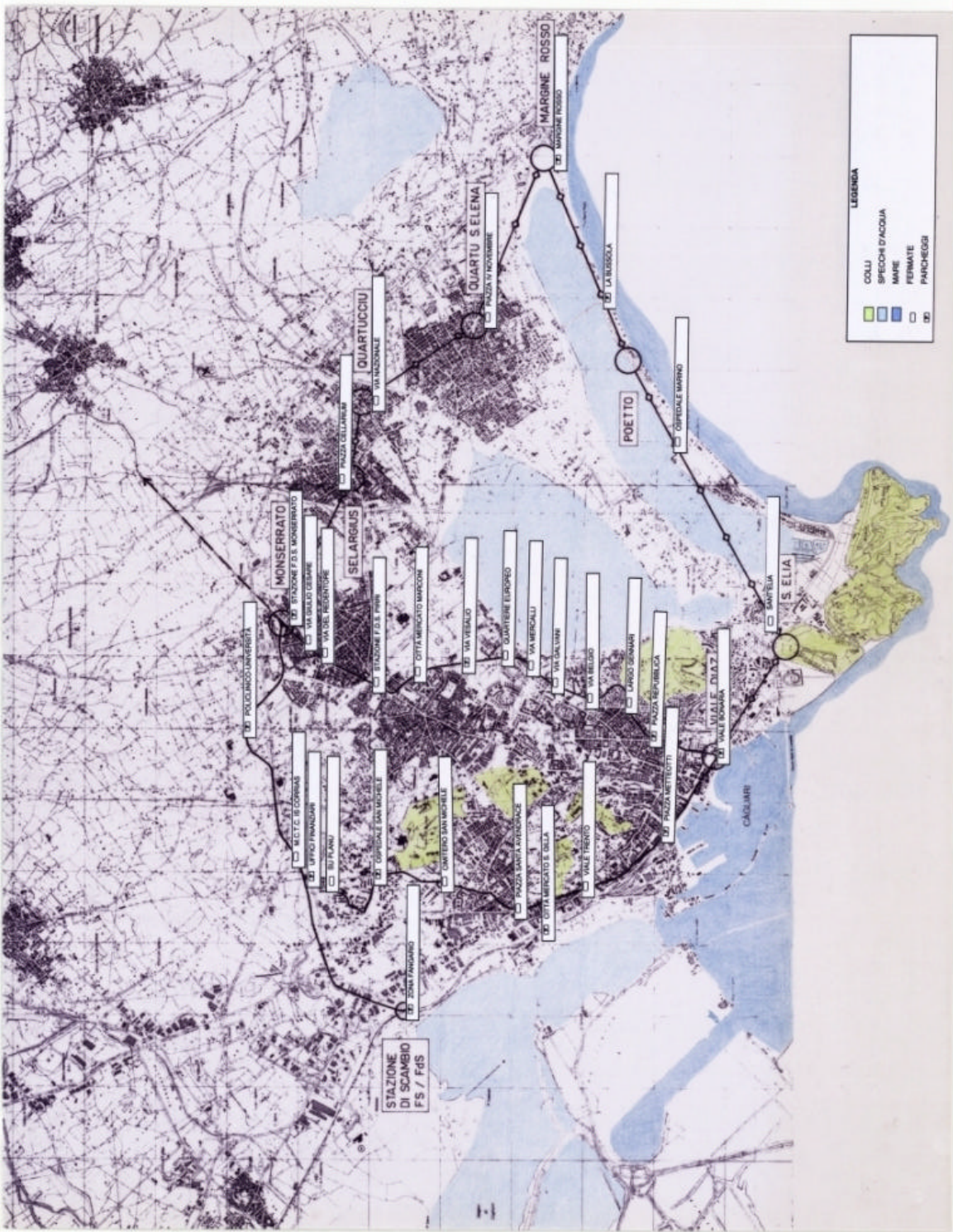


Figure 2: Locations of train stops and parking lots



A detailed discussion on urban and environmental economics methodologies is presented in a very interesting essay of Cropper and Oates (1992). Zoppi (2000; 2000a) has developed a case study based on the hedonic approach developed by Palmquist (1991) to evaluate planning policies whose aim is to mitigate impacts of negative externalities generated by illegal building activity in the metropolitan area of Cagliari.

In this essay, a CV case study is discussed based on the method of dichotomous choice with follow-up. Through this method, the willingness to pay (WTP) of a local community is estimated, with reference to the implementation of a public planning policy. WTP is evaluated through a survey referred to a random sample of the local community. People included in this random sample are informed on the public policy definition, implementation and expected outcomes. The public policy evaluation is based on the answers of people included in the sample to a questionnaire. These answers must be directly connected to the information they received in advance.

The implementation of the dichotomous-choice method implies that people included in a random sample be asked if they are willing to pay a given monetary amount, for example a yearly tax, to benefit from the outcomes of the implementation of the planning policy to be evaluated. The implementation of the dichotomous-choice-with-follow-up method implies a follow-up after the first question on WTP, consisting of another inquiry referred to a monetary amount greater or smaller than the first one, depending on whether the first answer was “yes” or “no”. León (1995) puts in evidence that a second inquiry may help increasing information on the interviewed person’s preferences, and efficiency of the estimates (Carson *et al.*, 1986; Hanemann *et al.*, 1991).

If the answer to the willingness-to-pay question is “yes”, the interviewed person thinks he/she would be better off if outcomes of the implementation of the planning policy to be evaluated were available once a monetary amount had been paid, than otherwise.

If this is the case, then

$$V(1, Y - \Phi; S) + \varepsilon_1 \geq V(0, Y; S) + \varepsilon_0,$$

if

$$U(j, Y; S) = V(j, Y; S) + \varepsilon_j, \quad j=0,1,$$

where:  $U$ , the individual utility, is a random variable whose mean is  $V$ ;  $j$  is a dichotomous variable that is equal to 1, were the outcomes of the planning policy to be evaluated available, and 0 otherwise;  $Y$  is yearly disposable household income;  $S$  is a vector of social and microeconomic characteristics;  $\varepsilon_j$  is a white-noise random variable;  $\Phi$  is the monetary amount the interviewed person is willing to pay for the implementation of the planning policy.

The probability of a “yes”,  $P_1$ , is given by the following expression:

$$P_1 = P(V(1, Y - \Phi; S) + \varepsilon_1 \geq V(0, Y; S) + \varepsilon_0) = P(\varepsilon_0 - \varepsilon_1 \leq \Delta V) = F_\tau(\Delta V),$$

where  $\tau = \varepsilon_0 - \varepsilon_1$ . This probability is equal to the value of the cumulative probability distribution of  $\tau$  at  $\Delta V$ , that is  $F_\tau(\Delta V)$ . Since the probability distribution of  $\tau$  can take whichever form, provided that this form is consistent with the general rules of probability distributions, a prior is needed to implement estimates starting from  $F_\tau(\Delta V)$ . In the literature, the priors are usually the normal, logistic and Weibull distributions, and the derived models are named *Probit*, *Logit*, and *Weibit*. For a basic discussion on these models see the pertinent chapters of the Greene’s econometric manual (1993). Estimates implemented in this essay are based on a Bivariate Probit model.

The following two specifications of the functional form of  $\Delta V$  are considered (León, *cit.*):

$$\Delta V(B) = \beta B + \alpha' C \quad (\text{linear}), \quad (1)$$

and

$$\log [\Delta V(B)] = \theta \log(B) + \gamma' D \quad (\text{log-linear}), \quad (2)$$

where:  $\alpha$  and  $\beta$  are parameters;  $\gamma$  and  $\theta$  are vector of parameters;  $B$  is the monetary amount the interviewed person would pay had she answered “yes” to the question about her WTP;  $C$  and  $D$  are vectors of social and microeconomic characteristics.

If  $E$  is the interviewed person’s WTP, then:

$$F_\tau(\Delta V(B)) = P(\Delta V(B) \geq \tau) = 1 - G_E(B), \quad (2')$$

where  $G_E(B)$  is the value of the cumulative probability distribution of  $E$  at  $B$ .  $G_E$  derives from a normal density of probability in case  $\Delta V$  is a linear function of  $B$ , and from a log-normal density of probability if  $\log(\Delta V)$  is a log-linear function of  $B$ . From now on,  $E$  and  $B$  indicate the logarithms of WTP and monetary amount of the question about the interviewed person’s WTP, if  $G_E$  is derived from a log-normal distribution of  $E$ .

WTP can be calculated either with reference to the mean ( $M$ ) of the density of probability of  $E$ ,  $g_E$ , or with reference to either the mean ( $MT$ ), or the median ( $MEDT$ ), of the normalized density of probability of  $E$ , truncated at  $B = B_M$ ,  $g_{EN}$ . The mean of a density of probability function is more influenced by the tails than the median. The mean or the median of the normalized density of probability of  $E$ , truncated at  $B = B_M$ , are calculated with reference to the density of probability of  $E$  truncated at the maximum value  $E$  is supposed to take; this original density of probability is normalized accordingly (*ibid.*).

$M$ ,  $MT$ , and  $MEDT$  are calculated as follows:

$$M = \int_{-\infty}^{\infty} B g_E(B) dB = \int_0^{\infty} [1 - G_E(B)] dB - \int_{-\infty}^0 G_E(B) dB,$$

$$\begin{aligned}
MT &= \int_{-\infty}^{B_M} B g_{EN}(B) dB = \int_0^{B_M} [1 - G_{EN}(B)] dB - \int_{-\infty}^0 G_{EN}(B) dB = \int_0^{B_M} \left[1 - \frac{G_E(B)}{G_E(B_M)}\right] dB - \int_{-\infty}^0 \frac{G_E(B)}{G_E(B_M)} dB = \\
&= \int_0^{B_M} \frac{F_\tau[\Delta V(B)] - F_\tau[\Delta V(B_M)]}{1 - F_\tau[\Delta V(B_M)]} dB - \int_{-\infty}^0 \frac{1 - F_\tau[\Delta V(B)]}{1 - F_\tau[\Delta V(B_M)]} dB,
\end{aligned}$$

$$\frac{F_\tau[\Delta V(\text{MEDT})]}{[1 - F_\tau(\Delta V(B_M))]} = 0.5.$$

The value of the mean and median, named MED from now on, in case of a normal density of probability are equal to  $\alpha' C(-\beta)^{-1}$  (Kristroem, 1990), where  $C$  is the vector of the average values of the variables of  $C$ . If the density of probability is log-normal, the mean and median are equal to  $\gamma' D(-\theta)^{-1}$  (León, *cit.*), where  $D$  is the vector of the average values of the variables of  $D$ .

For dichotomous-choice applications, the estimates of parameters  $\alpha$  and  $\beta$ , or  $\gamma$  and  $\theta$ , are implemented by solving the first-order maximization problem of the following log-likelihood function,  $\log(L)$ , referred either to expression (1) or to expression (2):

$$\log(L) = \sum_i \{I_i \log[F_\tau(\Delta V_i)] + (1 - I_i) \log[1 - F_\tau(\Delta V_i)]\},$$

where  $I_i = 1$  if  $\Delta V_i \geq \tau$ , and  $I_i = 0$  if  $\Delta V_i < \tau$ .

In case parameters  $\alpha$  and  $\beta$ , or  $\gamma$  and  $\theta$ , are estimated through a dichotomous-choice-with-follow-up experiment (DCFU), the log-likelihood function takes the following form:

$$\begin{aligned}
\log(L) = & \sum_i \{I_i^a \log[F_\tau(\Delta V(B_i^a))] + I_i(1 - I_i^a) \log[F_\tau(\Delta V(B_i)) - F_\tau(\Delta V(B_i^a))] + \\
& + I_i^b(1 - I_i) \log[F_\tau(\Delta V(B_i^b)) - F_\tau(\Delta V(B_i))] + (1 - I_i)(1 - I_i^b) \log[1 - F_\tau(\Delta V(B_i^b))]\},
\end{aligned}
\tag{3}$$

where:  $I_i = 1$  if  $\Delta V(B_i) \geq \tau$  and  $I_i = 0$  if  $\Delta V(B_i) < \tau$ ,  $I_i^a = 1$  if  $\Delta V(B_i^a) \geq \tau$  and  $I_i^a = 0$  if  $\Delta V(B_i^a) < \tau$ , and  $I_i^b = 1$  if  $\Delta V(B_i^b) \geq \tau$  and  $I_i^b = 0$  if  $\Delta V(B_i^b) < \tau$ ;  $B_i^a, B_i$  are  $B_i^b$  are respectively increased, initial, and decreased monetary amounts which help understanding the interviewed person's preferences over the outcomes of the planning policy to be evaluated through the DCFU experiment.

Empirical findings must be qualified with regard to potential distortion factors. Beyond problems connected to the implementation of econometric models, there are several general problems connected to the interviewer's and the interviewed person's behavior (Carson, 1991). These questions are discussed in an author's essay (Zoppi, 2000b).

### 3.2. Design

The assessment of the WTP for the metropolitan railway project through a DCFU experiment is implemented with reference to the civic communities of Cagliari, Quartu Sant'Elena, Monserrato, Selargius, and Quartucciu.

A random sample of people of these civic communities is extracted by means of the association of a random number to each name that is listed in the phone list. Initially, a random sample of about 250 people was extracted in order to obtain a sample of about 100 people willing to cooperate. The initial number of extracted people was established taking account that in similar experiments the rate of cooperation is about one out of two or less.

In the extracted random sample, the population of each civic community is represented by a proportional number of people: 142 are from Cagliari, 57 are from Quartu Sant'Elena, 23 are from Selargius, 18 are from Monserrato, and 10 are from Quartucciu. The willingness to cooperate has revealed lower than it was forecasted in two out of the five civic communities, and a further extraction of 25 people from Quartu Sant'Elena and 5 from Quartucciu was necessary. Finally, a 105-people sample is obtained for the experiment, even though 120 people had initially declared their availability to cooperate, 56 of whom are from Cagliari, 24 are from Quartu Sant'Elena, 11 are from Selargius, 8 are from Monserrato, and 6 are from Quartucciu.

The randomness of the sample can be questioned by the objection that a phone list does not include the names of all the resident households of a civic community for many reasons. However, there is no doubt that each household has the same probability to be extracted from a civic community's phone list, with the only exception of the excluded households.

A more important question is represented by the fact that lots of people have denied their cooperation, due either to a diffused lack of interest in regard of the problems the metropolitan railway tries to solve, or to the lack of confidence in the utility of the experiment.

A big proportion of people who refused to cooperate is constituted by old people. It is plausible that these people show a lower interest in the impacts of the project than younger people since the use value of a public good, as a metropolitan railway, is intrinsically related to the duration of its availability, which is undoubtedly shorter for an old person than for a young person, everything else being equal. This is the unsolved problem of the evaluation of the non-use values of investments, which is particularly important for intergenerational investments, that is, the importance that people tribute to the availability of goods and services for their children, and their willingness to give a part of their goods and services up to improve the quality of life of their children. The high refusal rate shown by the older people included in the initial sample indicates that their non-use values for the metropolitan railway are rather low, even though it is not possible to address this question analytically with the available data. A further reason could be recognized in the fact that the metropolitan railway is a public good, and, being so, people, especially old people, probably perceive it as non-exclusively owned and available, therefore they may not find sound reasons to pay for it, since there are no property rights on it. In other words, neither there is a sound reason to be certain that their children will enjoy the good, nor they could be very confident that they will receive significant benefits from the availability of the good for the rest of their lives, since the rest of their lives might be very short, and the good is even not available yet. In any case, the empirical results reported and discussed in this essay are exclusively referred to the portion of the people of the civic communities who are really interested in the metropolitan railway, who are less than 50% of the total population, with reference to the extracted random sample.

Following the method proposed by Cooper (1993), and applied in the case of the estimate of the degree of consensus of the civic communities of the metropolitan area of Cagliari on the Park of the Wetland of Molentargius (Zoppi, 1999), a pre-test was implemented in order to establish the most suitable bids to be asked in the WTP question of the questionnaire.

The results of the pre-test are the following: the most suitable bids are 40.000 lire and 55.000 lire, with follow-up's of 45.000 and 30.000, and 70.000 and 40.000 respectively; the first bid and its follow-up's were proposed to 42 people, the second bid and its follow-up's were proposed to 63 people.

People included in the first sample received a first telephone call which aimed to ask them if they were willing to cooperate. If a person gave his or her availability, an envelop were sent him or her containing an informational report on the metropolitan railway project. The person was asked to read carefully this report, which would have been the informational basis to answer a questionnaire which would have been submitted through a further call, after about two weeks from the first.

The questionnaire is submitted through a second call instead of being sent in the envelope containing the informational report for two reasons. First, by doing so the moment the interviewed person acquires the information is totally separate from the moment she gives her answers. Second, the interviewed person can clarify through a direct contact with the interviewer the doubts and misunderstandings she may eventually have with respect to the meaning and informational goals of the submitted questions. So, the questionnaire is submitted to people who are informed on the project ideas and objectives, instead of being submitted to people who read an informational report aimed uniquely at filling in a form whose questions she had already known before reading the report, so that she could have been previously led to increase her information just at finding some politically correct answers.

#### 4. VARIABLES

The estimate of WTP is implemented through the DCFU CV model described above, taking as explanatory variables the bids defined through the Cooper's method, that is the variable B of (1) and (2), and a vector of social and microeconomic variables, that is the variables of vectors C and D of (1) and (2).

The vector of social and microeconomic variables includes the following variables [variable name]:

- a dummy variable to identify the civic community of the interviewed person, that takes the value 1 if the civic community is Cagliari, and 0 otherwise [Cag];
- age of the interviewed person [Eta, or log(Eta) in case the prior on the distribution of WTP is that it is log-normal];
- a dummy variable to identify the sex of the interviewed person, that takes the value 1 if the sex is male, and 0 otherwise [Sex];
- three dummy variables to identify the number of components of the household of the interviewed person, that take the values 0 0 0 if the household has one or two components, 1 0 0 if the household has three components, 0 1 0 if the household has four components, and 0 0 1 if the household has five components or more [Fam3, Fam4, Fam5];
- a dummy variable to identify the number of components of the household who are younger than fourteen, that takes the value 1 if the household has at least one component younger than fourteen, and 0 otherwise [Comp13];

- four dummy variables to identify the professional condition of the interviewed person, that take the values 0 0 0 0 if the interviewed person is either a student or unemployed, 1 0 0 0 if the interviewed person is either an employee, or a detailer, or a craftsman, 0 1 0 0 if the interviewed person is a housewife, 0 0 1 0 if the interviewed person is either a university professor, or a professional person, or a manager, or a member of a senior staff, or a member of the Italian Army or Navy, and 0 0 0 1 if the interviewed person is a retired person [Comartim, Casal, Unprlidi, Pens];
- two dummy variables to identify the interviewed person's level of education, that take the values 0 0 if the interviewed person attended either the elementary school or the secondary school, or he/she did not receive any school education at all, 1 0 if the interviewed person took a high-school degree, 0 1 if the interviewed person took a university degree [Licmed, Laurea];
- a dummy variable to identify the interviewed person's level of knowledge of the metropolitan railway project, that takes the value 1 if the interviewed person knows the project, even though his/her knowledge is minimal, and 0 otherwise;
- two dummy variables to identify the share of the monthly expenditure of the interviewed person's household devoted to transportation services, that take the values 0 0 if the share is less than 10%, 1 0 if the share is at least 10% and less than 15%, and 0 1 if the share is 15% or more [Exp1015, Exp1530];
- two dummy variables to identify the preference of the interviewed person over the agency that should be responsible for the management of the new metropolitan railway, that take the values 0 0 if the interviewed person thinks that the railway should be managed by a public agency, 1 0 if the interviewed person prefers a private agency, and 0 1 if the interviewed person believes that the railway should be managed by a public-private consortium or by a non-profit agency [Gestpri, Gestcons].

The variable relative to the sex of the interviewed person shows that men are a 47.62% of the sample and women are a 52.38%; the average age is about forty-two years. A 51.43% of the interviewed people belongs to households with at least four components, while a 27.62% belongs to households with three components, and a 20.95% belongs to households with one or two components; the percentage of the interviewed people's households with at least one component younger than fourteen is only at 12.38.

The professional condition of the interviewed people is characterized by a significant prevalence of the category of employees, detailers, and craftsmen (33.33%), and by a less important presence of university professors, professional people, managers, members of a senior staff, and members of the Italian Army or Navy (19.05%), of housewives, and students or unemployed people (18.10%), and of retired people (11.43%).

The percentage of the interviewed people who have a university degree is at 20.95, while the percentage of people who have only a high-school degree is at 60.00, and people who have only a secondary school degree or less are at 19.05%.

A 63.81% of the interviewed people declared that they knew the metropolitan railway project, at least a little bit, while a 36.19% answered that they did not know anything about it.

A 23.81% of the interviewed people said that their household monthly expenditure for transportation services is at less than 10% of the household income, a 32.38% said that their transportation expenditure is between 10% and 15% of the household income, and the remaining 43.81% answered that it is over 15%, even though never higher than 30%.

The opinions on the management of the future metropolitan railway are favorable to a public agency (43.81%); preferences for a private management are slightly less significant (35.24%), while the public-private or non-profit management is the least preferred option (20.95%). Moreover, it is important to put in evidence that a 56.21% of the interviewed people thinks that the private sector, either profit or non-profit, should participate in the management of the future railway.

A variable to define the influence of the household disposable income on WTP is omitted in the development of the DCFU estimates, since only 32 people out of 105 interviewed people gave this information to the interviewer. However, an income effect may be inferred from the estimates of the coefficients and marginal effects of some of the explanatory variables of the Probit models.

The average yearly disposable income of the households of the thirty-two interviewed people's who answered the question on their income is about 38.69 million lire.

## 5. DISCUSSION

Either the prior on the functional form of  $\Delta V(B)$  is (1), or it is (2), the estimates of the Bivariate Probit models, obtained through the procedure "Bivariate" of the econometric package "Limdep" (Greene, 1995), show qualitatively similar results in terms of the overall fitting, while these results are quite different from the quantitative point of view, even though the implied values of WTP are also quite similar. In the rest of this paragraph the results of the models (1) and (2) are discussed. Tables 1 and 2 summarize these results; Table 3 reports the implied values of WTP.



Not to be redundant, the following formulas, concerning statistical inferences on the estimates of models (1) and (2), are referred to model (1); their extension to model (2) is omitted, since it is trivial. In case of model (2), the coefficients  $\alpha$  and  $\beta$  must be substituted by  $\gamma$  and  $\theta$ .

On the one hand, Bivariate Probit models allow us to estimate the coefficients of the variables that maximize the log-likelihood function (3), which is relative to the cumulative probability distribution  $F_{\tau}(\Delta V_i)$ ,  $\Delta V_i$  is expressed by either (1) or (2); on the other hand, these models provide estimates of the marginal effects of the explanatory variables on the implied values of WTP, which is indicated by the symbol  $\underline{E}$  in the following formulas. According to the procedure proposed by Greene (1993, pp. 639; 643-647), the marginal effect on the expected value of WTP of an explanatory variable  $x$  or of the explanatory variable  $B$  in model (1) is given by:

$$\frac{\partial \underline{E}}{\partial x} = \alpha_x \phi(\beta \mathbf{B} + \alpha' \mathbf{C}) \text{ or } \frac{\partial \underline{E}}{\partial B} = \beta \phi(\beta \mathbf{B} + \alpha' \mathbf{C}), \quad (4)$$

where  $\alpha_x$  is the coefficient of  $x$ , which belongs to vector  $\mathbf{C}$ , that can be estimated through the Bivariate Probit model's implementation, and  $\phi(\beta \mathbf{B} + \alpha' \mathbf{C})$  is the value of the standardized normal density of probability function at  $z = \beta \mathbf{B} + \alpha' \mathbf{C}$ , where  $\mathbf{C}$  is the vector of the average values of the variables of  $\mathbf{C}$ , and  $\mathbf{B}$  is the average value of  $B$ .

The standard error of a marginal effect can be calculated by means of the elements of the diagonal of the asymptotical variance-covariance matrix  $\Gamma$ , which can be computed through the following formula:

$$\Gamma = [\phi(\beta \mathbf{B} + \alpha' \mathbf{C})]^2 \{ \mathbf{I} - [\beta \mathbf{B} + \alpha' \mathbf{C}] [(\beta/\alpha)(\mathbf{B}/\mathbf{C})'] \}' \mathbf{V} \{ \mathbf{I} - [\beta \mathbf{B} + \alpha' \mathbf{C}] [(\beta/\alpha)(\mathbf{B}/\mathbf{C})'] \}',$$

where  $\mathbf{V}$  is the vector of the asymptotical variances and covariances of the vector  $\beta/\alpha$ .

### 5.1. Model (1)

The marginal effects on average WTP of the explanatory variables referred to the implementation of model (1), evaluated at the average values of these variables, are in most cases significant at 5%. The estimates of the model are reported in Table 1.

The estimated marginal effect of variable *Offerta*, that is variable  $B$  of model (1), is negative as expected, and about 10 lire. Variable *Offerta* is measured in Italian lire, thousand, so an average decline of 9 lire in WTP is correlated to an increase of 1,000 lire in the bid. This puts in evidence that the civic communities of the metropolitan area of Cagliari show a certain attitude towards the acceptance of higher taxes to be devoted to the new metropolitan railway's management.

The positive and significant marginal effect of variable *Cag* stresses that people who live in Cagliari have a higher positive attitude (44 lire) towards the project than people who live in the civic communities of the hinterland. Variable *Eta* has also a positive and significant marginal effect on WTP, that is about 5 lire per year; however this effect is very low.

It is a little bit more difficult to interpret the estimated marginal effects of variables *Fam3*, *Fam4*, and *Fam5*, which are significant and show different signs. The estimated coefficients indicate that three and four-component households are less favorable to the railway project than one and two-component households; this may be possibly connected to a higher preference for the use of private transportation. The negative marginal effect of *Fam5* may be possibly due to a less positive attitude towards private transportation by five-or-more-component households, even less than one or two-component households. This less positive attitude is probably connected to the fact that five-or-more-component households would need two cars instead of one, did they utilize private transportation. The presence/absence of younger-than-fourteen components (variable *Comp13*) does not seem to have a significant marginal effect on average WTP, which indicates that there is no significant difference in the preference for collective public transportation with reference to households with younger children.

The professional condition of the interviewed person plays a significant influence on average WTP, with respect to the conditions of being either a student or unemployed. Among the four categories of professional conditions, only the retired-people category does not present a significant marginal effect on average WTP. Variable *Comartim* shows a significant positive marginal effect of about 65 lire, housewives a significant positive marginal effect of about 368 lire. Moreover, variable *Unprlidi* presents a significant negative marginal effect, which indicates that the category of university professors, professional people, managers or members of a senior staff, and members of the Italian Army or Navy, has the lowest attitude towards collective public transportation among all the professional-condition categories of the civic communities of the metropolitan area of Cagliari. The other categories' attitudes in favor of collective public transportation is much higher than the category of students and unemployed people, especially with reference to housewives.

**Table 1** Bivariate Probit Model (variable Offerta (B) expressed £It, thousand)

Functional form:  $\Delta V = \beta B + \alpha C$  (linear)

Variables	Coefficients	Stand.error	z-statistic	Marginal effect			z-statistic	Prob.
				Prob. [( z > z-stat )]	on the expect. value of WTP	Stand.error on the m.eff.	marg.effect on the expect. value of WTP	[( z > z-stat )]   z=0] marg.effect
Costante	0,4608	1,0461	0,4405	0,6596				
Offerta	-0,0248	0,0151	-1,6432	0,1003	-0,00972	0,00003	-291,20947	0,00000
Cag	0,1114	0,3072	0,3628	0,7168	0,04364	0,01396	3,12712	0,00177
Eta	-0,0133	0,0149	-0,8972	0,3696	-0,00522	0,00003	-159,25056	0,00000
Fam3	-0,1959	0,3963	-0,4942	0,6211	-0,07670	0,02321	-3,30519	0,00095
Fam4	-0,8004	0,4781	-1,6740	0,0941	-0,31342	0,03337	-9,39372	0,00000
Fam5	0,6473	0,4679	1,3833	0,1666	0,25347	0,03262	7,77155	0,00000
Comp13	-0,0743	0,4930	-0,1507	0,8802	-0,02909	0,03579	-0,81273	0,41637
Comartim	0,1650	0,5052	0,3266	0,7440	0,06460	0,03778	1,71025	0,08722
Casal	0,9404	0,6509	1,4448	0,1485	0,36824	0,06273	5,87031	0,00000
Unprlidi	-0,8116	0,5604	-1,4483	0,1475	-0,31782	0,04555	-6,97805	0,00000
Pens	-0,0139	0,8291	-0,0168	0,9866	-0,00546	0,10132	-0,05391	0,95701
Licmed	1,0174	0,4793	2,1228	0,0338	0,39840	0,03328	11,97309	0,00000
Laurea	1,4079	0,6364	2,2123	0,0269	0,55132	0,05889	9,36188	0,00000
Conosc	0,2974	0,2938	1,0121	0,3115	0,11644	0,01267	9,19018	0,00000
Exp1015	-0,0519	0,3824	-0,1358	0,8919	-0,02034	0,02154	-0,94433	0,34500
Exp1530	0,1630	0,4190	0,3890	0,6973	0,06382	0,02592	2,46210	0,01381
Gestpri	0,0002	0,3069	0,0005	0,9996	0,00006	0,01389	0,00435	0,99653
Gestcons	-0,4525	0,4302	-1,0518	0,2929	-0,17720	0,02722	-6,50988	0,00000

**Statistics of the model**

**Comparison between observed and forecasted values (forecasted values in parentheses)**

First Question	Follow-up	
	No	Yes
	No	49 (75)
Yes	18 (0)	29 (30)

**Maximized log-likelihood function:** -110,4165

The interviewed person's level of education shows significant positive marginal effects of the dummy variables Licmed and Laurea, that mark the differences in average WTP of people who earned either a high-school degree, or a university degree, with respect to people who attended either the elementary school or the secondary school, or who did not receive any school education at all. These estimated marginal effects are about 398 and 551 lire respectively.

The knowledge of the project, and of the future scenarios that may be generated through its implementation, exercises a significant positive influence on average WTP, since the significant positive marginal effect of variable Conosc is about 116 lire.

The marginal effect of the dummy variables related to the interviewed person's household expenditure for transportation services, that is Spesa1015 and Spesa1530, are different from each other. On the one hand, Variable Spesa1015, that indicates the difference in average WTP of people whose share of the household expenditure devoted to transportation is between 10% and 15% with respect to people whose share is less than 10%, shows a non-significant marginal effect on average WTP; on the other hand, variable Spesa1530, that indicates the difference in average WTP of people whose share of the household expenditure devoted to transportation is more than 15% with respect to people whose share is less than 10%, is significant, positive, and about 64 lire. This result indicates that people whose households devote the largest share of their expenditure to transportation services are more favorable to the railway project than the others, as expected.

The preference of the interviewed person over the agency that should be responsible for the management of the new metropolitan railway does not exercise a positive marginal effect on average WTP in case this preference is in favor of a private agency with respect to a public agency, while the preference for a public-private consortium or a non-profit agency indicates a significant and positive marginal effect, which is about 177 lire.

Although the marginal effects on WTP of the explanatory variables referred to the implementation of model (1), evaluated at the average values of these variables, are in most cases significant at 5%, however the numeric values of these effects are generally quite low, a few tens or hundreds lire, and indicate a high rigidity of WTP, that is of the degree of consensus, with respect to the monetary bid which the interviewed person is asked if he/she is willing to pay, and to the other explanatory variables. This rigidity implies that this DCFU CV model could have been approximated by the following more simple model:

$$\Delta V(B) = \beta B + \alpha, \quad (5)$$

where the vector of the social and microeconomic variables does not appear any more, and their influence on  $\Delta V(B)$  is summarized by the constant  $\alpha$ . This model was estimated by Melis (2000). The calculated values of WTP are very close to the values derived from the estimates of model (1). Of course, the model estimated by Melis provides information only on WTP, while it does not give any information on the marginal effects of the variables that may be derived from the interviewed people's answers to the questionnaire.

## 5.2. Model (2)

The marginal effects calculated through formula (4) are referred to the average value of the logarithm of WTP. The marginal effects on average WTP, evaluated at the average values of these variables, are equal to:

- $\gamma_x M$ , if  $\Delta V$  depends linearly on  $x$ ;
- $(\gamma_x / \bar{x}) M$ , if  $\Delta V$  depends log-linearly on  $x$ ;

where  $\bar{x}$  indicates the mean of variable  $x$  and  $M$  the average WTP.

The marginal effects on average WTP of the explanatory variables referred to the implementation of model (2), evaluated at the average values of these variables, are in most cases significant at 5%, as before. The estimates of the model are reported in Table 2.

The estimated marginal effect of variable Offerta, that is variable B of model (2), is negative as expected, and about 3.973 lire, so an average decline of 3,973 lire in WTP is correlated to an increase of 1,000 lire in the bid. This puts in evidence that the civic communities of the metropolitan area of Cagliari show a low attitude towards the acceptance of higher taxes to be devoted to the new metropolitan railway's management. This outcome counters what was observed above with reference to the marginal effect of variable Offerta in model (1).

The positive and significant marginal effect of variable Cag stresses that people who live in Cagliari have a higher positive attitude (1,994 lire) towards the project than people who live in the civic communities of the hinterland, as before. The marginal effect of this variable on WTP is much higher than in model (1), 1,994 vs. 44 lire.

The professional condition of the interviewed person plays a significant influence on average WTP, with respect to the conditions of being either a student or unemployed, as before, with marginal effects much higher than in model (1). Among the four categories of professional conditions, only the retired-people category does not present a significant marginal effect on average WTP, as before. Variable Comartim shows a significant positive marginal effect of about 4,310 lire, housewives a significant positive marginal effect of about 15,390 lire. Variable Unprlidi presents a significant negative marginal effect, which indicates that the category of university professors, professional people, managers or members of a senior staff, and members of the Italian Army or Navy,

has the lowest attitude towards collective public transportation among all the professional-condition categories of the civic communities of the metropolitan area of Cagliari, as it was derived from the estimates of model (1). The interviewed person's level of education shows significant positive marginal effects of the dummy variables Licmed and Laurea, that mark the differences in average WTP of people who earned either a high-school degree, or a university degree, with respect to people who attended either the elementary school or the secondary school, or who did not receive any school education at all. These estimated marginal effects are about 14,217 and 19,835 respectively, vs. about 398 and 551 lire respectively.

The estimated marginal effects of variables Eta, Fam3, Fam4 and Fam5, Conosc, Exp1530, and Gestcons, are also qualitatively very similar and quantitatively much higher (in absolute value) than the correspondent estimates of model (1), as follows:

- the marginal effect of variable Eta is about -2,852 lire vs. about -5 lire;
- the marginal effects of variables Fam3, Fam4, and Fam 5 are about -2,509, -11,009, and 9,406 lire respectively, vs. about -77, -313, and 253 lire respectively; the presence/absence of younger-than-fourteen components (variable Comp13) does not seem to have a significant marginal effect on average WTP, as before, which indicates that there is no significant difference in the preference for collective public transportation, with reference to households with younger children;
- the marginal effect of variable Conosc is about 4,661 lire vs. about 116 lire;
- the marginal effect of variable Exp1530 is about 1,787 lire vs. about 64 lire; variable Exp1015 does not seem to have a significant marginal effect on average WTP, as before;
- the marginal effect of variable Gestcons is about -6,157 lire vs. about -177 lire; variable Gestpri does not seem to have a significant marginal effect on average WTP, as before.



**Table 2** Bivariate Probit Model (variable Offerta (B) expressed £It, thousand)

Functional form:  $\log(\Delta V) = \theta \log(B) + \gamma D$  (log-linear)

Variables	Coefficients	Stand.error	z-statistic	Prob.	Marginal effect	Stand.error	z-statistic	Prob.	Marginal effect
				[( z > z-stat )]	on the expect.		marg.effect	[( z > z-stat )]	on the expect.
				z=0]	value of	on the m.eff.	of log(WTP)	z=0]	value of
				z=0]	log(WTP)		of log(WTP)	marg.effect	WTP
Costante	5,5022	3,6305	1,5155	0,1296					
log(Offerta)	-1,0921	0,7550	-1,4465	0,1480	-0,42608	0,08278	-5,14741	0,00000	-3,97306
Cag	0,1412	0,3040	0,4646	0,6422	0,05510	0,01363	4,04405	0,00005	1,99352
log(Eta)	-0,7442	0,6119	-1,2162	0,2239	-0,29033	0,05548	-5,23346	0,00000	-2,85202
Fam3	-0,1777	0,3998	-0,4446	0,6566	-0,06934	0,02354	-2,94581	0,00322	-2,50888
Fam4	-0,7799	0,4806	-1,6227	0,1047	-0,30428	0,03366	-9,04120	0,00000	-11,00891
Fam5	0,6664	0,4760	1,3999	0,1615	0,25998	0,03363	7,73188	0,00000	9,40624
Comp13	-0,0828	0,4959	-0,1669	0,8675	-0,03229	0,03608	-0,89491	0,37083	-1,16819
Comartim	0,3054	0,5471	0,5581	0,5768	0,11913	0,04427	2,69139	0,00712	4,31029
Casal	1,0903	0,6886	1,5834	0,1133	0,42537	0,06999	6,07808	0,00000	15,39005
Unprlidi	-0,7352	0,5787	-1,2705	0,2039	-0,28683	0,04850	-5,91456	0,00000	-10,37738
Pens	0,1445	0,8313	0,1739	0,8620	0,05639	0,10170	0,55445	0,57927	2,04010
Licmed	1,0072	0,4851	2,0763	0,0379	0,39295	0,03402	11,55067	0,00000	14,21706
Laurea	1,4052	0,6354	2,2116	0,0270	0,54823	0,05849	9,37308	0,00000	19,83500
Conosc	0,33021	0,2963	1,1144	0,2651	0,12883	0,01284	10,03737	0,00000	4,66106
Exp1015	-0,0685	0,3814	-0,1796	0,8575	-0,02672	0,02135	-1,25168	0,21069	-0,96662
Exp1530	0,1266	0,4250	0,2979	0,7658	0,04939	0,02657	1,85915	0,06301	1,78687
Gestpri	0,0042	0,30396	0,0139	0,9889	0,00164	0,01393	0,11797	0,90609	0,05946
Gestcons	-0,4362	0,43516	-1,0023	0,3162	-0,17017	0,02857	-5,95609	0,00000	-6,15659

Statistics of the model

**Comparison between observed and forecasted values (forecasted values in parentheses)**

	Follow-up	
	no	yes
<b>First quest.</b>		
no	49 (76)	9 (0)
yes	18 (0)	29 (29)

**Maximized log-likelihood function:** -110,3160

### 5.3. Remarks on the Estimates of Model (1) and Model (2)

The marginal effects on average WTP of the explanatory variables referred to the implementation of model (1) and model (2), evaluated at the average values of these variables, are in most cases significant at 5%. The marginal effects of variables estimated through model (1) are generally much lower than those estimated through model (2). The two models do not include the household disposable income of the interviewed person as an explanatory variable, since only 32 out of 105 interviewed people gave the interviewer this information. Nevertheless, some variables can be considered proxies in order to put in evidence an income effect on community consensus.

There are a few variables that indicate a relevant preference for collective public transportation, which is possibly connected, at least to some extent, to the household income of the interviewed person, such as those related to the number of components of the household of the interviewed person, and his/her professional condition.

Among the explanatory variables of the two estimated Probit models related to the interviewed person's professional condition, Unprlidi shows significant and negative estimates of coefficients and marginal effects, which are probably connected to these people's scarce preference for collective public transportation, due to their higher income, which may generate a relevant propensity to the use of more comfortable and expensive private cars.

Students and unemployed people, and retired people, present an average WTP lower than all the other categories of professional condition. This points out that people in the lowest-income category of professional condition have a comparatively lower degree of consensus on the railway project, possibly due to the fact that they are afraid that the implementation of this project would generate new taxes on their low household incomes.

Also the variables related to the interviewed person's level of education may put in evidence an income effect on average WTP. People who took either a high-school degree, or a university degree, present an average WTP higher than those who attended either the elementary school or the secondary school, or who did not receive any school education at all. This comparatively higher level of consensus on the metropolitan railway project may be due to their comparatively higher household income.

An income effect on average WTP can be also recognized with reference to the variable related to the share of the monthly expenditure of the interviewed person's household devoted to transportation services, when its share is between 15% and 30%. The estimated marginal effect of this variable is significant and positive. This result indicates that people in the middle-income class, who are the vast majority of people whose expenditure share for collective public transportation is between 15% and 30%, present an average WTP higher than those in the high and low income classes, who are the majority of people whose expenditure shares are either 10% or below, or between 10% and 15%.

Statistical indicators of the goodness of fit do not allow us to unambiguously choose between models (1) and (2), since the number of the forecasted "yes" and "no" is exactly equal, as it may be noticed in the lower part of Tables 1 and 2, and the values of the maximized log-likelihood functions are very close to each other. The test proposed by Zavoina and Mc Elvey (1975), and discussed and implemented by Greene (1995, p. 421) in the Limdep computer package, does not give an ultimate indication as well, since the estimate of the Bivariate Probit model (1) seems to be only slightly better than the estimate of model (2), with a percentage difference of about 0.2. So, the marginal effects estimated through models (1) and (2) can be considered the lower and upper limits of the explanatory variables' marginal effects on average WTP, since the marginal effects of variables estimated through model (1) are generally much lower than those estimated through model (2), even though marginal effects are qualitatively similar to each other in terms of sign and significance at 5%, as it was already put in evidence.

## 6. CONCLUSION

Although individual explanatory variables present quantitatively very different coefficients and marginal effects, however the estimates of the two models do not imply important differences in the calculation of mean and median WTP. The calculated values of WTP are reported in Table 3.

Positive correlations are estimated between average WTP and: the dummy variable that identifies the civic community of the interviewed person, when this is Cagliari; the dummy variable that identifies the number of components of the household of the interviewed person, when this is five or more; the dummy variables that identify the professional condition of the interviewed person, when he/she is either an employee, or a detailer, or a craftsman, or a housewife; the dummy variables that identify the level of education of the interviewed person, when he/she earned either a university or a high-school degree; the dummy variable that identifies the interviewed person's level of knowledge of the metropolitan railway project, when he/she knows at least a little bit of the project, and of the future scenarios that may be generated through its implementation; the dummy variable that identifies the share of the monthly expenditure of the interviewed person's household devoted to transportation services, when this share is between 15% and 30%.

Negative correlations are estimated between average WTP and: the variable that identifies the monetary amount the interviewed person would pay had she answered "yes" to the question about her WTP; age of the

interviewed person; the dummy variable that identifies the number of components of the household of the interviewed person, when this is either three or four; the dummy variable that identifies the professional condition of the interviewed person, when he/she is either a university professor, or a professional person, or a manager, or a member of a senior staff, or a member of the Italian Army or Navy; the dummy variable that identifies the preference of the interviewed person over the agency that should be responsible for the management of the new metropolitan railway, when he/she believes that the railway should be managed by a public-private consortium or by a non-profit agency.

Mean and median values of WTP are always included in an interval of about one thousand lire. Estimates derived from model (1) are slightly higher than those derived from model (2). The influence of microeconomic and social variables, and of those variables related to the interviewed person's preference on the management of the metropolitan railway and on the collective public transportation versus other modalities, does not seem to be relevant for the calculation of mean and median WTP, so these values are very close to those derived from model (5) (Melis, *cit.*), even though the estimated marginal effects of these variables are very different from each other. In any case, estimates of models such as (1) or (2) provide information on the marginal effects of the variables that may be derived from the interviewed people's answers to the questionnaire, which cannot be derived from models such as (5).

The generalized DCFU CV models estimated in this essay not only allow us to infer information on average WTP of the local communities, and, by doing so, on the potential effectiveness of the assessed planning policies, but also they provide important insights with reference to the implementation of these policies, by showing the influence of key-variables on the degree of consensus of the interested civic communities.

*Table 3* Values of Willingness To Pay Based on the Estimates of the Bivariate Probit Models (£It, thousand)

Functional form:  $\Delta V = \beta B + \alpha' C$  (linear)

Mean referred to normal density of probability of willingness to pay (M):	36,631
Mean referred to normal density of probability of willingness to pay truncated at 150.000 £It, normalized (MT):	36,627
Median referred to normal density of probability of willingness to pay truncated at 150.000 £It, normalized (MEDT):	37,097

Functional form:  $\Delta V = \theta \log(B) + \gamma' D$  (log-linear)

Mean referred to normal density of probability of willingness to pay (M):	36,180
Mean referred to normal density of probability of willingness to pay truncated at 150.000 £It, normalized (MT):	35,340
Median referred to normal density of probability of willingness to pay truncated at 150.000 £It, normalized (MEDT):	36,594

Moreover, it is important to observe that the estimates of mean and median WTP, so the degree of consensus on the metropolitan railway project, are almost not influenced by the priors assumed on the probability distribution from which the cumulative distribution  $G_E(B)$  of (2') is derived. Whether it is normal or log-normal, the implied values of mean and median WTP are always about 36,000-37,000 lire.

The values of mean and median WTP indicate that the civic communities of the urban area of Cagliari are definitely in favor of the construction of the metropolitan railway, whichever measurement is adopted. Evaluating the local communities' WTP at 36,500, which is consistent with the two models' estimates, and recalling that the total resident households of the five civic communities of the urban area of Cagliari were 109,973 according to the 1998 data available from the local Offices of the Registrar of Births, Marriages and Deaths, a potential yearly financial flow can be estimated at about 4.02 billion lire. This flow would be uniquely generated by the use value of the metropolitan railway, since it is calculated by means of a survey on the degree of consensus of the local residents of the urban area of Cagliari. Had be taken into account the non-use value that could be recognized to the metropolitan railway of Cagliari by other people, who may be willing to contribute to the management costs even though they do not utilize this railway, the potential financial flow would have been higher.

The calculated use value of the metropolitan railway may not be sufficient to pay the estimated yearly management costs, estimated at 10.46 billion lire by the F.d.S.. In any case, the potential financial flow generated by the use value of the local residents must be integrated by the payments of the metropolitan railway fares and season-tickets. Precise projections on financial flows generated by these payments have not been implemented yet, but they should provide funds sufficient to cover the administrative and management costs, and to make a profit as well.

The generalized DCFU CV models estimated in this essay not only allow us to infer information on average WTP of the local communities, and, by doing so, on the potential effectiveness of the assessed planning policies, but also they provide important insights with reference to the implementation of these policies, by showing the influence of key-variables on the degree of consensus of the interested civic communities.



This DCFU CV analysis is not so much important for the findings on WTP, whose evaluation is based on what the interviewed people say, rather than on their observed behavior, as it is as a case study that indicates how much the quality of information plays a key-role in implementing precise assessments of communities' attitudes towards projected planning policies, and in favoring public participation in the decisional processes. This is entirely consistent with what O'Doherty (1996) observed with regard to a CV case study referred to Bristol, Northavon District, UK. According to O'Doherty, the considerable potential of CV methods must be recognized both in the opportunity of policy assessments before implementation, and in the qualitative improvement of public participation in the decisional processes. However, a trade-off exists between CV performance and cost, since the greater the public participation in CV studies and the consequent qualitative improvement of the planning process, the more expensive the experiment in logistic, informational, and financial incentive terms. Cartographic and computer support available for the CV experiment of the Bristol North Fringe Local Plan is certainly more complete and exhaustive than the informational report utilized in the case study presented in this essay.

With the assessment of the metropolitan railway project implemented so far, it must be stressed that the estimated degree of consensus of the communities of the urban area of Cagliari is significantly influenced by their household incomes. In other words, the upper limit of average WTP is almost deterministically conditioned by the average household disposable income. It is evident that the estimates of this essay do not take account of the increase in the degree of consensus that may be generated by an increase in average household disposable income, since this is not included among the explanatory variables of models (1) and (2). This increase may occur especially in the long run, through a more suitable and efficient organization of the collective public transportation system.

The quality of urban living space and its components, which include the collective public transportation system, are intrinsically public goods, and, being so, the different levels of the public administration, and the national community, must cooperate to their production through their human and financial resources, at least to some extent. In particular, public intervention should exploit a share of the national fiscal revenues to mitigate social and economic disparities, and to insure equity in development opportunities across the national territory. From this point of view, Sardinia and its regional urban structure need the implementation of economic and territorial planning policies directed towards compensation for their historical structural slowness of economic and social development, with respect to the fast-growing Northern and Central Italian regions. One of the main reasons of this slowness must certainly be recognized in the historical lack of adequate public investments in favor of the realignment of the productive capacity and standard of living with respect to the average national levels.

So, consensus assessment must take into account that the investment choices aimed to produce public goods must be primarily based on the political recognition of their implementation opportunity, and, secondarily, on the quantitative evaluation of average WTP of the local communities.

Consensus-evaluation techniques, such as the DCFU case study implemented in this essay, are very effective to increase the level and quality of information of the local communities, and of the different levels of the public administration, on the impacts of the projected planning policies, and to favor feed-backs between the recognition of the political opportunity of such policies and the potential reaction of the affected population. In any case, these techniques must not be utilized to draw final decisions in deterministic terms.

The definition and implementation of the metropolitan railway project, that aims to reorganize and rationalize the collective public transportation system of the urban area of Cagliari, are based on the ruling idea according to which the local communities have the right to enjoy an adequate urban standard of living, that is decisive in catalyzing the local social and economic development. The historically-built relationship between the local communities and environment in the metropolitan area of Cagliari has always allowed these communities to develop their urban organization so that it can express a peculiar structural harmony between human activities and active environmental protection. An efficient collective metropolitan public transportation helps significantly maintain and strengthen this harmony.

The globalizing and reductionist mature capitalistic ideology, that generates the organization of the contemporary U.S.-like big metropolises, is leading us to project and plan homogenized urban fabrics that parallel a "negation of the sites" (Magnaghi, 1994, p. 30). This negation consists in missing unrepeatable cultural connections that characterize the complex relational system between the local communities and spatial organization of their settlements, which expresses their historical cultural development.

This long-lasting dynamic equilibrium is presently threatened by the unsustainable pressure the human activities are exercising on the environmental and historical characteristics of the urban sites, and by the lack of medium and long-run perspectives of economic and social development, which is causing a progressive structural delay of the urban planning capacity and outcomes of the Sardinian cities, with respect to the European and Italian trends.

This situation, that reveals itself through the incipient weakening of the urban weave of the Sardinian region, generates negative externalities that may be recognized in the continuous growth of the regional unemployment rate, which not only is a problem of the local communities, but also a generalized regional issue. The consequent decline or lack of the capability of the local communities to control and protect the regional environment will cause widespread erosion, geomorphologic damages, and generalized irreversible environmental consumption, in the medium and long run. These communities have historically exercised this control and protection through their inhabitation and the development of their economic, social, cultural and spiritual activities.

These phenomena and their consequences do not impact the local communities as much as they hit all the people who live in Sardinia, and the Sardinian economy and development potentials. According to Maciocco (2000, pp. 167-168): “La crisi della città è, anche, crisi ambientale, cioè smarrimento del luogo, de-localizzazione, una perdita della territorialità umana, una sorta di indifferenza verso il contesto fisico della vita organizzata, sempre più trascinata dai flussi che rappresentano la nuova forza di gravità della città contemporanea. Questa presa di distanza dal luogo può verificarsi, oltre che per problemi di degrado ambientale, per il fatto che un luogo diventa estraneo, sia in quanto trattato con modelli insediativi estranei, sia perché trattato con modelli estranei dell’economia delle attività”<sup>3</sup>.

Even though the analytical results of the DCFU CV case study discussed so far indicate that the metropolitan railway project cannot be considered economically efficient with reference to the comparison of costs and degree of consensus, however its assessment should not be confined to an issue concerning compensation that the Sardinian people deserve, as they truly deserve by the way, because of the historical damages generated by the often ill-conceived policies of investment and regional development of the central governments, which have determined huge structural disparities between Sardinia and the other Italian regions. The project should be rather assessed as inspired with a policy that aims to catalyze an open planning process directed towards the establishment of the conditions for an auto-sustainable organization of the living space of the local environmental contexts. This organization must be based on the recognition and exploitation of a historically-developed complex and valuable, economic and cultural, relationship between civic communities and their environment in the urban area of Cagliari. So, it is not a question of land-use planning policies inspired with merely book-keeping principles of equity planning (Krumholz and Forester, 1990), as much as it is an issue related to the identification of a Friedmannian (Friedmann, 1987) definition of the organization of the living space of the local civic communities directed towards equity. This organization originates from the local human and environmental contexts, and generates spill-over effects. The benefits of these effects not only are enjoyed by the communities of the contexts where they originates, but also by other users, whose living space is located elsewhere. This is made possible through progressive planning processes based on a generalized social mobilization (Friedmann, *cit.*). The governmental structure who could better catalyze these utopian planning processes is a federal system of “local villages”, which should oppose the “telematic, atypical, homologating” global village (Magnaghi, *cit.*, p. 62).

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<sup>3</sup> The crisis of the city is the crisis of the environment of the city as well, that is the loss of its sites, of its human territoriality, the feeling of a de-localization from the citizens, a sort of indifference to the environmental context of the urban living space, which is progressively driven by the new global economic forces that mould and shape the contemporary city. This de-localization not only may be generated by environmental degradation, but also by the fact that a site may become estranged from its communities, because either settling models, or models of economic and social activities, develop which are not belonging to these communities. (Translation of the author)

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