Innovation and Society

*Statistical methods for service evaluation*

Firenze, 30 May - 1 June 2011

**Book of Abstracts**
IES 2011

Innovazione e Società
Metodi statistici per la valutazione dei servizi

Innovation and society
Statistical methods for service evaluation

30 May – 1 June 2011
Firenze (Italy)

Book of Abstracts
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**Welcome aperitif** (Monday, 30 May) will be held at:
Biblioteca Le Oblate
Via dell'Oriuolo, 26, Firenze

**Social dinner** (Tuesday, 31 May) will be held at:
Ristorante Pennello,
Via Dante Alighieri, 4, Firenze
IES 2011 Conference venue

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Performance measurements for healthcare services

Giorgio Vittadini¹, Paolo Berta²

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Performance measurements for healthcare services, the improvement of healthcare quality are becoming more and more important.

The most traditional methods for quality evaluation are the ex-ante methods, as accreditation of excellence methods in the fields of health. However, in order to obtain and to evaluate the healthcare structures we also need benchmarking results defined as ex post evaluation based on quantitative indicators of outputs and outcomes.

Efficiency consists of the comparison between production input and business output in terms of both quality (days, cases etc.); Customer satisfaction, used to measure consumer’s satisfaction regarding aspects related to a product or a service; relative effectiveness is defined as the ability to provide treatment to patients, improving healthcare outcome and improving the ability to modify the patient’s state (Donabedian, 1988).

In particular relative effectiveness needs to be adjusted for patient-specific and hospital-specific variables. For this goal given also the multilevel nature of data, in the nineties, numerous authors proposed utilizing the Multilevel Model (Goldstein & Spiegelhalter, 1996; Marshall & Spiegelhalter, 2001, Vittadini, Minotti, 2005).

However, the previous proposals concern small samples of patients affected by particular diseases and therefore are not sufficient for evaluating benchmark hospitals. Moreover, the use of the death rate as health outcome has been discussed (Goldstein, Spiegelhalter, 1996). Finally, the use of risk adjusted comparisons for benchmarking health structures has been strongly criticized (Lilford, Spiegelhater et al., 2004).

In order to overcome these problems:
1. Instead of utilizing small samples, we base our effectiveness analysis on large administrative data sets (Health discharge cards).
2. We build the intrahospital mortality ratio and we also use context outcomes obtained from administrative data giving more complete information about effectiveness.
3. We perform our analysis for the single DRG getting less generic and confused case-mix corrections and more robust risk adjusted comparisons.
4. Instead of ranking health structures we classify them in few effectiveness subgroups (inferior, superior and equal to regional average).
5. We present all the ex ante and ex post indicators in a different, simple and synthetic way (radar scheme).

All the indicators are tested on Lombardy hospitals.

References
The evaluation of the educational system

Giacomo Maria Elias

Dr. Engineer, PHD, Former Full Professor of Applied Physics at the Milan University, Former President of INVALSI and member of CNVSU

The exposition of this issue as far as I'm concerned requires two premises that derive from more than a decade of studies and experiences on the field.

First the educational system should be understood as a continuum throughout the life: it helps, together with the experiences, to the formation of Human Capital (HC), i.e. the "culture" of each.

The second is that the concept of evaluation is not absolute, but "measure" on a case-by-case basis the achievement of one or more objectives (measured with suitable indicators). These must be established by means of a "policy" (for example education policy) that must be declared and adopted by those who has the responsibility of a given service and, for this reason, it promotes the evaluation of the results achieved.

I am convinced that, as all social systems, educational one possesses the peculiarities of a CAS (Complex Adaptive System). Consequently, it cannot be considered a system "closed" (linear approach), but reciprocally interacts with the environment, understood in the broadest sense (non-linear approach, network).

This leads us to say that the policy adopted for the educational system, on the one hand, is indissolubly linked to the one chosen for the development of the Country, on the other hand it must take account of a high number of stresses that come from outside. For the latter reason, it must be sufficiently flexible in order to respond to the continuing challenges from outside and at the same time be capable to reconcile the right of everyone to have an adequate education with the educational and cultural autonomy of educational institutions that operate in the territory and from this are influenced.

In order that the effects on individuals are to be effective (it is necessary to distinguish between efficiency and efficacy), the educational system must not present discontinuities, although increases in the UC that it determines, always positive, can be different in different periods. For example, studies have been developed at INVALSI, primary and secondary education (by L. D'Ambra e A. Paletta), and at CNVSU, university (for example, by G. Vittadini), and they are very difficult to be connected between them.

It is evident that the process of assessing the effectiveness of the system cannot (and must not) be fragmented (for example, referred to the different stages of development from childhood to maturity), nor it may present solutions of continuity or, worse, be entrusted to structures between them are not coordinated, as it is happening today.

We must not misunderstand: every phase of the development of the person (education is a service to the person) has different needs and involves different targets and indicators for measuring the achievement, but the assessment of the preceding phase must represent the point "zero" of the next.

Taking account of the above, it is very difficult to imagine and design a system for the evaluation of the university system without having input data consistent with the objectives assigned to it (for the time, very general). This may be partially true only if it tends to assess the organizational efficiency of it or the quality of teaching. It is absolutely wrong if we wish to assess efficacy, i.e. the adequacy between resources (human and financial) invested and the "product" obtained.

A final consideration concerns the complexity and the cost of the creation of an organizational structure to collect the data necessary to calculate one or more indicators (for
example the CU, a function of many variables) which distinguish each person throughout life. Some attempt, even of good quality, is already underway (see for example Alma Laurea and Alma Diploma), but each of them still suffers from the incompleteness at national level and from the need of a greater accent on assessment.

In conclusion, I think that it must be continued and increased research on indicators of efficacy (for example the CU) to find viable solutions, which could be implemented on national plan and that, at the same time, have to be more objectively defined by the Government policies, the resulting goals and instruments for assessing the educational service.
Specialised Sessions
Specialised session A

Business and Bank
Banking services evaluation: a dynamic analysis

Michela Lacangellera¹, Caterina Liberati², Paolo Mariani³

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Customer centric vision has been successfully applied in the last years in the banking sector. Such a concept has customer satisfaction as the most important asset of a company. According with this idea banks have increased their products differentiation in order to match with potential clients requests or expectations. This resulted in offer homologation making necessary a focus on service attributes differentiation.

Such scenario leads banks to employ intelligent systems to monitor their own clients in order to build and preserve a robust relationships with them. That generated an operative improvement in terms of efficiency and economic returns. However, as it is well known, the bank-consumer is an “ever-changing” relationship due to both environment and actors evolution.

Therefore the core of our contribution focuses on analysing the evolution of customer satisfaction and track patterns of customer evaluations related to bank service features. The tested hypothesis is the loss of bank retail services competitiveness, probably due to a drop of customer satisfaction.

A multiway factorial model run on data collected by an Italian bank has employed information coming from a satisfaction survey repeated in 3 different temporal waves on a sample panel composed by 27.000 instances per wave. The questionnaire has been framed according to SERVQUAL model. The multiway technique rationale is based on a particular decomposition of the total variability: within and between groups. This second part is modelled through a linear regression where the different times represent the observations of the covariate. In our case a time series with only three observations is inadequate for the regression model. Thus we propose a technique based on principal components which enables the definition of a “compromise plan” in order to perform a joint analysis of the three waves data.

This dynamic study has been carried out on a three-way data matrix Xijk (professional segments (i), service attributes (j), waves (k)) of 9x24x3 dimensions. The interstructure analysis shows a high similarity among the waves and it justifies the search for a common “compromise” matrix through the infrastructure analysis. In this phase on a common plan are represented the individuals trajectories in the three waves according to two factors (84%) summarizing service dimensions in terms of expectations and evaluations.

Results show an increasing satisfaction between the 1st and the 2nd wave which highlights an effective positive impact of management actions. However the orientation discontinuity in individual tack patterns suggests a future expectation fall (third wave) and, in a medium term a consistent customer satisfaction drop.

References
Ordinal logistic regression response functions with main and interaction effects in the conjoint analysis

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In the Conjoint Analysis (COA) in order to link the categories of overall evaluation to the factor levels, we adopt a cumulative logit model (De Luca, 2010) at the aggregate level *(pooled model, Moore, 1980)*. The novelty in our approach is that one set of aggregated part-worths is estimated in connection with each category *Yk*. The number of profiles *(combinations of levels of the M attributes or factors of a product)*, constitutes a full-factorial experimental design. It is assumed that the overall evaluation *(Y)* of a product consists in the choice of one of the ordered categories *k* = 1, 2, …, *K*. The effects of the factors express the variations of the probabilities *Pks* associated with the vector *zs* corresponding to the combination *s* (s = 1, 2, …, *S*). The *k*th cumulative response probability is:

\[
P_k(z) = \sum_{j=k}^{K} \pi_j(z) = \pi_1(z) + \pi_2(z) + \ldots + \pi_K(z).
\]

The cumulative logits of the first (*K*-1) probabilities are:

\[
L_k(z) = \log(F_k(z)) = \ln\left(\frac{\sum_{j=k}^{K} \pi_j(z)}{\pi_{k+1}(z)}\right) = \delta_k 0 + \tilde{\delta}' z,
\]

with *k* = 1, 2, …, *K*-1; *zs* is the vector of the dummy explanatory variables relative to the profile *s* in the reduced matrix *Z*; *δk*0 is the constant term, *δ*' is the unknown vector of regression coefficients of the factor levels.

The algebraic form of the response functions with main and first-order interaction effects is:

\[
L_k(z) = \sum_{m=1}^{M} \sum_{l=2}^{l_{m}} \lambda_l \tilde{z}_{l_{m}}^{(m)} + \sum_{m=1}^{M} \sum_{l=2}^{l_{m}} \sum_{h=2}^{p} \lambda_{l_{h}}^{(m,p)} \tilde{z}_{l_{h}}^{(m,p)} + e_k; \quad k = 1, \ldots, q, \quad h = 1, 2, \ldots, l_{m}, \quad p = m + 1, m + 2, \ldots, M; \text{where: } \tilde{\delta}_k 0 \text{ is the constant term associated with the reference category; } \lambda_l \text{ and } \lambda_{l_{h}}^{(m,p)} \text{ are the unknown regression coefficients, respectively, for the } l_{th} \text{ level of the } m \text{ factor and for the first-order interaction of the factors } m \text{ and } p; \tilde{z}_{l_{m}}^{(m)} \text{ and } \tilde{z}_{l_{h}}^{(m,p)} \text{ are the dummy variables, respectively, for the } l_{h} \text{ level of the } m \text{ factor and the } h \text{ level of the } p \text{ factor in the stimulus } s; e_k \text{ is the error term pertinent to the } s\text{th stimulus. We provide an application to real data with PLUM-Ordinal regression procedure of SPSS.}

References


Measuring media reputation for private and public institutions

Paola Cerchiello

Reputation can be defined as how an entity (private or public) is perceived by each of its stakeholder groups, and reputation risk as the risk that an event will negatively influence stakeholder perceptions. Since reputation involves intangible assets (public opinion, perception, reliability, merit), it is not simple to define and consequently to measure and to monitor the correlated risk. Because of the novelty of the problem, the scientific literature on the topic is limited and/or not completely shared. In this contribution, we propose statistical models based on ordinal data aimed at measuring effectively reputation and reputational risk. Such models are applied to real data on Italian public companies taken from financial media corpora. We propose two parallel approaches rooted in the context of, respectively, non-parametric and parametric statistics. The former allows us to employ a scorecard approach based on flexible indexes with the final aim of creating a ranking. Besides non-parametric models, we need a parametric model whose estimation allows not only to describe and rank reputation, but also to predict and, therefore, prevent, reputational risks. In particular, we need a parametric model suited for ordinal variables, as most reputational data is typically available in such format. We propose a mixture model that extends the CUB model proposed by D’Elia and Piccalo in 2005, particularly useful when covariates are not available.

In order to enable the application of the scorecard approach and of the CUB-CUBB models in this context, we have collaborated with the Italian market leader company in financial and economic communication, "IlSole24ORE" and with DFKI a German Research Centre for Artificial Intelligence in the framework of the European research project MUSING. The objective is to evaluate the corporate reputation of 40 Italian companies listed as Blue Chips in the Italian Stock market, on the basis of newspaper articles delivered by "IlSole24Ore" and analyzed by means of an opinion mining tool. The OM result pursues data structured according to the following ordinal scale: 1 (very bad news), 2 (bad news), 3 (neutral news), 4 (good news) and 5 (very good news). Such output represents our variable of interest, which we use to assess the scorecard approach and the mixture model. By means of the two parallel approaches we can rank Italian public companies and evaluate the latent component named reputation awareness contained in the analyzed newspaper.

References


The confidence ellipses in decomposition Non-Symmetrical Correspondence Analysis for the evaluation of the innovative performance of the Manufacturing Enterprises in Campania

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Non-Symmetric Correspondence Analysis-NSCA (D’Ambra L. & Lauro, 1989) is a useful technique for analyzing a two-way contingency table. There are many real-life applications where it is not appropriate to perform classical correspondence analysis because of the obvious asymmetry of the association between the variables.

The key difference between the symmetrical and non-symmetrical versions of correspondence analysis rises in the measure of the association used to quantify the relationship between the variables. For a two-way, or multi-way, contingency table, the Pearson chi-squared statistic is commonly used when it can be assumed that the categorical variables are symmetrically related. However, for a two-way table, it may be that one variable can be treated as a predictor variable and the second variable can be considered as a response variable.

Yet, for such a variable structure, the Pearson chi-squared statistic is not an appropriate measure of the association. Instead, one may consider the Goodman-Kruskal tau index. In the case that there are more than two cross-classified variables, multivariate versions of the Goodman-Kruskal tau index can be considered. These include Marcotorchino’s index (Marcotorchino, 1985) and Gray-Williams’ index (Gray & Williams, 1975).

In the present paper, the Multiple Non-Symmetric Correspondence Analysis- MNSCA (Gray, L. N., Williams, J. S,1975), along with the decomposition of the TAU by Gray-Williams in main effects and interaction (D’Ambra, L. et al., 2010), is used for the evaluation of the innovative performance of the manufacturing enterprises in Campania. Innovation represents a very important element for the competition of the enterprises and economic growth. Only the enterprises which are able to innovate regularly can have at their disposal a range of more and more appealing products for the customers. Moreover, only a constant innovation provides the constant efficiency of the processes and the optimization of the production costs. Finally, the use of the ellipse confidence (Beh, 2010) has allowed to identify a category which is statistically significant.

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Specialised session B

Ordinal data models
A review of multilevel models for ordinal data

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An ordinal variable is just a categorical variable supplemented with information on the ordering of the categories. The statistical methods for ordinal variables are designed to exploit such information. Here we focus on regression models for an ordinal response, with special emphasis on cumulative models, namely models based on cumulative probabilities.

We review random effects cumulative models for multilevel data and we discuss several issues peculiar to the random effects extension such as the distinction between marginal and conditional effects, the measures of unobserved cluster-level heterogeneity, the consequences of adding covariates, and the main types of predicted probabilities. We also briefly consider the topics of estimation, inference and prediction, with a brief look on available software.

The issues are illustrated through an analysis of student ratings on university courses.

References

A categorical data model to assess critical points

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In this paper the scholastic performance of young students during their compulsory studies has been studied.

The analysis is based on the data collected by the Scholastic Observatory of Province of Bologna in the recent years. They include individual performances for every student monitored over time.

The relations between scholastic results and predictive variables as gender, place of origin, previous school mobility, family status, and type of school have been studied.

Interesting conclusions about the effects of some variables of interest have been drawn by using logistic models and classification trees.

In particular, the importance of monitoring the student histories of life to identify critical points in the scholastic careers emerged. Moreover, the inclusion of one student in a given class of a classification tree can permit to forecast the further steps of his educational path.

References

Modelling multivariate ordinal data: some experience with CUB models

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A mixture model for ordinal data modelling (denoted CUB) have been recently introduced in the literature (D’Elia and Piccolo, 2005; Piccolo, 2006). Specifically, the ratings are represented by means of a discrete mixture of a Uniform and shifted Binomial random variables. The parameters characterizing the mixture have an interesting interpretation in terms of ‘uncertainty’ and ‘degree of liking/disliking’ expressed by the raters with respect to a certain item. Moreover, those parameters can be related to covariates so that further flexibility to the final model is added (see Corduas et al. 2010 for a discussion).

However, in real applications the modelling is performed on single items separately. In complex surveys, instead, when subjects are asked to evaluate a certain object with respect to several features or to express their satisfaction with respect to various objects, it is often the case that responses are associated.

In this paper, we discuss the problem of incorporating CUB models within a multivariate distribution useful for the analysis of correlated ordinal data. In particular, we consider the Plackett distribution (Plackett, 1965; Dale, 1986; Molensbergh and Lesaffre, 1994) in order to construct a class of distributions with CUB models as marginal distributions. The approach is interesting since it provides a framework to move from the bivariate case to the multivariate one. In addition, it allows to retain some useful interpretation and devices of marginal models and to use significant covariates for improving final distribution fitting.

The paper presents some methodological and computational aspects related to such technique and the results obtained from an empirical study.

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References


Specialised session C

Public transports evaluation
Preliminary studies to define critical threshold for customer satisfaction and loyalty

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Company often debate on which is the satisfaction level to be reached to make sure of customer loyalty. The determination of such a threshold could be done through different methodologies, empirical or mathematical. The article shows two ways to do that: first one is used and proved along many years, and is based on the measurement of the decrease in the customer satisfaction in function of the perceived quality. Second one is more theoretical but has more developing perspectives, and is born observing the gap between objective evaluations, global satisfaction and loyalty declared from the customer.

References

Mixed logit models using Gaussian mixtures with covariate-dependent weights

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The multinomial logit (MNL) model has been widely used in the analysis of discrete choices and has found large application in transport studies (McFadden (1974)). However, its restrictive assumptions, such as independence from irrelevant alternatives and preference homogeneity across respondents, have motivated the development of more flexible model structures that allow for an increasingly realistic representation of travel behaviour. Among these, a primary role is played by mixed logit (MNL) models (McFadden and Train (2000), Train (1998)), in which the utility of each individual is a function of the alternative attributes, with attribute coefficients that are random and reflect individual preferences.

In MMNL models a crucial issue is that of specifying an appropriate mixing distribution of the random coefficients that may be interpreted as representing random taste heterogeneity. Popular specifications have been the normal, triangular, uniform, lognormal distributions. However, any of them has shown its deficiencies (Hess et al. (2005)).

To deal with this issue, Fosgerau and Hess (2009) proposed to make use of a semiparametric mixing distribution consisting of a discrete mixture of normal distributions (MOD). Scaccia and Marcucci (2010) considered the MOD approach and illustrated how to estimate this model in a Bayesian framework. Moreover, they extended the approach to the case in which multiple random coefficients, potentially correlated, are present in the model.

Here, we develop the MOD approach to allow for the dependence of the observations on subject-specific covariates. In practice, we let the weights of the mixture depend on the covariates through a logit-type function, so that the weights can vary between observations.

The model is applied to a data set referring to a study carried out in Urbino (Italy) to analyse the attributes of the local public transport and investigate possible interventions to improve the service (Marcucci and Scaccia (2005), Scaccia (2009)). Five attributes of the service were considered: cost of monthly ticket, headway, first and last run, real-time information displays, bus shelters. Covariates such as gender, monthly budget, public transport usage frequency, availability of other transport means were also accounted for.

References


An evaluation of Customer Satisfaction in public train transport by complex principal component analysis

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For a company, the knowledge of Customer Satisfaction (CS) regarding a given product or service, represents an important starting point for every business strategy. In order to measure CS many methods have been proposed: Servqual, Servperf and etc (Franceschini & Rossetto, 1996). In many of these methods, the survey allows to have two sets of data collected in two fully matched matrices (Amenta P. & Sarnacchiaro P., 2001). In order to analyze this scheme of data, a first solution consists in analyzing the two matrices separately using Principal Component Analysis (PCA). If we want to analyze the two matrices at the same time, we can perform a PCA on a new matrix obtained by horizontal juxtaposition of the two data matrices. Other more appropriate symmetrical and non-symmetrical solutions, that allow to analyze the two sets of data jointly, are: Co-Inertia Analysis, Co-Structure Analysis and Partial Least Square (Vivien, 2001). The information obtained by means of the mentioned analysis is of different types, in order to have almost all the information embedded in only one analysis, it is possible to use Complex Principal Component Analysis (CPCA) (Horel, 1984). An application enhancing the interpretative gain of the results will concern the evaluation of public train transport CS.

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Optimal Sample strategies in public transports assessment

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In Local Transportation Planning (LTP) with the aim to contribute to encourage the use of public transport and to reduce the pollution in a city, it’s important to understand the expectation of people living in delineated study area so to increase the number of passengers.

Because the business is strictly correlated to the level of quality perceived, it’s important to define an approach that could be allow us to capture the diversity insight the people expectation concerning public transport in terms of quality. This means that the aspect of interest may not be just the “customer satisfaction” itself but the interactions between expectations and the environmental stress gradient in a specific area.

As a consequence, traditional measures of customer satisfactions may be not solve our problem because they may do not take into account the different ordering of people in terms of their expectations. From this way the results of comparative studies may depend on the selected index of diversity that it incorporate a particular degree of sensitivity to rare and common expectations. A solution is given by the use of parametric families of indices of diversity borrowed from the ecological diversity (Gov et al., 1994) which are usually referred to the diversity profiles which consist of a sequence of measurements allowing different aspects of community structure so that they take back all the differences in to a single diversity spectrum.

Therefore, the diversity measure can be seen as a curve unlike the index of “customer satisfaction” which is a scalar. This approach could emphasize the importance of using such an approach that does not collapse the information of a multidimensional item into a singular number.

In this framework the Functional data analysis (FDA) approach will be considered (Gattone and Di Battista, 2009). As known (Ramsay et al., 1996), the aims of FDA is that the observed data could be thought as single entities rather than sequences of observations. Starting from this point of view in the LTP field the goal could be investigate the customer satisfaction diversity by means of the diversity profile (Patil and Taillie, 1982). The approach can be inferential or censorious.

In this work we deal with circumstances where the diversity insight into the expectations is a known function such as diversity profiles. In this case the focus is to estimate the diversity function by means of a suitable sampling design. A fixed population sampling point of view will be assumed and we will provide statistical inference based on the Horvits-Thompson estimator of the functional diversity profile.

References


Specialised session D

Rasch Analysis
Motivation to achieve academically: Rasch analysis and first results regarding correlation with students outcomes at the university of Udine

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Academic achievement is related to various factors and motivation is expected to be an important determinant. This work aims to measure motivation of university students and to study the correlation between motivation and academic outcomes.

The sample is composed of 99 students enrolled in the first academic year of the faculty of Economics of the University of Udine. Data were collected during the lessons of statistics.

The questionnaire used to measure motivation is the questionnaire developed by Waugh (2002), that applied Rasch analysis. The questionnaire is composed by 24 items on an ordinal scale with four categories. In the original version, each item requires two responses: What I aim for and What I actually do. A rating scale model (Andrich, 1978) was used to analyse the data. Consistently with Waugh, the items relative to What I aim for resulted easier than What I actually do. In order to avoid dependencies between items, only the responses relative to What I actually do, that presented difficulties more adequate to the motivation levels, were considered. Ten items were discarded due to poor fit statistics. Item difficulties estimated with our data are similar to those obtained by Waugh (correlation = 0.44).

In order to validate the scale obtained, the relation between students outcome and the measure for motivation was studied using a multiple regression model. Students outcome is defined as the sum of the grades obtained by the students in the exams passed in the first academic year multiplied by the credits. The other variables that resulted significant are the intake level (measured using the score obtained in the enrollment test) and the secondary degree grade. All the explanatory variables are standardized. Measurement error present in the measure for motivation and in the intake level was adjusted using the SIMEX method (Cook and Stefanski, 1994). The method requires the knowledge of the measurement error variance. For motivation, the measurement error variance can be considered known and equal to the variance of the person parameter estimates. Since the responses given to the enrollment questionnaire were not available but only the total score was, a Rasch analysis was not possible for this variable. Consequently, the measurement error variance for the intake level is not known and a sensitivity analysis with reliabilities equal to 0.7, 0.8 and 0.9 was performed. The measure for motivation obtained resulted positively related to the academic outcome (p-value=0.01), irrespective of the reliability assumed for the intake level.

References

Effects of DIF items on Rasch measures

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Differential item functioning (DIF) is understood to be present when something about the characteristics of a test taker interferes with the relationship between ability and item responses. For a given level of trait, the probability of endorsing a specified item response should be independent of subgroup membership; if it does not happen, then that item is said to exhibit DIF. Two types of DIF can be identified: uniform and nonuniform (Mellenbergh, 1982). Uniform DIF (UDIF) occurs when an item is endorsed at a consistently higher level by one group over the other group at all levels of the underlying trait. Nonuniform DIF (NUDIF) means that at certain levels of the underlying trait, one group has higher scores, while at other levels the opposite is the case. In a typical DIF study, subgroups are studied in pairs, labeled the reference and focal group.

When DIF is present, an impact on the estimated ability measure could be expected. The present simulation study addresses the issue in assessment of the impact of both kinds of DIF on the measures obtained applying the Rasch model when the questionnaire is formed by polytomous items. There are several methods to assess DIF in polytomous items; good reviews are given by Potenza and Dorans (1995) and Penfield and Lam (2000).

The Rating Scale Model (Andrich, 1978) is the one used to simulate responses to items without DIF and to estimate the RSM parameters. The data generating mechanism that allows to simulate data affected by UDIF or NUDIF are based on adding to the log-odds ratio of two adjacent categories an extra term which depends on the interaction between the item and the dummy variable group, coded as 1 if the subject belongs to the focal group and 0 otherwise, in the case of UDIF, and between the item, the subject ability and the variable group for NUDIF.

In the present study 1000 subjects and 15 items with 6 response categories are considered. Two different cases of UDIF are analysed; in the first one the DIF sign and size compensate each other whereas in the second one the focal group shows a relative advantage (disadvantage) over the reference group for all the items exhibiting DIF. For each case, 500 data sets were simulated and analyzed and 500 sets of estimated abilities and item difficulties were computed. The simulation shows that when the items exhibit UDIF with DIF sign and size which compensate each other, the estimates of ability are not significantly influenced by the presence of DIF; different results show up when DIF sign and size do not compensate each other. When the items exhibit NUDIF, there is an impact on the measures.

The results highlight the importance to identify the nature of DIF in order to decide the best strategies to face it.

References

Impact of educational test features on item difficulties by the Linear Logistic Test Model

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Educational testing studies focus on latent variables, usually named abilities. Remarkable examples are reading ability or mathematical ability. A primary goal of these studies is how much of such abilities persons possess and to this aim a test consisting of a number of items (questions) is developed. Item response theory (IRT) is essentially a theory of the relation between item responses and the underlying abilities (or traits). Mathematically, the relation is described by a function (named item characteristic curve, ICC) linking the probability of correct response to an item and the ability scale. Since test items are not necessarily equivalent in difficulty or validity in measuring the underlying trait, item parameters are included in ICC. When only one difficulty parameter for each item is considered and a logistic model is adopted for the ICC we obtain the famous Rasch model, whose attractive theoretical properties have been extensively studied (e.g. Fischer 1995).

Linear logistic test model (LLTM) proposed by Fischer (1973) is a Rasch-family model that includes parameters for the impact of cognitive design variables and other test variables on item difficulty. LLTM breaks down the item difficulty parameter of the Rasch model into a linear combination of certain hypothesized elementary parameters. Apart from the primary application of generating items, there are many other potential applications of the LLTM (see e.g. Kubinger 2008, Xie & Wilson 2008, Daniel & Embretson 2010). In this communication some recent developments and potentialities of the model are reviewed and an application to Italian PISA 2006 sample is provided.

References

Specialised session E

Latent variable models
A Bootstrap procedure to test the cograduation between two ordinal scales: a proposal of two new indices.

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In psychometric sciences the choice of a good response scale is a typical problem. Several studies (see, in particular, Bonanomi, 2004) proved that different measurement scales lead to highly dissimilar evaluations of goods/services, in particular in the measurement of observable variables in latent variables models. So, this requires that proper cograduation indices should be available, in order to compare the attitude of different measurement scales (typically ordinal scales) in assigning the attitude of different number of allowed response modalities. For this purpose, an innovative proposal is given, consisting not only on the measurement of the natural concordance between two scales in the evaluation of the same good/service, but in the possible propensity and attitude of a scale to provide more positive or negative evaluations: two new different indices are proposed, \( I_{p1} \) and \( I_{p2} \).

The evaluation of an item with two response scales, \( S_1 \) (with modalities \( s_{11}, \ldots, s_{1I} \)) and \( S_2 \) (with modalities \( s_{21}, \ldots, s_{2J} \)), with \( I \geq J \), is proposed to the same sample of \( n \) subjects, randomizing the presentation sequence of the scales, in order to avoid memory effects. Considering a generic item, let \( n_{ij} \) be the number of subjects which assigned the \( i \)-th modality evaluating with \( S_1 \) and the \( j \)-th with \( S_2 \), in a \( I \times J \) contingency table. \( I_{p1} \) is based on a comparison between frequencies in the inferior and superior triangle in a \( I \times J \) contingency table (\( I \neq J \)) is also implemented.

\[
I_{p1} = \left( \frac{\sum_{i<j} n_{ij} - \sum_{i>j} n_{ij}}{n} \right)
\]

\( I_{p2} \) is determined by a comparison of the empirical cumulative distribution functions, having previously normalized the scales in the \([0;1]\) interval. With reference of the two Lorenz curves, \( I_{p2} \) is obtained as the region between the cumulative functions. Let \( F \) be the relative empirical cumulative function of \( S_1 \) and \( G \) of \( S_2 \); \( I_{p2} \) is

\[
I_{p2} = \frac{\sum_{i=1}^{I} F_{i+1} + F_i - \sum_{j=1}^{J} G_{j+1} + G_j}{2I} - \frac{\sum_{i=1}^{I} G_{i+1} + G_i - \sum_{j=1}^{J} F_{j+1} + F_j}{2J}.
\]

\( I_{p1} \) and \( I_{p2} \) are then rescaled in the domain \([-1;1]\); zero indicates the perfect concordance of the two ordinal scales. In order to verify the attitude of a scale to assign a mainly positive or negative rating compared to a differ ent one, a non-parametric test is setup. The null hypothesis is referred to the perfect concordance between the two considered scales (\( I_{p1} \) and \( I_{p2} \) equal to zero). A bootstrap procedure is useful in this context: non-parametric bootstrap confidence intervals are used (DiCiccio, Efron, 1996), in the particular BCA version (bias-corrected accelerated percentile method), since they have accuracy and correctness higher than other similar bootstrap intervals.

References


Combining PLS and GME to estimate Structural Equation Models

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Structural Equation Models with Latent Variables (SEM-LV) are commonly used in frameworks, e.g. Customer Satisfaction (CS) analyses, where, once defined a construct by means of a path model, the interest is mainly focused on the estimation of the parameters indicating the strength of the relationships among the considered unobservable entities.

Partial Least Squares (PLS) and LISREL are the estimation procedures usually considered (the first method performs the parameter estimation after a latent score reconstruction; while parameter estimates are directly obtained with the latter method from the covariance structure of the observed variables). Possible drawbacks may ensue from the presence of multi-collinearity in the following cases: in the outer model, only for the PLS algorithm, when constructs of the formative type are present; in the inner model, when some explicative latent variables are highly correlated, possibly due also to the correlations among the observable variables pertaining to different blocks.

The Generalized Maximum Entropy (GME) method (Golan et al., 1996) represents a semi-parametric estimation method for the SEM (Ciavolino, Al Nasser, 2009) which works well in case of ill-behaved or nonlinear data. The GME approach considers the re-parameterization of the unknown parameters and the disturbance terms as a convex combination of the expected value of discrete random variables. The estimation is achieved by the maximization of the Shannon’s entropy function.

Our proposal is to define a combined algorithm that use first PLS to estimate the latent variables and, then, GME to estimate the parameters in the inner and outer models, thus overcoming the possible presence of multi-collinearity.

Moreover the algorithm will deal with the presence of missing values, by considering in the PLS step the procedure proposed by Boari et al. (2007).

The behaviour of the proposed procedure is evaluated by using the ‘mobile’ data set, proposed by Tenenhaus et al. (2005) and available in Sanchez, Trinchera (2010), also simulating the presence of missing values.

References


Simultaneous Factor Analysis Across Several Populations (SIFASP): identification criteria for latent structures

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A growing number of international surveys put the same questions (in translation) to national random samples. The number of countries (groups) involved often are too few for a multilevel approach, even when researchers know the relevant higher level variables, but too many to handle each sample (group) on its own. In such contexts multisample analyses can be useful. (Jöreskog 1971) The many ways in which factor models can be specified frequently lead in multisample solutions to unclear procedures and interpretations. This paper as sumes that variables are similar but vary, across groups, through linear transformations, and explores the consequences of this for factor analytic models.

Consider a multisample covariance model with latent variables where a number of variables (j) are similar in all groups (g). $y_{gj} = a_{hj} + b_{hj}y_{hj}$: the responses, $y_{gj}$ and $y_{hj}$ for a similar variable (j) in different groups g and h, have the same meaning but measurements are affine transforms of one another. It specifies the question of Ahmavaara (1954) about factorial invariance in such situations. The (partial) answer offered here is put in the framework of (strongly) constrained solutions. The covariance model used differs from the common factor analytic model (CFA) in that it includes a specific linear scaling coefficient for the variables, different in the various groups, (using G diagonal matrices $B_g$ with entries changing over the G groups 1…G) so: $\text{Var}_g(Y) = \text{Var}(B_gA_gH_g) + \text{Var}(D_g)$, a model suggested by Wiley et.al. (1973). The model requires scale invariant estimation methods (ML, GLS, WLS, but not principal components, principal factors or ULS). For single factor models with the same number of observed variables this model can be scaled so that all loadings are the same within each group and across groups. The variance of the (single) factor can however vary. For congeneric factor models the rescaling of loading is as for the single factor model, but the different constructs underlying the observed variables can still have varying variances and covariances (correlations). In models with at least three latent factors the covariances among factors in different groups can be put equal, thus also fixing the variances of the latent variables. For the congeneric factor model a subset of the model satisfying the criteria of the congeneric model is defined, and the rescaling constraints are applied for that submodel; parameters not fixed or constrained this way still provide remaining degrees of freedom for testing further similarity constraints. More general models with constraints on unique variances or correlated errors can be dealt with in a similar way. Means can be handled separately afterwards. Fit and partial fit indices for these procedures will be discussed. An example are given on estimating and interpreting such models with standard SEM software (LISREL, Jöreskog, Sörbom 1988), using ten ‘trust in institution’ variables from the various waves of the European Social Science Survey in ten countries. (van der Veld, Saris 2009).

Specialised session F

Evaluation of local authorities performance
Methodology and Tools for Local Government Services Monitoring: the IQuEL project experience

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The eGovernment project IQuEL (Innovazione e Qualità per Enti Locali) funded by the Italian Dipartimento Affari Regionali (DAR) of the Presidenza del Consiglio dei Ministri, and ended in year 2009, produced a qualitative- and quantitative-analysis methodology for the monitoring of services provided by Local Governments. Such a methodology starts by a co-design with stakeholders, in order to define variables and metrics, then ends with the delivery of reports and dashboards enabling decisions on the provided service under examination.

Such a methodology is enabled and powered by means of a software platform - which was developed within the project itself - composed of a tool for data collection (citizen satisfaction surveys, data collection through online forms, datasets or external surveys import from other sources) and an open-source tool for decision support reporting.

The project focused on five different municipal services, namely, kindergarten subscription, change of address within the same municipality, road maintenance, request to start building and commercial activities, and public and institutional communication.

By adopting the proposed approach, for each service it will be possible to exploit the results of the analysis (both in terms of perceived quality and internal quality), in order to highlight the strengths and the main critical factors, thus supporting with processed data the managers conduct, for a continuous improvement of the services under their scope.

The IQuEL project was aimed at developing Business Intelligence for the Public Administration, thus following guidelines coming from the Italian Ministry for Public Administration (L.6 9/09, DLgs 15 0/09), that mainly regard performance, transparency, accountability, and continuous process improvement.
The customer auditing system in Milan, a certificated managing procedure ISO 9001

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For some years commune of Milan has been using quality controlling means on its services and other self-evaluating means such as CAF and EFQM; since 2006 Comune of Milan has started an articulated iter for certification ISO 9001-2008 and ISO 14001-2004 which has resulted in the standardization of every Board service.

More precisely: through the adoption of UNI ISO standards and indicators Comune of Milan has made its commitments about quality and customer’s auditing clear to its customers and other city users.

Goal of the process was that to integrate the managing means with the contract of service set up by the system of volunteer certification in order to make the two areas (law – required and volunteer) consistently oriented to the development of the quality system inside the local public services.

The system has its strength in the process of the customer auditing; it’s not only a managing procedure of SGQ, it also represents a strong signal of the need for no-self reference, identification and meeting our customers and city users needs and expectations keeping up and improving the global performances. The system is transverse to the whole administration and is formed by the complaint and data collecting desk. Complaint desk is a multichannel net system (fax, on line, mail, direct delivery) for complaint reception which was born in 2007 and has dealt with more than 25,000 complaints giving the customers concrete and guaranteed answers in average time limit of 6 days; it has also permitted to collect and monitorate more than 3000 events.

The customer satisfaction collecting activity is addressed to the users of the municipal services and undertakings; it foresees a yearly planning of the investigations arranged with the different directions and services.

These investigations have been drawn into legal form through data collecting forms with passages, formalities and responsibilities of the necessary activities to the surveys which have been cleared in the “managing procedure” and integrated through their guidelines.

Each survey is planned both for the most appropriate survey mean (e.g. questionnaire, focus group, phone calls, emoticon) and for the example plan which must consider every time the goals of: our research, our users’ target, the time management and of the resources of the involved services. Keywords for both the adopted methods are:

- Economicity: all the activities are realized and managed with internal resources of the board
- Attention to the technological support: complaint managing e monitoring/reading of the customer satisfaction work on technological applications which have been planned and implemented thanks to the synergies between the Board sectors and services
- Optimization of the listening skills: will-power to change criticisms into improving actions and strategic goals
ELISA PROGRAM - LOCAL INNOVATION SYSTEM
measuring the quality of the services of local Public Administrations

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Elisa Program, managed by the P residency of the Council of Ministers - Department for Regional Affairs, and in particular the structure of the PORE (Project Opportunities for Regions in Europe) with the technical assistance of Invitalia SpA, has funded projects on innovation and development of local authorities also on the measurement of quality of services provided by local government.

IQUEL – The city of Parma has successfully completed the IQUEL project, which was attended by a large number of municipalities and provinces, aggregated together (23 administrations of central and northern Italy). The project aims to provide local governments tools to optimal management of the services on different channels. IQUEL achieved the following results: identifying and sharing a set of statistical indicators for measuring access and performance on different channels (web, desk, telephone, etc.); a set of indicators of customer satisfaction, a set of features of Citizen Relationship Management to help optimize the delivery of services to users.

ELISTAT – ELISTAT is a work in progress project, managed by the Province of Brescia as Responsible aggregation, with a local identity as systemic, involving 42 provinces from 12 different regions and a catchment area of more than 22 million inhabitants. The initiative participating the local authorities of various kinds: metropolitan provinces and reduced size, newly created provinces, provinces with high intensity of small municipalities. ELISTAT project intends to design, develop and publish on the Internet an integrated system of statistical indicators covering all the functions and services provided by the provinces, with particular attention to services for small municipalities, for a constant measurement of performance, cost and induced benefits throughout the country.
Innovation and Quality in Local Authorities: A combination to be pursued

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The transformation of Public Administration, which began in Italy since the early 90's in times of financial crisis, was the solution to meet the dual objectives of reducing the costs of administrative cars as well as the public services and by offering quality services with the continuity to the real needs of the citizens. A necessity-oriented culture is established in policy plannings for improved performance.

Parma has created a Citizen’s Service Centre that is innovatively efficient in Italy, by using new technologies and interaction-sensitive services.

For further advancement of the quality services offered to the citizens, the City of Parma has promoted the "IQuEL" project, funded by the first notice of ELISA program, acting as the coordinator of more than twenty local administrations represented mostly from the national territory.

To implement a continuous improvement of the service, IQuEL has created an efficient detection system of the local administrations, starting from the quality level of the services offered. Brunetta’s Decree highlighted the need to combine the assessment of its performance with the capability of the administration to be "accountable" to the citizens.

Quality assessment becomes an obligation to address the need to give tangibility to the achieved results so as to prepare a social report which highlights its contribution to the welfare of the citizens.

The IQuEL Project has developed significant experiences on three lines of action:
- to know and to describe the services objectively (quality supplied)
- to know the perceived quality (Customer Satisfaction)
- to set up the service on the needs of the customer (CRM)

A quality-oriented Public Administration updates the citizen-customer the time of testing and the re-organization of the service.

The City of Parma has given its specific contribution in analyzing and implementing the CRM software (Citizen Relationship Management) which represents its contact center, designed to be the main access of the citizen to a multi-channel contact with the Administration.

The CRM was founded in the trading scheme as a high-tech system created to collect and process client-related informations and aimed at proving the services offered reformulated based on the characteristics and the value of the clients.

The PA certainly does not intend to discriminate among its “clients” but exploit the CRM to manage the complexity:
- of the numerous contact channels that are available to the citizens
- of a number of internal and external information creators that certification of sources are mandatorily provided
- of the processes necessary to fulfill a single requirement that makes it necessary to trace the process of handling the request

The CRM is a tool to help improve the quality by ensuring the uniformity and certainty of the response. It allows you to extract performance indices from the supplied responses and supports the outbound as a too I to collect the customer’s satisfaction or to carry out proactive steps.
Specialised session G

Teaching evaluation in the Italian university system
Descriptive analysis of student ratings

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Let $X$ be a statistical variable representing the student ratings of university teaching. It is natural to assume for $X$ an ordinal scale consisting of $k$ categories (in ascending order of student satisfaction).

At first glance, student ratings can be summarized by a location index (such as the mode or the median of $X$) associated with a convenient measure of dispersion (Leti, 1983) or asymmetry (Leti, 1983; Arnold and Groeneveld, 1995). For instance, the median of $X$ may be associated with the asymmetry index of Leti, resulting in a synthesis that takes into account the ordinal nature of ratings and also communicates information in an effective way.

More generally, there are infinitely many indexes (such as the ordinal entropy) that can be properly employed to measure the ordinal dispersion.

In addition, on the basis of any measure of ordinal dispersion, it is possible to define the corresponding index of ordinal asymmetry following Leti (1983).

On the other hand, student ratings are often converted into scores and treated as a quantitative variable. More generally, it is possible to measure student satisfaction by means of a suitable real-valued function (Agresti, 1984; Bross, 1958; Capursi et al., 2001; Cerchiello et al., 2010; Chiandotto et al., 2000; Civardi et al., 2006), which we denote by $S$. It turns out that $S$ is naturally defined on the standard simplex

$$\Delta = \left\{ (p_1, \ldots, p_k) : \sum_{i=1}^{k} p_i = 1, \forall i \quad p_i \geq 0 \right\},$$

where $p_i$ is the relative frequency of the category $i$ ($i = 1, 2, \ldots, k$). Besides, it seems necessary that such a function satisfies some appropriate conditions. For example, the function $S$ is expected to reach its minimum at $(1, 0, \ldots, 0)$ and its maximum at $(0, \ldots, 0, 1)$.

Finally, each measure of student satisfaction can be associated with a suitable measure of variability.

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Students’ Evaluation of Teaching. The need for adjusted measures in comparative evaluations

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Private stakeholders (families and enterprises) and public financing system constantly ask for a system of indicators suitable for evaluating, in comparative terms, the performance of the university system. These indicators are frequently used to support and enhance only those actors (universities, faculties, departments) who satisfy specific quality standards (defined in terms of efficiency and efficacy).

Some of the indicators considered for the comparative evaluation of teaching institutions in terms of efficiency pertain to the domain of the Students’ Evaluation of Teaching (SET). It has already been argued by different authors that students’ evaluations are influenced by sources of heterogeneity which are external to the teaching processes: students’ cultural background, their previous school/university career, if they are part-time students etc. From these considerations arises the demand to make available comparative indicators which take into account the effects of the so-called Performance Con founding Factors – PCF (Draper and Gittoes, 2004) that operate on both macro (e.g. degree programs) and micro (students) levels. From the second half of the Eighties there has been a growing interest on studies on the effectiveness of educational institutions (Goldstein and Spiegelhalter, 1996; Bratti et al., 2004; Bird et al., 2005) and on the use of statistical methodologies to assess the effect of PCF on the outcome variable at different levels of the data structure.

The approach underlying the building up of adjusted comparative indicators relies on regression analysis models that allow us to measure the influence played by evaluators’ characteristics on the outcome variables used to monitor the performances. In this work we present some applications on data referred to SET in order to explore the potentiality of latent variable modelling approaches belonging to the families of the Item Response Theory – IRT (Rijmen and Briggs, 2004) and Latent Class Regression Analysis – LCRA (Bartholomew, 1999; Hagenaars JA and McCutcheon AL, 2002).

References


The evaluation of educational university processes and teaching activities in Italy: aims, surveys and open problems

Luigi Biggeri

In Italian Universities, the evaluation process started in the early 90s, with D. Lgs. n. 29/93 followed by L. n. 537/93 introducing Internal Evaluation Units (IEUs) in each University and the Observatory for University Evaluation System (UESO) to coordinate them, which was transformed into the National University Evaluation Committee (NUEC) in 1999.

Since the beginning, it was clear that the evaluation of the teaching activity and its quality had to be conducted inside of a general framework of the university educational process, taking into account all the factors that affect the last one’s. In particular in the analysis of the university process of human capital formation emphasis has to be placed on the fact that the student is also a user of the service and, therefore, he plays a more or less active role in carrying out the process and affects the results.

Along these lines, the Law 370/99 foreseen that each university must collect the opinion of the students about the teaching activity implemented in every course programs and the NUEC underlined the importance of using a “minimum set of general questions”, in order to make the methods of collection of the data homogeneous among the Italian universities.

This paper has three main aims. First, an explanation of the place and importance of the students’ opinion surveys and of the evaluation of the quality of teaching on the framework of the evaluation of the educational process and its “accreditation” is presented. Second, a description of the different methods for the collection of the students’ opinions implemented by the different faculties and universities is illustrated, in order to verify the homogeneity of the surveys. Proposals coming from a recent seminar on this topic organized by the NUEC are also presented. Third, attention is devoted to the analysis of the results of the students’ opinion surveys and to their use for the improvement of the quality of the teaching activity.

As regard to each objective, the paper point out the issues still open and some possible solutions.

References

Specialised session H

Law system
The Italian judicial offices productivity in 130 years of cognition civil procedures

Carlo Cusatelli

In Italy, one of the hinge points on which the concept of State leans - the justice - has slipped in a deep crisis more and more since remarkable difficulties in its internal reorganization are accompanied to the natural process of review in the civil society in evolution. The more evident external aspects of such crisis are translated in the slowness of the judicial mechanism, in the high cost of its antiquated procedures and in the difference of the sentences for degrees of judgment and for districts of Appeals Court.

To comfort or to contradict this or that thesis, also, sometimes statistic data are brought in contrast from each other, because of what they define is not well specified. Wanting to give clarity, it is first of all necessary to delimit this analysis to the procedure of cognition, essential unit of the civil trial activity, for an objective knowledge of the phenomenon from the quantitative point of view, to be able to supply stable terms of reference for a better interpretation of the facts and a more serious search of the causes and the effects, reaching a suitable territorial distribution of the enquirer personnel, judging or not.

The analysis of some statistic indicators (e.g., the procedures duration, the index of disposal, the percentage variation of pending) derived by the data related to supervened, exhaustions and pending allows to estimate the productivity of the judicial offices in comparison to the justice demand. In the centennial oscillation of the civil procedures of cognition (and particularly of the relative quotients for 100,000 inhabitants), both in first degree and appeals, a growth is established, especially in the last twenty-thirty years, of supervened and exhausted procedures, and still more than those leaning that among the 1991/2000 decade and the average value of the last seven years go over the doubling. The average life of the civil procedures in every degree of judgment that on the contrary has gone growing since 1881 to today, even though with occasional lowering events. The civil procedures of cognition have reached by now the average duration of 3,000 days, and this means around eight years of waiting for the definitive sentence.

Inefficiency of the judicial system in its complex certainly depends on the backwardness of fartraginous rules and from the shortage of human and material resources, but also - and perhaps above all - from how much it reveals to us, at last, the different productivity of the 29 Appeals Court districts.

References

Evaluating the Administrative Efficiency of Justice Courts in Italy

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Efficiency and effectiveness are central goals for the administration of justice in Italy. Efficiency means economically applying available resources to accomplish statutory goals, while effectiveness refers to carrying out justice system activities with proper regard for equity, proportionality and public safety.

A commonly held view is that the justice system in Italy is chaotic and rather poorly administered. The justice system is busy, with a very large number of transactions taking place annually.

Unanimous agreement exists that the justice system ought to be efficient, effective, and fair (Cook, 1982; Snipes, 1980, Vito, 1972). Less accord, however, exists about how best to secure these essential qualities or how to measure whether they have been achieved.

One of the main goals of the Italian government is to plan expenditure and measurement activities of the justice system. There is an attempt of determining measurement criteria and performance indicators, according to some best practices implemented by some courts.

In this work, using data collected by Istat and Ministero di giustizia (Lupo, 2011), we propose an aggregate index (Molteni, 1999, Sciacca, 2007), obtained through a weighted synthesis of standardized ratios which should preserve the relevance of the context.

Those synthetic indicators (Wilodhorn, 1977) can be decomposed in sub index, in order to obtain a dashboard of indexes useful to evaluate the efficiency of the different subsystems.

The ranking of the Italian justice courts so obtained can be useful to compare the different departments and Corti d’Appello to reward to the courts which best perform.

A critical analysis, from the statistical point of view, finally evaluates the different alternatives proposed.

References
The participatory evaluation in the analysis of the judicial system: the georeferencing of the opinions

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The evaluation of the judicial system affects both the ability to make impartial sentences in compliance with the requirements of substantive law, and the containment of the costs in terms of using public and private resources. The impartiality of the sentences and the compliance with the substantive law are related to the final decision and the "social sharing", while the other component regards the efficiency of the judicial services.

In this context, the subjective data is of great importance, both because it is the basis of "social sharing", and because it is decisive in cases where objective data are not available.

The efficiency, in the broadest sense, is the rationalization and optimization of available resources in terms of employees, facilities and technology, time and resources. In this context it is appropriate to distinguish between administrative/organizational efficiency and procedural efficiency (Romei Pasetti, 2001). The efficacy concerns the evaluation of final results, in terms of how much the final goal has been reached (Cicala, 2000).

In this context, we consider desirable for the immediate future, by means of special surveys, the collection of the citizens opinions about the gravity of the offenses, following an approach to the policy that passes through the surveying of the need for justice (Pacinelli, 1995).

As it happens in other areas of the evaluation, for some particular aspects (such as the perceived risk of the crimes) it is also important to take into account the spatial component. Very often a problem is perceived differently depending on the location or spatial context to which it is related. Thus, for example, it is known that the perception of risk of certain crimes, such as robbery or theft, in a quarter with high crime rate is higher in respect to another quarter of the same city that is considered more secure. Or, in a larger scale, some cities or regions are considered more dangerous than others. In these cases, in addition to the classic tools for opinion survey, it is possible to use other systems that take into account the spatial component, to detect the views of each person (whether citizen or expert) with geographical references: here we propose the “spatial questionnaire”. Therefore, we can collect different opinions on the same subject depending on the location to which they relate.

In this way it is possible to improve the ex-ante evaluation to identify different degrees of plausibility/feasibility of interventions on different places of the same territory or to reconstruct the relevance of the needs and desiderata in a greater spatial detail. This would lead to a diversification of the interventions on the territory that, other things being equal, would produce (ex-post) both an improvement of the efficiency and efficacy of the interventions and a gathering of end-user satisfaction geographically diversified.

References

Specialised session I

Evaluation of cultural services
A Structural Equation Model Proposal for evaluating Visitor Satisfaction at an Exhibition

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The main problems in measuring visitor satisfaction in a museum context are related to the characteristics of intangible services, in the sense that visitors give only an intrinsic psychological evaluation, having made no experience of use. The concept of loyalty, in its common sense, may seldom be encountered; it is sometimes associated to the concept of intensification, usually measured through the evaluation of the satisfaction in consumption of extra services – like purchases of guides, publications, souvenirs or presents –, that are assumed to be related to the word of mouth and thus to the confirmation and transfer of the repurchase and revisit intention also to other people. Sampling problems may arise: unless tickets are purchased on the web, there is no database of the visitors, and when it exists it can be of little use, e.g. when visitors are tourists. The sole impressions of people filling the questionnaires are available and not all visitors may be interested before they attend the event. A kind of systematic sampling is usually adopted, which does not ensure optimality criteria, though giving a representative sample for the visitors’ population.

Structural Equation Models with Latent Variables (SEM-LV) have been commonly and successfully applied to Customer Satisfaction (CS) analyses. To build a SEM-LV we have first to define a construct consisting of a net of concepts related to CS – which are classified in determinants and consequences of CS – and the causal relationships existing among the involved concepts. Here we propose a construct to evaluate the satisfaction level for an exhibition: we consider the ‘Information availability’, the ‘Impression at the visitor arrival’, the ‘Logistic aspects’, the ‘Expositive Route’ and the ‘Hall Personnel’ as exogenous latent variables, the ‘Visitor satisfaction’ and ‘Extra Services’ as endogenous ones.

The parameter estimates confirm what is reported in the international literature; ‘Expositive Route’ has the strongest impact on ‘Visitor satisfaction’. The observed socio-demographic variables may be useful to study the different behaviour of clusters of visitors: (e.g., it is possible to create a segmentation based on the visitor art knowledge background).

Future developments will regard the purification of the scales and the possibility to include in the construct also the modern vision of the service user: he is considered a co-creator of satisfaction, an aspect assuming great importance for art connoisseurs.

References

Between accessibility and marketing: online ticketing for entertainment events

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As part of the larger phenomenon of Internet diffusion and e-commerce development, sale of tickets for entertainments events has gradually grown in the network. The paper aims to assess, through a survey, the level of perceived effectiveness of online sales systems and consumer/audience satisfaction with respect to these services. In particular, we intend to analyze whether and how such services might increase the accessibility of cultural events (live concerts, theatrical events, operas, ballets, film shows) for consumer/audience and as such, however, are tools of an integrated marketing implementation by enterprises operating in this sector. With the term accessibility we intend to refer to the possibility of overcoming the typical economic, social or cultural barriers which tend to make a elitist consumption the attendance at cultural events. This issue is of particular interest because the scientific literature has investigated many aspects of the e-commerce but has not yet considered the specific case of cultural products.

References

An Exchange market model to improve the impact of Lyric Opera theatres in the social and working life

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The main object of this work is to introduce a possible model describing how an Exchange secondary market for the lyric opera productions may work, in order also to originate a new channel of fund raising public or private. In particular, the model should identify all the auto-financing capabilities and, at the same time, define how to measure the value of the specific “product” offered by lyric opera theatres: namely the product is not to be considered only an object for a single specific production but also an entity with a value for and in the market, both in a cultural sense and also from a financial point of view. It seems to be clear, first at all, that his model of market can be constructed only for the tangible asset of the lyric production. In other words, the fundamental topics for this model are basically two: the first one is certainly related to the financial problem that seems to appear as the main problem for the cultural world, not only in our country: the financial constraint require to continuously find new financial sources allowing lyric opera theatres to create new productions; the second factor is that in many cases the “old” productions – also historical and with artistic value and recognition – are subject to a progressive disinvestment program due to the numerous times that a singular theatre has used that specific production and also to the cost of conservation and storage of the inventory related to the production.

There is no model implementing the above issues at the moment, only an hybrid model based on the logic of co-production has been proposed that can be signed as a model intended to reduce basic and real timing costs of a specific production but do not consider the future benefit to realize the production from an economic point of market.

The model that we propose makes it possible to define a real market and compute the value for these productions. In this way it is possible to evaluate: 1) the market artistic value. This is the first time that we can consider the tangible asset of a lyric production as an artistic market product 2) the value of the re-proposing the production at other theatres 3) the value of the possibility of re-proposing to other public institutions.

References

Specialised session L

Evaluation of knowledge transmission via web
Java visual tools for economic, social and epidemiologic statistical model simulation

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During the last twenty years we have assisted to a constant growth of software for statistical analysis and econometric forecast and simulation. These programs also have been boosted by many additional tools and technical procedures. Moreover, the introduction of WYSIWYG (what you see is what you get) form into these applications has made their access easier also for non-specialists. In spite of this greater simplicity, these software need a bit of learning time and a minimum level of technical knowledge. This contribute puts forward some simple Java applications (Java stand-alone desktop applications) useful to make simulation in the economic, social and epidemiologic fields. These applications, which do not require any previous technical learning, consist of single jar-files that do not need to be ins talled and may be distributed as e-mail attachments or also by a copy-paste operation. They only require the JRE (Java Runtime Environment), which is generally installed in every computer with internet connection. Opening these jar-files (by double-clicking) an extremely intuitive main form will appear, in which it is possible to change exogenous variables and see directly the corresponding change of endogenous ones. The underlying simulation model may be complex or not, but its use for the simulation application will remain extremely simple and intuitive. These products could be useful for policy makers, managers or for other categories of users that do not possess a high technical and statistical knowledge but are nonetheless interested in using the simulation model. The presentation will show three of these Java-tools developed in IRPET.

- **Economic simulation and forecast by Input-Output Model of Tuscany.** Simulation tool of a input-output model (Miller, Blair 2009) to see the evolution of four endogenous variables (growth rate of gdp, regional import, foreign import, and employees) by change of the exogenous variables (growth rate of final demand composed by household expenditure, government expenditure, investments, regional and foreign exports).

- **Simulation of health services related to demographic population structure in Tuscany.** Simulation tool to see the evolution of government health expenditure and of the number and type of health services at every change of the population level and age structure plus the evolution of the capital needed to face the request of health services by population.

- **Simulation of outbreak and spread of infectious diseases in populations.** Simulation tool based on a SIR Model (developed first time in 1927 by W. O. Kermack and A. G. McKendrick) to see the evolution of an infectious diseases depending to some parameters (number of susceptible people, number of daily mean contacts per person, infection probability at each contact, starting infected people, share of vaccinated people, incubation period). The tool will show, by graph and table, at each change of parameter, the number of ill people and the incidence of infection.

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Evaluating peculiar lexicon for medical record sections identification

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Information and communication technologies applied to health care domain had lead to the so-called Electronic Health (E-Health) with the challenge to provide value-added services, enhancing efficiency and reducing the costs of complex informative systems. Actually, the e-health is going to change the interactions between patients and healthcare providers. Since many efforts are currently devoted to extract knowledge from texts in order to enhance some features provided by several systems, knowledge management applications, dealing with acquiring, maintaining, and accessing knowledge within data, have a central role in the e-health context. In order to improve the effectiveness of medical record management procedures, techniques for automatic comprehension of textual content are required. The automatic handling of textual contents involves the adoption of several text-processing disciplines that work considering complex and strongly inter-dependent syntactic, semantic and pragmatic aspects. In order to extract knowledge from textual medical records, it is necessary to identify domain relevant terms, their meanings, and the relationships among them.

In general the first activity for knowledge derivation from text has as requirement the identification of the peculiar lexicon, which is a terminological vocabulary representative of the domain (in our case the medical one). For peculiar lexicon identification, different kinds of text analysis based on NLP techniques are required. In this field, methods adopted are related to cross-disciplinary perspectives including Statistical Linguistics (Balbi et al.), (Bolasco and Pavone), (Lebart et al.) and Computational Linguistics (Giovannetti et al.), whose objective is the study and the analysis of natural language and its functioning through computational tools and models.

In this work, we propose a methodology for semi-automatic derivation of knowledge from medical records by means of both statistical and lexical approaches. Moreover, we propose a statistic-based methodology for the peculiar lexicon extracted quality evaluation. The evaluation is performed by means of a semantic distance, based on $\chi^2$ statistical measure, between the lexicon extracted and the corpus composed by the set of medical record analyzed. The methodology can be used for automatic medical record section identification in order to improve the interactions among different actors belonging to the health care domain.

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The assessment of knowledge transfer via WEB

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Nowadays e-learning is becoming increasingly important in the learning environments, thanks to its undeniable advantages respect to traditional training. Unfortunately the transfer of the knowledge through learning-object in the various environments is missing of reference standards for the assessment.

The proposed indicators (Scalise, et al., 2006; Selim, 2007) that are used today are inadequate for a comprehensive assessment of the service. The traditional or e-learning training can be evaluated at four progressive levels: 1. Reaction, 2. Learning, 3. Behavior and 4. Results (Kirkpatrick 1979). In particular, this work focuses on the second and fourth level.

For the second level, it is suggested to identify in the learning-object the critical points (Critical Success Factors - CSF) (Champy, Hammer, 1993; Bracchi, et al., 2001; Selim, 2007) that allow a complete learning. Also, these CSF indicators should be useful to confirm the validity of learning-object or to direct the eventual reengineering.

For the fourth level, it is necessary to define an indicator System that is activated each time you start the transfer of knowledge to the user who connects via the web.

Aim of this work is the design of a System of simple and complex indicators by means of suitable Algorithms.

The indicators proposed in this paper are of two types:
- indirect (the critical tasks, the number of accesses to the module, the usage time of a session, the mode of use, etc.) and
- direct (the average response time to questions, the number of attempts before you answer correctly, etc.).

The system of indicators and the Critical Success Factors identified for learning-object have been implemented for a first-year University Course.

Thus it was possible to evaluate the success of knowledge transfer by means of the learning-objects.

References

Contributed Sessions
Contributed session 1

Education I
A new proposal to assess evaluation models

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In this paper we introduce a novel multivariate concordance index that can be usefully employed to study the dependence between a response variable and a number of explanatory ones. In order to achieve this goal one can resort to some specific statistical tools such as the concordance curve and the Lorenz curves. Let us suppose to have a k-variate random vector \(Y, X_1, \ldots, X_k\) and let us describe the relationship among the response variable \(Y\) and the explanatory variables \(X_1, \ldots, X_k\) through the multiple linear regression model. More precisely, let us suppose that the response variable \(Y\) assumes non-negative values. Furthermore, this approach will be applied when the most relevant explanatory variables have categorical nature and are always characterized by non-negative values representing the corresponding assigned label values. Once built the response variable Lorenz curve and its dual (obtained by ordering all the response variable values in a decreasing sense), one proceeds to the concordance curve construction defined as the set of ordered pairs \((i/n, (1/nM_Y) \sum_{j=1}^{i} y_j^* )\) where \(y_j^*\) is the \(Y\) variable values ordered according to the ranks assigned to their respective estimates. This index can be very useful as a measure of fit when the relevant explanatory variables have categorical nature because it is based on the response variable values ordered according to the ranks assigned to their corresponding estimated values rather than on the euclidean distance. An application in the evaluation context will be developed.

References

Impact evaluation of University grants

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Is the scholarships an effective tool to prevent students from dropping out of higher education? The paper deals with the impact evaluation of university scholarships financed by the Tuscany Region during the last years.

The data used in the empirical analysis are drawn from the three Tuscany universities – Florence, Pisa and Siena-, and collect all the individual data of the freshmen from 2000 to 2008.

We used several statistical methodologies (probit models, propensity score matching, regression-discontinuity design) to compare the performances of students who obtained the scholarship with the other ones.

The analysis shows how the scholarships reduce drop-outs for two cohorts of freshmen and encourage to their graduation. Scholarships’ effects may otherwise vary according to the university and to the amounts, moreover some scholarship’s amounts are too low to prevent low-income students from dropping out.

References

Differential variability of test scores among schools: a multilevel analysis of the 5th grade Invalsi test using heteroscedastic random effects

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The performance of a school system is usually evaluated through the learning levels of the pupils, focusing on school average scores. The variability of the scores across schools is rarely studied in detail, though it is a crucial aspect: especially in primary schools, a low variability across schools helps to guarantee equal rights. To investigate the patterns variability in Italy, we analyse data from Invalsi, the Italian national institute for the evaluation of the school system, which regularly carries out standardized tests to assess the learning levels of pupils at various grades. We consider the mathematics test administered to 5th grade pupils at the end of the 2008/2009 year, along with a pupil's questionnaire for measuring socio-economic factors. The sample includes about 1000 schools and 40000 pupils (Invalsi 2009).

The analysis is performed using a two-level linear model (Hox 2010) on the Rasch score of the mathematics test, with pupil-level errors depending on gender and school-level errors depending on the geographical area. The model includes several socio-demographic and economic covariates and some contextual covariates obtained as school means of pupil variables. The results are essentially in line with the literature and the expectations based on the knowledge of the Italian situation. Nevertheless, the increase in the variance among schools when going from North to South is astonishing, pointing out a serious issue of segregation in Southern Italy. Specifically, the South/Isles area (Basilicata, Calabria, Sicilia and Sardegna) has a low mean score and a high between-school standard deviation (0.486 versus 0.197 of the North-West area), whereas the South area (Abruzzo, Molise, Campania and Puglia) has a mean score similar to Northern Italy but a huge between-school standard deviation (0.652). As a consequence, the Southern regions have both the best and the worst schools in Italy.

References


University careers evolution. A multistate modeling for a perspective study of the Italian situation

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University teachers are a fundamental component for the research and teaching activities development. For this reason it is important for the Ministry of research and policy makers of the Universities to adopt strategic policies of recruitment and retirement of the academic personnel in order to improve the turn-over, to satisfy the needs of planning of research and teaching activities, as well as to improve the efficiency of the related economic activities. In this work we propose a depiction of the evolution of the Italian academic staff from 1988 to 2008 years, and provide a perspective of this evolution for the next five years. To do that we implement a multistate modeling using information such as sex, age, length of service, job position, academic branch and salaries, provided from Ministry of Research and Italian Consortium of Universities (CINECA).

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Contributed session 2

Economics and labour market
A Statistical Analysis of Accidents at Work and Sectoral Performance in the European Economy

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Our research describes safety at work as an issue to be addressed in terms of legislation, with due statistical knowledge of the phenomenon. Through the application of multiple indicators while investigating the rate of homogeneity and non-homogeneity of available data, especially at an international level, the concept at study can be analyzed using specific scientific methods.

The Total Frequency Rate of accidents could be influenced by a country’s industrial structure, so as the added value growth rate (gross domestic product). The standardization of industrial structures into NACE divisions or sub-divisions (and not only on an aggregate activity level), has proved very useful as an integral part of the statistical infrastructure used within the European statistical system for producing comparable statistics. Moreover, thanks to its relation to the International Standard Industrial Classification of all Economic Activities this framework is also an important tool for comparing statistical data on economic activities at international level.

Looking at the distribution of the Total Frequency Rates of accidents in different world regions, the picture is quite different, as the phenomenon is by no means evenly spread across the globe. Fatalities are proportionately much higher in some regions than in others. Carrying out a country-by-country analysis would in no doubt reveal greater variations. Occupational accidents and work-related diseases in some European countries are twice as high as in some others, while in the Middle East and Asia, these phenomena are the biggest component as fatality rates rise four times higher than those in the safest industrialized countries.

In Italy, however, thanks to progressive improvements in the last thirty years, injury levels have fallen considerably below the European average. However, the impact of an excessive economy and the influence of organized crime in the South, which could alter the basis for reporting work-related accidents and occupational safety performance indicators, has led to the consideration of the actual rate of accidents in Italy slightly higher than the European average.

Finally, we highlight that, in the European economy, total accident rate is influenced by sectoral breakdown of gross value added. It is relevant to analyze the relationship between black economy amplitude and the rate of injuries: in Italy it is well above the national average for all regions of the South. Within the entire Central and Northern regions (with the exception of Lazio and Piedmont), it is below national average. Southern regions having a higher level of irregularity based on estimates by ISTAT, should, logically, have higher accident rates, or at least equal to that of the northern regions, which have a lower prevalence of underground economy. Since the data show the opposite, the presence of a large number of accidents not reported could be easily identifiable in these abnormalities, especially in Calabria, Sicily and Campania.

In Europe the existence of significant underground economies and new areas to investigate, particularly in Greece, Hungary, Lithuania, Romania, Southern Italy, Spain, explains the need to make Eurostat indicators more comparable.
A composite index used for measuring intellectual capital of SMEs from Romania

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The aim of the paper is to determine a composite index used to measure the intellectual capital of Romanian enterprises. The composite index is determined testing more statistical methods such as: DEA, Conjoint Analysis, Partial Least Squares or Principal Component Analysis combined with Classical multiple regression model(PCA&CMRM) or Structural Equation Modelling (SEM).

The study continues the previous researches made in this domain. Statistical techniques are applied on a large set of indicators proposed in previous approaches. All the analyses were made on a representative sample of SMEs from Romania.

Our database contains 10-15 indicators used to measure intellectual capital. From all the methods mentioned we decided to apply and compare the results on PCA&CMRM and SEM because due to the context of data availability and nature of indicators it seems that these methods are the most appropriate.

Applying these methods we are trying to find out if there is a method which can indicate how to obtain the final composite indicator for measuring Intellectual capital.

Our studies reveal that none of this method is best. The suggestions are to use both methods because: PCA method is more advantageous when the number of indicators is small and it shows the natural association of components. In most of the cases the Principal components are overlapping the principal components of IC-index found in the literature. The problem of this method is that the new components achieved are losing the practical/economical significance and in most of the cases the standardization is required.

SEM modeling is more complex and there are many mathematical restrictions. Since we are not able to choose multiple variable or large samples because of multiple reasons related mostly of the economic context of SMEs this method is hard to be applied. Even if it is hard to be applied it has a big advantage compared with PCA method. SEM modeling shows in structural form or in reduced form the natural expression and the latent correspondence between the variables as they are in the economy or as they cannot be measured in the reality (but could be seen in the reduced form).

In conclusion we recommend in the first steps a PCA analysis in order to see the natural associations of the factors and then SEM modeling starting from the ideas achieved after PCA results.
The analysis of informal economy and its implication on the services sector. The case of Romania as a country in transition

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In this study we had the goal to estimate the informal economy of Romania using a monetary model. The objectives followed by this method were to know better the dimension of the informal economy during 2000 and 2010 and to see the impact of it on other macroeconomic variables. A special attention was given for the evaluation of the informal economy of the services sector. This importance was given for the services sector because it is the most important sector on Romanian GDP value formation and an estimation of informal economy, without a coherent analysis of this sector, is inadequate. The large weight of its contribution, the heterogeneity and complexity of this sector makes the analysis more difficult. For these purposes we used specific econometrical techniques such as: Granger causality, VAR etc.
Combining Statistical and Algorithmic Models for Latent Variables Analysis: A Look at the Fairness of Work

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The fairness is a psychological construct for assessing the quality of work that has a key role in the workers well-being (Tortia, 2008; Jones and Martens, 2009). Statistically, it can be represented with some latent variables to be inferred by specific questions to the workers which are next projected onto homogeneous groups of items (Likert-type scales).

In this study, using a comprehensive Italian social cooperatives workers data collected in 2007, the so called ICSI 2007 (Carpita, 2009), we combine statistical models, i.e. Rating Scale Model (Andrich, 1978; Brentari and Golia, 2008) and CatPCA (Michailidis and de Leeuw, 1998; Meulman et. al, 2004) with a data mining algorithm, such as Random Forest (Breiman, 2001), to inspect the work fairness. The reason of our proposal, which mixes together two very different statistical approaches, is because when combining the two classes of models we offer more insights than using them separately. Indeed, on the one hand, using Rating Scale Model and CatPCA we first construct some work intensity measures for grouping the subjects within three homogeneous clusters (low, medium and high work intensity) and then identify which aspects of fairness are more or less easy to endorse. On the other hand, Random Forests and, in particular, its variable importance indicator (Carpita and Zuccolotto, 2007), identifies which drivers of the fairness have a strong impact on the overall distributive and procedural fairness items.

For the overall distributive fairness, our results show that for low and medium work intensity, the drivers having the major importance are Responsibility, Effort and Training (with trivial shift on their order), while for people with high work intensity, the most important driver is the Economic resources owned by the cooperative. For the overall procedural fairness, the Respect is the most important driver for all the work intensity categories, however for the medium and high clusters the difference relative to the remaining drivers, having approximately the same importance, appears to be significant.

References

Contributed session 3

Latent variable models
A Latent Class Approach for Estimating Labour Market Mobility in the Presence of Multiple Indicators and Retrospective Interrogation

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With panel data analysts can estimate labour force gross flows — i.e., transitions in time between different states.

Measurement (classification) errors in the observed state can induce substantial bias in the estimation of gross flows, thus leading to erroneous conclusions about labour market dynamics (Bound, Brown, & Mathiowetz, 2001).

A large body of literature on gross flows estimation is based on the assumption that errors are uncorrelated over time. According to that assumption, classification errors produce spurious transitions and consequently induce overestimation of changes.

However, the independent classification errors (ICE) assumption is not realistic in many contexts, because of survey design and data collection strategies. This is especially relevant when panel data are collected by retrospective interrogation (Tourangeau, Rips, & Rasinski, 2000).

We use a model-based approach to adjusting observed gross flows for classification errors, eventually correlated. A convenient framework for formulating our model is provided by latent class analysis, specifically latent class Markov models (Bassi & Trivellato, 2009).

We apply our approach to data collected on the Italian labour market from January 2004 to October 2007 with the Continuous Quarterly Labour Force Survey, which is cross-sectional with a 2-2-2 rotating design yielding two-wave panels one quarter, three quarters and one year apart. The survey collects information about labour market participation on a sample of respondents from the resident non-institutional population.

The questionnaire allows to dispose of multiple indicators of labour force condition for each quarter: (i) each respondent is classified as employed, unemployed or out of the labour market according to the definition of the International Labour Office on the bases of answers given to a group of questions (ii) each respondent is asked to classify himself as employed, unemployed or out of the labour market, the so-called self-perceived condition; and (iii) a retrospective question asks about condition in the labour market one year before the interview.

Our approach provides a means to estimate labour market mobility taking into account correlated measurement errors and the rotating design of the survey. Special attention will be given to the validity of the retrospective questions in relation to the actual measurements made at each time point.

References


Latent growth models with multiple indicators: a longitudinal analysis of student ratings

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Latent Growth Curve (LGC) models aim at modelling change across time. While traditional LGC models are based on a single observed indicator, we focus on a multivariate extension, namely a LGC model with multiple indicators for modelling change across time of a latent factor which is measured at different occasions by multiple items. This model is also known as ‘second-order LGC’ or ‘curve-of-factors’, see McArdle (1988), Meredith and Tisak (1990), Muthén (2004), Bollen and Curran (2006), Steele (2008).

When fitting LGC models with multiple indicators we need to account for both the interrelationships of the observed variables (indicators) within each occasion and the interrelationships of the same indicator across occasions in order to measure change in the latent variable (factor) across time. In this work, we consider a widely used form: the structural model specifying that the latent variable grows according to a random slope linear model, combined with a measurement model specifying that the latent variable is measured at each occasion by a conventional factor model with time-invariant loadings.

The specification of a multiple-indicator LGC model involves several interrelated choices. In particular, the features of the structural model, such as the functional form of the growth, are linked to the features of the measurement model, such as the correlation structure across time of the measurement errors. In this work, we investigate the empirical implications of different specification strategies through an application to the change of student satisfaction about university courses. Specifically, we analyse student ratings collected in four academic years over the period 2005-2008, concerning 380 courses of the faculty of Economics of the University of Florence.

References

SEM and IRM procedures to assess the relationship between latent traits

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The present work is part of the measurement of subjective perceptions, using statistical models to understand their dependencies. The aim of this study is to analyze the relationship between the latent variables (estimated through measures affected by measurement errors) that underlie many of the observed socio-economic phenomena.

Being able to measure these relationships is very important in practical applications: for example to evaluate customer or job satisfaction we can directly measure them through a battery of items, but we have to keep in mind that the assessment should be strongly influenced by other latent variables, such as motivations or expectations.

We will focus on bias and standard error of some parameters estimators of the regression models with variables affected by measurement errors and we make a comparative analysis of the two different approaches: the Item Response Model (IRM) and the Structural Equation Model (SEM).

The comparison between the two proposed procedures will state that the two-step procedure (based on IRM), at the cost of a small loss in efficiency and accuracy, allows more flexibility and provides some useful indications about the reliability of obtained measures.

References

Latent Markov models from a potential outcome prospective for causal inference in dynamic settings

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The latent Markov model was proposed by Wiggins (1973) as a tool for the analysis of longitudinal categorical data. The basic assumption of this model is that the response variables are conditionally independent given an unobservable Markov chain, which represents the evolution of the individual characteristic of interest.

The initial version of the latent Markov model has been extended in several ways; for a review see Bartolucci, Farcomeni & Pennoni (2010). One of the most recent extensions is to multilevel data; this extension was dealt with by Bartolucci, Pennoni & Vittadini (2010), who exploited it to set up an educational evaluation system.

In this paper, we reformulate the latent Markov model from a potential outcome perspective, so as to better justify the use of this model in evaluation contexts. Our approach follows the same lines as that of Heckman (2010), who, in a more general context, shows the equivalence between econometric structural models and potential outcome models (Rubin, 1974). Note that, only recently, both approaches have been extended to longitudinal contexts (Gill and Robins, 2001; Abbring & Van Den Berg, 2003), when the effect of repeated treatments over time is of interest.

From the methodological point of view, the proposed causal formulation of the latent Markov model is based on some assumptions of conditional independence between the potential outcomes and the treatment variables, given the occasion-specific latent variables. Similar assumptions were adopted in the approaches for causal inference of Bartolucci (2010).

We illustrate the proposed framework through an application to a dataset concerning the labor market history of young individuals residents in the Lombardy Region. In this application, the interest is in assessing how university education impacts on job careers.

References


Contributed session 4

Education II
The Course organizational structure as a determinant of academic success. Some evidences from Padova University

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University drop-out is one of the major problems in Italian University. According to data of MIUR/CNVSU (2011), in 2008/09 only 60% of students had a regular career in tertiary first degree level of education and 18% of students withdraw from university after the first year. The percentage of drop-out was quite high before the University reform of 2001. Drop-out had a temporary small decrease after 2001 but, at present, the proportion of students who enter tertiary education without obtaining a first degree is still below OECD and EU19 average (OECD, 2010).

In the literature some authors present studies that aim to detect the subjective factors of academic failure / success (see for example MIUR/CNVSU, 2010; Cingano and Cipollone, 2007). Furthermore, some studies analyse the data at most at the Faculty level or separately for 1st and 2nd cycle degree.

In this contribution we present an analysis by cohort of students and by courses using data from the administrative archives of Padova University in a longitudinal perspective. The goal is to examine the influence of different organizational characteristics of the didactic paths on educational failure / success.

We examine the trends of three specific phenomena: withdraw, change of course and delay, referring to five cohorts of students (2001/02-2005/06) enrolled in 84 undergraduates courses (ex D.M. 509/1999). We carry out the analysis in two steps.

First of all we use *Multiple-decrement life tables* (Garcia, 1994) to describe, by means of survival rates and cumulative decrement rates, levels of withdraw, change of course and delay, to obtain a segmentation of the courses in homogenous groups.

Then we analyse, by means of hierarchical regression models, the effects of context variables that, with personal characteristics, influence the different phenomena we are studying. In this way we can in integrate in an interpretative frame the dimensions that affect withdraw, change and delay. According to the emerging typology we can propose specific intervention strategies to contrast academic failure.

**References**


Measures for Ph.D. Evaluation: the Recruitment Phase

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In the last years the quality of Higher Education (HE) system and its evaluation have been key issues of the political and scientific debate on education policies all over Europe. Apart from the individual political orientation, some of the several themes discussed are critical for the renewal of the education system pursuing the continuous improvement perspective, both on efficiency and efficacy. Following this perspective the measurement of the status quo of the HE Italian system takes an even greater importance. Therefore not only the concepts and the overall set of the assessment measures should be reviewed but it should be also designed a coherent information system able to provide the needed information for implementing Quality Assurance (QA) for HE and its components.

In the wide landscape that involves the entire HE system we draw attention on the third level of the organization of it, i.e. the Ph.D., that represents one of the crucial aspect of the overall education process. Indeed the Ph.D. can be viewed as a production process whose task is to respond to the increasing need of knowledge in all economic, social and institutional activities. This statement lead us to recognize the importance of monitoring the whole Ph.D. system from the recruitment to the placement phase through the training process. In this paper we focus our attention just on the former phase whose main aspects are Ph.D. attractiveness and selection policies.

Referring to the Ph.D. attractiveness, it is crucial to define a basic core of measures able to classify each Ph.D. course or school. We propose some indicators on attractiveness for quantifying an applicants. Instead, considering the selection policy the measures considered are principally related to transparency, fairness and consistency of the defined institutional guidelines and objectives.

The empirical analysis refers to the XXV cohort of Ph.D. schools of the University of Siena. It is based just on administrative data that allow us to compute the over-mentioned measures for each Ph.D. schools. The comparing these indicators we are able to provide useful tools for detecting weakness and strength of each Ph.D. and to aggregate the results at scientific area level. The preliminary results show excellences among Ph.D. schools which seem to be reasonable and in particular useful for the QA process.

References


In the last decades the demand for information about student satisfaction has considerably increased. A large part of the information available about the efficiency and the effectiveness of universities is referred to data collected on objective bases, but there is an increasing need for subjective data and in particular of student satisfaction judgments.

There is a strong interest in measuring the reputation of a university (Giuditta and Costabile, 2006; Iezzi, 2005; Milioli and Zani, 2003). This kind of information is usually difficult to collect, but our proposal is devoted to building a monitoring system very cheap, extensive and reliable.

Our proposal can be implemented by a university interested in monitoring the student satisfaction about same aspects as: information and communication technology available, library resources, accommodation facilities offered by the campus or the city, laboratories, classrooms, parking and public transportation available, feeling with academic institutions, placement of graduate students, quality of life in the area, efficiency and effectiveness of services offered and international relations.

In order to build a system of monitoring reliable and inexpensive it is possible to follow a Delphi like approach. As known the Delphi method is an interactive forecasting method which relies on a panel of experts (Dalkey and Helmer, 1963). In the classical version, the experts answer questionnaires in two or more rounds. At the end of each round, a facilitator provides an anonymous summary of the experts' forecasts from the previous round as well as the reasons they provided for their judgments. Thus, experts are encouraged to revise their earlier answers in light of the replies of other members of their panel. It is expected that during this process the range of the answers will decrease and the group will converge towards the "correct" answer (Pacinelli, 2008).

We will use a version of the Delphi method adapted for web interviews. The student's opinion can be collected by using a CAWI method (Biffignandi and Pratesi, 2003) which is able to split the different aspects considered in many questionnaires that can be randomly administered to the students at the time of booking exams. The monitoring system can be administered directly by the university that will adapt the exam reservation system to the needs of the monitoring system. Data collection will take place during the year. The data will be published in an annual report and in the university website. It will be possible to do some online queries to obtain the information requested. The annual report will contain dashboard indicators useful to compare the student satisfaction with the different aspects considered. The procedure proposed is inexpensive, easy to deploy and manage. It provides a continuous and reliable monitoring system.

References


A two level structural equation model for evaluating the external effectiveness of PhD

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PhD is the third level of university education and is the highest degree of specialization offered by the universities for academic and research careers. In recent years the number of PhDs in Italy has grown significantly and purpose of PhD program have expanded from the traditional ones. The analysis of the contribution of PhD for employment is an important tool for evaluating the quality and effectiveness of doctoral programs. For this reason, knowledge of the employment status and career of PhD graduates becomes essential and can help to reduce the gap between academia and labor market. The aim of this paper is to build a two level structural equation model with latent variables to assess the external effectiveness of PhD. The analysis is performed using data from the research "Current situation and employment prospects of PhDs", commissioned by National Committee for the Evaluation of the University System (CNVSU) to the Department of Statistics "G. Parenti" of the University of Florence. The proposed measure of "external effectiveness" is a latent variable obtained by evaluating the level of satisfaction with the employment status of doctoral students who graduated in 2008. The opinion was expressed one year after graduation on a ten ordered point scale. External effectiveness indicators used are "consistency with studies", "use of acquired skills" and "meet the cultural interests".

References


Contributed session 5

Health and social services
Text-mining: an application for classifying pathology reports

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This work presents a text-mining application for the automatic classification of the pathology reports related to oncological diseases. The reports belong to the laboratories of analyses of the Tuscan region and are very heterogeneous, depending both on the tumour type and location and on the subjective ability in the description of the analysis results. The technique used to perform the classification is named “text categorization” and belongs to the “machine learning” algorithms. Starting from a sample of reports already classified, this technique of text mining allows to train a classifier able to assign new reports to classes defined on the tumour location.

References

NANOVA as a new tool for the evaluation of health services

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In a context of evaluation of services data are often expressed as nominal. Nominal responses are rated the natural way of expressing opinions or actions.

A definition of variance for nominal data was first proposed by Gini (1939).

In the past, since the nominal responses do not generate numerical data, they have been underutilized in behavioral research. This is the case in which nominal responses are elicited, the responses are customarily aggregated over people or trials so that large-sample statistics can be employed (Keppel, 1991).

This paper presents an innovative analysis that directly associates differences among responses with particular sources in factorial designs.

In particular, in this paper we consider data from a survey on the evaluation of health services. The collected data are nominal expression levels of judgment on the evaluation of the hospitals. The importance of data processing and are rated the performance of a newly developed methodology the analysis of variance for nominal data, NANOVA (Weiss, 2009) that will be applied to the opinions expressed in the evaluation of hospitals in Naples.

In these paper the design presented is characterized by: 9 hospitals, each with a score in 5 domains. The null hypotheses would be that neither hospital (9 levels) nor domain (5 levels) affects the numbers obtained. The analysis set it up as a 2-fact or, repeated-measures design with hospitals taking on the role of subjects.

The projected actions, reported nominally, were analyzed with the NANOVA computer program (Weiss, 2009).

References

Domiciliary assistance satisfaction among aged and disabled beneficiaries: a Rasch analysis

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In the European Union countries we assist to a gradual but stable increase of the aged segment in the society composition. Local governments have undertaken programs to improve the quality of life of elderly and disabled. Accordingly, policy makers are focusing more on quality of assistance for social services.

An important component of the quality of care is satisfaction with services. This satisfaction is related to how beneficiaries experience the received assistance compared to their expectation. Generally, measuring satisfaction with home based assistance is not an easy task. First of all reliable measures and data on quality for domiciliary assistance are not readily available. In addition, developing measures of quality for home assistance is difficult partly because of the special characteristics of the service.

In this study we want to measure home assistance satisfaction among aged and disabled people by developing an appropriate questionnaire. We also aim at identifying aspects of the social service achieving a low quality score. These characteristics might require immediate action if they were given a rank of primary importance. In this respect, a questionnaire is administrated to a sample of 117 elderly and disabled people with home assistance services, provided by social services of eight municipalities of Pescara (Italy) district. The questionnaire is composed of 34 items related to various aspects of domiciliary assistance, grouped according to six different dimensions. The importance and satisfaction of these quality aspects is measured by four-point Likert type items.

To comply with the aims of this study, the Rasch model is employed as a statistical, appropriate tool for calibrating the questionnaire itself. As known, the Rasch model has two notable advantages over the traditional methods: the resulting measure is on interval scale and the extent to which data fit the model is assessed. Hence through the Rasch analysis, we are able, in this study, to evaluate the items unidimensionality for each dimension and the model fit, to estimate the items and subjects parameters as well as the thresholds values. Finally, in order to obtain a “strengths and weakness” analysis, the Rasch item evaluation in each dimension is crossed with the importance level, also required in the questionnaire.

References

Performance assessment in healthcare as a management tool

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Performance evaluation allows policy to be linked to management and to orient output results in order to achieve outcomes. In the public healthcare system, multidimensional performance evaluation systems and benchmarking analysis are demonstrated to be useful tools to link performance measurement to performance management.

The paper reports the effects of the application of performance evaluation system first in Tuscany Region and then in other eight Italian regions, as a tool to support decision makers in public health care systems.

Methodology: a multidimensional performance evaluation system has been extensively and systematically used since 2005 within Tuscan healthcare sector both at regional and local level. This system is based on 130 indicators classified in six dimensions: population health status; capacity to pursue regional strategies; quality; patient satisfaction; staff satisfaction; efficiency and financial performance. These indicators, routinely collected, allow benchmarking analysis across all the health care organizations.

With years improvements were achieved in most of the monitored indicators of the performance evaluation system and the high variability of performance across HAs has been reduced allowing a more equitable system. Moreover, further evidence of the importance of using performance evaluation was the presence of a negative correlation between overall performance and costs that indicates that decision makers should focus their actions on improving quality, effectiveness, and efficacy in order to reduce costs.

Practice implications: the performance evaluation system, implemented first in Tuscany, then in other eight Italian regions and now at the national level on behalf of the health care ministry, has become a public policy tool that helps, on one side, the regional government to evaluate its strategic actions and, on the other, to promote a “managed” competition among the HAs. It has been demonstrated to be helpful to enhance innovation and improve results, to increase efficiency, effectiveness and cost containment.
Contributed session 6

Quality and risk
Statistical Analysis of the Perceived Quality and Customer Satisfaction of a ski school: the Sesto Survey 2010

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For manufacturers or service providers who wish to prove their capacity of providing a product that meets the customer needs and also want to increase the customer satisfaction, the quality monitoring and the statistical analysis of data are needful. In particular the quality system of a service provider needs to measure the quality of process and of service through customer satisfaction surveys.

This is the case of the ski schools of Alto Adige which promoted a pilot survey on customer satisfaction, performed in 2010 at the Ski School of Sesto-Bozen (north of Italy near the border with Austria). Specifically the parents of young children under the age of 13, who participated in ski courses organized in Sesto, were asked to answer a questionnaire to express their level of satisfaction about some aspects of the service. The data processing is mainly aimed to two goals:

1. To calculate a global index of quality, as synthesis of the customer satisfaction for the various evaluated aspects;
2. To estimate the degree of “feeling” toward the service and the degree of uncertainty of the respondents and to detect if and how the personal characteristics of the customers can affect these two psychological components, according to the idea that customer satisfaction can measure the “perceived” quality of the service.

To perform point (1) the NPC methodology was applied so that partial and global complex indicators can be calculated for each customer segment (Arboretti et al., 2007). To study the psychological mechanism (feeling and uncertainty) on which the choices of the respondents are based (point (2)), the theory of the CUB model and a suitable test on the covariates of the model can be applied (Bonnini et al., 2011).

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References

Risk Profile using Rasch Analysis

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In this paper we propose an evaluation of the investors’ risk profile in order to account the minimal requirements that Italian financial institutions must satisfy by law (d. lgs. 164, 2007). Therefore we investigate all the aspects characterizing the so-called risk profile: the investor’s knowledge and his financial experience (about financial instruments and their use); the financial objectives, the temporal horizon and the personal predisposition to risk/earn.

The methodology to deal the risk profile in financial literature is essentially based on basic statistics that do not consider any psychological aspect. In order to account the investor preferences and his psychological attitude we propose a Rasch analysis (Fischer & Molenaar, 1994) characterizing the main features of the individual risk profile. In particular we identify a questionnaire whose items describe different characteristics of the latent variable (predisposition to risk/earn). From a first Rasch analysis—conducted using RUMM 2020 (Andrich et al., 2003)—we could observe that there exist at least three latent variables that characterize the risk profile. Thus, we suggest to analyze: the investors’ financial knowledge (financial products, institutions, etc.), the investor’s temporal horizon and the personal aversion to risk using a Generalized Multidimensional Rasch Model with within-items multidimensionality—that may be treated as an instance of a Multidimensional Random Coefficient Multinomial Logit Model (Adams et al., 1997). These analyses are conducted using ConQuest (Wu et al., 2007).

The Rasch analysis applied to results of the test permits to better define the investor’s risk profile. In particular, given the multivariate position of each investor with respects the three latent traits (personal knowledge, risk predisposition and temporal horizon) we can represent his position with respect the possible investments proposed from the bank. Therefore opportuneely rescaling the three dimensions we can prospect different situations that respect the investors risk profile characterizing better the typical investor choice.

References

Safety at work and industrial accidents in Europe: an efficiency analysis

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Safety and health at work is now one of the most important and most highly developed aspects of European Union’s policy on employment and social affairs. For the European Union, in fact, the improvement of working conditions and the prevention of workplace accidents are amongst the primary objectives to pursue, as stipulated in the Treaty of Rome (article 136) and confirmed by the Framework Directive 89/391. Again, at the Lisbon European Council in March 2000, the objective that the European Union set itself was “creating more and better jobs” (Commission of the European Communities, 2002).

In this context, the present paper examines the performance of fifteen European countries with respect to the number of industrial accident. To this purpose, we apply the non-parametric approach to efficiency measurement, represented by Data Envelopment Analysis (DEA), to European data for the year 2005.

However, while in traditional DEA models we have two categories of factors (inputs and outputs), now we consider a third kind of factor, an undesirable output, represented by the number of accident at work. The ordinary efficiency measures are not suitable in contexts where at least one of the variables that have to be radially contracted or expanded is not a “good”. In the standard DEA models, decreases in outputs are not allowed and only inputs are allowed to decrease (similarly, increases in inputs are not allowed and only outputs are allowed to increase). Hence, our objective is to adapt the DEA technique to the problem at hand, where outputs do not refer only to goods, but we also consider undesirable outputs. To effect rankings, we propose therefore a new model type of DEA, where undesirable and desirable outputs will be treated differently.

References


The front-office services provided by some municipalities of the area of Florence: An evaluation of the quality from the supply side

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The objective of this work is to highlight the efficiency of the front-office services provided by the “open office for citizenship” (Uffici Relazioni con il Pubblico, URP) and from the “population registry system” (Anagrafe) in some municipalities of the Joint Statistical Office of the Area Florence (Ufficio di Statistica Associato) for which the Statistical Office of Florence serves as a coordination office. In particular, the selected municipalities are Calenzano, Impruneta, Scandicci, and Sesto Fiorentino. The study is conducted under the project QUA.SER, financed by the Tuscany region, that has the scope to establish a common set of qualitative and quantitative indicators of customer satisfaction among the public administrations that joined the project.

In this vain, we conducted two focus groups with the aim of finding words and contents that can be helpful to describe the peculiarities of the front office services. We studied the text produced along the focus groups through textual analysis statistical techniques, following a mixed method approach (i.e., quantitative-qualitative).

The findings are in line with standard literature on local welfare-state systems. In the analyzed text we clearly found the classical dichotomization between demand and supply, complemented by a subjective dimension. Interestingly, the persons that joined the focus groups (that by definition represent the side of the supply) tend to see themselves as a citizen that make potential usage of such services (and so from the side of the demand).

Our results gave us useful inputs in order to prepare a specific ad hoc questionnaire to evaluate the efficiency of such front-office services among the resident population of each municipality.

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Contributed session 7

Transports
Consumers’ satisfaction with railway transport: a Bayesian Network approach.

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Background. In the last years the interest for consumers’ experience with Services of General Interest (SGI) largely increased. Several surveys have been conducted in order to observe how consumers’ satisfaction differs across EU countries. Judgements are based on personal perceptions and evaluations which, in turn, depend on several unobservable and subjective factors, such as individual characteristics, group-specific features and social norms, as pointed out by several contributions (Bertrand and Mullainathan, 2001).

Research motivation. Some studies (Fiorio and Florio 2010) already focused on the connections between consumers’ satisfaction with SGI, respondents’ characteristics and socio-economic indicators. This literature usually makes use of econometric models for categorical dependent variable. Our work tries to analyse the same issue through Bayesian Networks (Kenett and Salini 2009). Compared with other procedures, this approach allows to remark any interdependency between the variables included in the model. The objective of this work consists in checking the consistency of our results with previous findings.

The data. We use Eurobarometer data, and in particular the results from three surveys conducted in 2000, 2002 and 2004 about SGI. These surveys were sponsored by the European Commission for monitoring and planning purposes and record individual level of satisfaction with SGI, combined with some information about respondents’ individual characteristics. Among all SGI we focus on railway transport. Moreover, we include in our network some macroeconomic variables, in order to underline any link between the socio-economic environment on satisfaction.

Method. In this application we use the package R and the library bnlearn (Scutari, 2010). Compared with other software, the advantage of using this package relies in the possibility to perform both constrained-based and score-based methods on our sample, testing several and alternative algorithms.

Results. Our results show how networks’ estimations slightly differ based on the learning algorithm applied. Concerning individual characteristics, most of the findings are consistent with the results pointed out by previous literature. The inclusion of socio-economic indicators is apparently more complex and highlights the limitations of this approach when dealing with mixed datasets.

References
An overall passenger satisfaction measure through a Structural equation model with high-order latent variables

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The aim of this paper is to propose a new concept of global measure for the Passenger Satisfaction (PS), by considering the approach of the high order latent variables (Henseler et al., 2010).

The paper will introduce the idea of the high order Latent Variable (LV) in the context of the Structural Equation Models (SEMs), by considering the Partial Least Squares (PLS) estimation method. We will present the two main approaches consis dered in literature: the repeated indicator and the two-step approach, showing the advantage and the disadvantage of choosing one method rather than the other.

After the presentation of the statistical method, we propose a new paradigm to define the global measure of PS by using an high order LVs with Path PLS. The global measure of PS, rather than being conceived as one LV directly measured by manifest variables in the questionnaire, is here modelled as the meaning underlying all the dimensions of satisfaction measured by the questionnaire (i.e. Tangibility, Reliability, Responsiveness, Assurance and Empathy, for the SERVQUAL approach. Parasuraman et al., 1985).

We will compare some PS surveys known in literature (Camminatiello et al., 2010; Gallo et al., 2009; Ciavolino et al., 2010), where the PS model is defined via SEM and the global measure is identified by a specific or derived LV.

The comparative analysis, between the high order model and the PS models, will be made by evaluating the accuracy of the LVs estimated and the efficiency of the parameters, drawing some conclusions on the empirical results obtained.

Moreover, the results of a simulation study, aimed at evaluating the effect of a reflective and formative measurement and the relationships between the first and high order LVs, will be shown and commented.

References
Passenger satisfaction: a multi-group analysis

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To analyse the level of passenger satisfaction of a public local transport service a PLS Path Modelling (Lohmöller, 1989; Tenenhaus et al., 2005) was adopted. The results obtained were used in a classification tree model (CHAID algorithm, Kass, 1980) to detect which aspects most influence the passenger satisfaction, or better, which latent variables can be used to segment the travellers population in subgroups.

The main goal of this paper is to verify the opportunity of matching the PLS results with a CHIAD algorithm and to verify, through a multi-group analysis, the invariance of the classification rules with respect to some variables.

In the model that we hypothesized, the passenger satisfaction is the result of many unobservable factors. The influence of each factor was estimated by using a PLS algorithm. The passengers are found to be very sensitive to the level of the service organization and to the way the service is delivered (punctuality and regularity of the buses and short waiting time).

The safety and reliability of buses, the level of comfort and cleanliness and the professionalism and courtesy of staff had, also, a big weight to determine the passenger satisfaction. Applying a segmentation analysis, such latent variables were used to detect the best classification of passenger satisfaction, i.e. which latent factors are better able to segment the travellers into different subgroups in terms of satisfaction. It has been marked that the results of the two procedures do not overlap, rather they are complementary in the characterization of the passenger satisfaction.

The organization of the service was found the best splitter variable, dividing the population into three subgroups: very unsatisfied, medium satisfied and very satisfied. In this way it was possible to study the behaviour of the subgroups in order to discover the reason of the satisfaction or of the dissatisfaction and to improve the level of the service.

References


Using the Disco index for the determination of the Passenger Satisfaction

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In the local public transport the monitoring of the opinions expressed from the passengers on the quality of the service offered is of strategic relevance. The passenger satisfaction is, in fact, very important to keep the market, to increase the use of the public transportation system, to attract new travellers, to improve the image of the company in the public and to ensure financial results in the future years.

Obviously the measurement of the satisfaction is complex because of its subjective nature and the presence of other factors that are not always easily separable.

The global satisfaction of the users of a service is determined by different factors that influence the judgement (according to Zeithaml, Parasuraman and Berry, 1991, five categories – assurance, empathy, tangibles, reliability and responsiveness – affect the perception of the quality by the users). Of course, each researcher modifies the classical questions and the categories according to the aim of his survey, but the fact that the overall quality is influenced by many features of the services is incontrovertible.

The building of a good questionnaire is then of fundamental importance to detect the satisfaction that a user, in our case a passenger, perceive by the service. At the same time it is important to use the right statistical techniques to measure the satisfaction and to underline the variables that have a bigger weight in the determination of the perceived quality. Many techniques have been used during the years to reach this purpose, with benefits and pitfalls.

In this paper we describe as the disco index introduced by Raveh in 1983, developed subsequently (Guttman, 1988; Raveh, 1989), and applied prevalently in the context of discriminant analysis (Choulakian et al., 2001; Simonetti et al. 2003) can be an important instrument that can be used by the researcher to discover if some variables have more importance in the determination of the overal satisfaction for the passenger of a local public transport firm. The disco coefficient will be used in a discriminant analysis and in a logistic regression model in which the dependent variable will be the passenger satisfaction (satisfied or not satisfied) and the independent variables will be some features of the service.

References
Contributed session 8

Latent variable models and customer satisfaction
PLS models: importance of the stability during the time, how was insured in the case history of Hera

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Hera, multiutility leader in water, energy and environmental services based in Bologna, monitors its clients satisfaction using a PLS models developed with CFI Group Italia since 2005. The multivariate model built for Hera is very complex and peculiar due to latent variables with different number of respondents. To compare scores and impacts along the years is very important they are stable and consistent. The causal models are processed using PLS (Partial Least Square) algorithm that ensures stable and consistent results throughout the years. The article shows how the model has been built and which statistical parameters have to be considered to obtain stable and consistent models.

References

The customer satisfaction in INAIL

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The Institute has always been in the forefront of adopting innovative services to its users and, therefore, careful to maintain a high level of quality.

This continuing research aimed to raise the quality perceived by users is a challenge increasingly difficult with increasing complexity of the system (channels detection, increase in services, integration and cooperation with other agencies, etc.).

Every year the Institute is responsible for the periodic survey of customer satisfaction. The survey is one of the tools to measure the degree of satisfaction compared to the service provided for the improvement of quality services.

Starting in 2010, according to new regulations, the survey has also become a tool for evaluating staff Inail and this was extended to all the offices.

The Inail’s universe is made up of 222 offices of different sizes located throughout the country, about 20 million policyholders and 3.9 million companies of which approximately 900,000 injuries annually.

The survey regards all INAIL’s offices and the questionnaire is delivered through three channels of detection: the interview at the headquarters, the interview by phone and e-mail.

The aim is to obtain an opinion as objective as possible about the services provided by Headquarters.

For the new project has developed a unique questionnaire, for each place was set, the minimum sample size according to the office portfolio and channels of detection.

The main criteria analyzed are: communication, trustworthiness, well-timed, clearness. The customers are profiled depending on the: kind (workers and companies), age and sex.

The total data are processed regardless of the means of detection used, would be included at trial on the work of reference.

To measure the degree of satisfaction with aspects monitored, prompting the user to express their opinion through a Lickert scale with 5 values.

It’s been set as an objective opinion “fairly satisfied” against which to evaluate the performance of each single Office.

In order to analyze the data are used different statistical indicators such as: weight mean, standard deviation, standard error, confidence interval 95%.

This article shows as the INAIL ‘s experience in recent years has achieved significant results regarding the quality of services provided.

References

Measuring the administrative compliance burden on enterprises. The Italian experience

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Regulation is an important tool to support public policies (taxation, environmental protection, health and employment rights) and creates benefits for the participants in an economy because it can correct market failures. However, badly designed administrative regulation or overly complex imposes excessive costs in terms of time and money. The challenge for government is to maximize the potential economic benefits from regulations while keeping cost as low as possible.

In 2007 the Italian Government launched a new national Multiannual Plan (2007 – 2010) for the Measurement of Administrative Costs and a quantitative reduction of administrative burdens for enterprises. According to the Law no. 133/08 article 25 (so-called “Taglia-oneri” – “Cutting red-tape”) the Italian government has approved a number of measures aimed to cost cutting, structure simplification and administrative processes streamlining through a specifically project labelled “Measurement of Administrative Costs” (Misurazione Oneri Amministrativi). The effort is to identify the regulatory requirements that could be measured and simplified, without altering the expected public interest objectives.

Quantifying these costs is difficult. Enterprises tend to apply the term of administrative burden in a much wider sense, incorporating many of the perceived direct and indirect costs of regulation. From a methodological viewpoint, there are two ways for measuring regulatory burdens: “top-down” and “bottom-up”. Top-down approaches typically involve surveys of organizations. Bottom-up approaches typically involve in-depth discussions with a smaller number of individuals and groups and case studies to examine the impacts of specific regulations.

The Italian experience combines advantages of both approaches. A two-phase national survey has been carried out only on small and medium enterprises. First of all, a screener questionnaire is used to identify enterprises that have complied with at least one administrative burden for the estimation year. This first survey also provides an estimation of enterprises affected by the regulation and categorizes enterprises in relevant economic segments. In the second phase, a subset of eligible enterprises is randomly selected. The aim is to estimate the costs incurred by enterprises in order to comply with information obligations. The methodology used is based on the EU “standard cost model” (SCM). It breaks down information obligation into a range of measurable components and activities and costs are then apportioned to the identified activities. Questionnaire and interviews guides in involve a continuous process of specific consultation of stakeholders and public administrations. Moreover, to reduce measurement errors, expert assessments provide a warning level alert when enterprise interviewed declares that administrative costs are exceeding the expected threshold.

Public authorities but also private enterprises demand reliable statistic information for decision-making: Istat efforts are meant to satisfy these requests. Between 2007 and 2010, Istat has estimated costs caused by 54 administrative procedures associated to eight different sectors. Some Central Administrations, coordinated by the Department of Public administration, have adopted Reduction Plans, in order to implement appropriate actions to reduce administrative burdens and costs for enterprise.
Common Components and Specific Weights Analysis of cross-product tables for the Full Multi Modules Customer Satisfaction Evaluation

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Servqual model (Parasuraman et al., 1994) involves a set of five dimensions that have been ranked by customers to be most important for service quality: Tangibility, Reliability, Responsiveness, Assurance and Empathy. Many multidimensional statistical methods have been proposed in literature for the description and the exploratory study of these kinds of data. Basic aims are to estimate the multidimensional aspects of the investigated system and the introduction of criteria of judgment. A lot of them are based on the maximization of the covariance coefficient between linear combinations of the variables of two matrices: the Co-inertia Analysis (Chessel, Mercier, 1993) and the Co-Inertia of Fully Matched Tables (Torre, Chessel, 1995). Amenta (2009) suggests to consider the Common Components and Specific Weights Analysis (CCWSA) (Qannari et al., 2000, 2001; Hanafi and Qannari, 2008) in order to estimate the multidimensional aspects of the investigated system by taking in account the number of dimensions directly in the criteria. The rationale behind this method is the existence of a common structure to the data tables, where data tables reflect the service quality dimensions. Therefore, the method determines a common space of representation for all the data sets. Each table is allowed to have a specific weight (or salience) associated with each dimension of this common space. Each salience represents the percentage of total variance of each table (service quality dimension) explained by the jth common component. A deeper analysis can be considered (e.g. in the student satisfaction) if we have questionnaires taken in different K modules or times (as example, during a post-degree training course with different teachers): we have K pre-service matrices (one for each module) and K post-service matrices (at the end of each module).

Aim of this paper is to propose a new approach in order to analyze this complex expectations-perceptions system (Full Multi Modules). This two-step strategy consists in performing a CCSWA analysis of the matrices of cross-covariances between the variables of each expectations/perceptions system. In the first step, we use Co-Inertia Analysis K times to compute the sequence of cross-covariance tables, and then CCSWA to analyze this sequence to highlight the common structure of the data tables.

References


Contributed session 9

Education III
Evaluation of performance at university with Rasch Analysis

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In 2007/2008 the University of Salento has started a degree course in Psychology. Right from the start, the people in charge of the course have been focusing on preventing early dropouts by stimulating a better professional awareness and by ensuring the best possible course experience (Venuleo et alii, 2009). To do so, the students were asked increasing performance standards to prevent the choice of university studies as mere alternative to work.

Various managing activities have been undertaken, some (Salvatore, Mossi et alii, 2008) regarding the training experience (seminar approach to the studies, debt recovery activities, tutoring, workshops based on the university experience) and others with the purpose of controlling the same training process (monitoring career). This study refers specifically to the latter aspect or the arrangements for monitoring the academic career through the analysis of performance studies. This has a double utility: on one hand it calls for the recruitment of competent student function in the degree course, on the other hand it makes clear to the students themselves that the intervention is not reduced only to the operational dimension, but it also implies the dimension of organizational management of the training process (Salvatore & Scotto di Carlo, 2005).

Normally a review of developments in the curriculum in relation to explanatory variables is performed using statistical inferential model where the dependent variable is the grade obtained in the different disciplines or even the credits acquired by the student (Kulatunga-Moruzi & Norman, 2001).

The particular structure of the activity since its inception allows the acquisition of the results of a career not only in terms of quantitative results, or through the allocation of a vote or the subsequent derivation of the credits, but also by examining the re porting of failures recorded by the students during the academic career. That's how it was possible to introduce the evaluation of the curriculum using Rasch Analysis. The model involves the insertion of the exam's outcomes analysed in terms of success / failure examination for each of the constituent disciplines of studies. So by treating the exam as a test, the Rasch model allows to assign a value to each student and to estimate logit that defines the degree of performance of the career.

This model establishes a more reliable criteria for the verification of differential variables useful for monitoring the training process (for example: final grade to high school diploma, sex, age, university registration renewal, etc.) and the subsequent management of the training process.

References
Ability effect influence on the Italian graduates’ labour income: ATT estimation and sensitivity analysis

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Several problems occur in estimating causal effect of education on individual labour income by utilizing traditional estimation procedures such as OLS and IV. The strong dependence between individual ability and schooling makes it difficult to estimate their separate effects on income, mainly as a consequence of the omission, in the specification of the income equation, of the “latent” individual cognitive ability.

The difficulty to find an instrument suitable as an unbiased measurement of ability produce a spurious relationship between labour income, as dependent variable, and education level and working experience as explanatory variables, in the sense that the estimated relationship partly reflects the influence of the latent unobservable ability on both income and explanatory variables. This circumstance implies potential inconsistency of the education effect estimates obtained by applying an IV procedure (Heckman and Vytlacil, 2001, inter alia). The aim of this contribution is to improve the IV approach in estimating the influence of education on labour income. To this purpose, we estimate the difference between the labour income earned by an Italian graduate and an Italian holder of a high-school diploma who are similar in terms of age, family size, status in the family and geographical area of residence. We consider graduates as a group of treated and the high-school diploma holders as a control group. In this context, education level can be assumed as a dichotomous selection criterion for the assignment of the subjects to the treatment. We suggest to utilize the results of a preliminary reduced form estimation of the conditional probability to receive the treatment or not as a matching procedure to estimate the difference between a graduate and a diploma holder in their perceived labour income. In this way, the impact of several factors on labour income gap can be estimated distinguishing the influence of individual ability, measured by the difference in high school test score, between a treated (graduate) and an untreated (diploma holders) subject both characterized by a similar socio-economic profile.

Treated and untreated subjects are drawn respectively from two different dataset. We select a survey sample of “treated” (graduate) subjects from the 2007 Istat Survey on Italian Graduates in the year 2004. The control group, holders of high school diploma, is drawn from the Bank of Italy SHIW Surveys in the years 2004 and 2006.

We suggest the use of a sensitivity test (cfr. Rosenbaum, 2002) to verify the robustness of matching results if the Ignorability condition (matching is not influenced by omitted variables) is violated. To this purpose, we verify the robustness of the ATT estimation results simulating the influence of “hidden” and potentially “confounding” factors on the assignment to the treatment.

References

The impact of the "3+2" reform on degrees

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The aim of this research is to evaluate the impact of the Italian University Reform (the so-called 3+2) on the rate of degrees achieved in the scheduled time. We obtained our data from the register office of the three Tuscan Universities (Firenze, Pisa, Siena), which contains all the personal information of the students.

Propensity Score Matching has become a popular approach to estimate causal treatment effects. It applies for all situations where one has a treatment, a group of treated individuals and a group of untreated individuals. Its basic idea is to find in a large group of non-participants those individuals who are similar to the participants in all relevant pre-treatment characteristics. That being done, differences in outcomes of this well selected and thus adequate control group and of participants can be attributed to the treatment. Our analysis refers to the group of freshmen enrolled during the academic year 2000/01: this student’s cohort is the only one that could choose, after the reform, if to shift into the new system or not.

In order to perform propensity score matching, we consider as “treated” the group of the students that shifted into the new system, while the untreated group consists of similar students in all relevant pre-treatment characteristics (age, gender, mark and kind of diploma, etc.).

The first results show a 24% increase in the rate of degrees obtained from the shift into the new system, even if the average effect of treatment varies across different universities. However, there is not a satisfactory effect on the probability of obtaining the long degree (laurea magistrale) within 7 years.

References
The Estimation of Dimension and Factors of School Abandon in the Romanian Development Regions

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During the transition period in Romania the dimension of school abandon had risen. The main goals of the study are: to estimate the school abandon rate by each educational level on the development regions from Romania, to identify the factors which affect school abandon; to determine the correlation between the school abandon characteristics and the gipsy population percentage, to analyze the effect of governmental strategies. In the same time the analysis had followed also the temporal component by including in the database of the last decade statistical information. The school abandon was measured as the difference between the numbers of pupils/students found at the end of the school year and the same category enrolled in the beginning of the same year.
Contributed session 10

Socio-economic topics
The system of “performance evaluation” of the Ministry of Labour and Social Policy: an analysis of the production function of output inspection

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For several years it has become the practice of Public Administration quality assessment as part of the institutional activities carried out by offices (Bank of Italy, 2002). Each Public Administration has therefore prepared appropriate instruments to enable an effective measure of its products (Morvillo, 2008).

The Ministry of Labour and Social Affairs has adopted a system of “quality assessment” based on indicators selected as representative of the inspection carried out in branch offices (eg. number of inspections carried out, undocumented and “black” workers, number of unprotected minors found in the company, requested administrative injuries received in the offices, non-payment contributions found during inspection access, etc.).

This scoring system - called Project Quality - is defined by three “synthetic indicators” determined periodically to the 92 Provincial Labour Departments operating in the country. It does indeed have a rating system that defines a ranking between the provincial offices. A pilot study carried out on the basis of this national ranking has suggested the possible influence exerted by the “local variables”, i.e. those relating to the socio-economic differentials, in explaining the efficiency of inspection.

The purpose of this paper is to present the results of research work in collaboration between the Regional Directorate of Labour of Puglia (peripheral organs of the Ministry of Labour and Social Policy) with the University of Salento, in order to analytically describe the performance level of the Provincial Labour Departments of Puglia. The measurement of performance according to variables related inspection and local was formalized through a structural equation model.

The results of the modeling and analysis will also be compared with those achieved in the project as defined at the national level by the Ministry.

References


Assessment of relevance and efficiency of scientific research in Universities departments

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The last legislative actions of the Italian government have started a revolution and a race to the improvement by the Universities, in order to avoid penalties. In this context, some doubts arise on scientific research evaluation and his costs: the 2001-2003 VTR exercise, conducted by CIVR in 2005-2006, was very expensive, providing a very partial picture of the Italian scientific reality. The next exercise of evaluation (considerably more detailed, but surely far from complete) should cost much more.

The key to any assessment must tend the improvement, but scientific research has fast dynamics; it is thus necessary to evaluate it with continuity: ideally, every year or every two years. But the continuous assessment of the research quality seems almost impossible: the cost of obtaining data in this field, with the criteria previously set by CIVR, appears huge. But other aspects could (and maybe should) be evaluated in the scientific research, although they were confused often with the quality (or the effectiveness): importance and efficiency of research, which, in lack of information on inputs, could be estimated through the output of the research, i.e. the number of scientific products.

In this paper we propose to estimate of the actual scientific productivity of institutions thru a simple indicator born as an evolution of VPS, proposed in 1999 by the Observatory for the Evaluation of University System. This indicator starts from the concept of equivalent product of a single researcher, \( EP^w_k = \frac{w_k}{a_k} \), where \( a_k \) is the number of holders of the \( k \)th scientific product (i.e. the number of authors of a paper), defining his "degree of property", while \( w_k \) is the weight of scientific potential of such product or its relevance.

The equivalent productivity of a research Department is simply obtained by adding all the \( EP^w_k \) values of the researchers who belong to it: \( EP^w = \sum_{j=1}^{c} \sum_{k=1}^{np} \frac{a_{jk} w_j}{a_k} \), where \( c \) are few categories of scientific relevance (with regard to scientific publications, we identified such categories using data available for each researcher in the database provided by CINECA). The numerator \( a_{jk} \) is the number of researchers belonging to such department that are "owners" of the same product (e.g., co-authors of a paper).

Two useful indexes may be easily obtained from such equivalent productivity value: the Product Relevance Index, \( PRI = EP^w / np \) (which maximum is given by the maximum value of \( w \)) and the Structure Productivity Index, \( SPI = EP^w / nc \), where the term \( nc \) is the total number of researchers belonging to that structure, including those without products.

Such indicators, which are easy to calculate (with low cost or zero cost), are not explicitly oriented to the evaluation of the quality of scientific research, but they highlight the productivity and the relevance of such research. They can be used to evaluate in a simple way the research potential and productivity in the university departments and to allocate internal funds for research, as already done somewhere with several criteria.

An experiment showed that \( PRI \) and \( SPI \) lead to almost balanced rankings between research departments of different orientation ("medical & health sciences", "science & technologies", "other orientation"), although it was limited to the database of publications. Better results could derive by using data on all scientific products.
A Structural Equation Model to analyze the Household Budget: a case study

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The Household Budget Survey (HBS) constitutes the basic information to describe, analyse and interpret consumption expenditure of households.

The survey, based on a sample of households, collects data on household expenditures for consumption, with a particular focus on social and economic aspects of households' living conditions. The survey allows both the qualitative and quantitative analysis of living standards and consumption behaviours of the households, referred to different typologies and territorial and social contexts.

The main purpose of the survey is, in fact, to collect information on the structures and levels of consumption expenditure by the main socio-economic and territorial characteristics of the households; all expenditures afforded by the households to purchase goods and services are registered. The definition of consumption expenditure includes also goods coming from the households' garden or farm directly consumed by the household itself (self-consumption), the goods and services provided by the employers as salary, the imputed rent for houses occupied by the owner or used without a charge.

In order to draw a complete picture, the survey collects data on expenditures for food and beverages, housing, furniture, clothes and shoes, health, transport and communication, recreation, culture and education and other goods and services not already mentioned, in addition to information on the household members (relationship, age, marital status, education level, professional condition and position) and on housing characteristics.

The results are presented by groups or categories of expenditure (those considered more relevant), analysed by territorial breakdown, household size and typology, occupational and professional condition of the household head, as well as by those characteristics which, more than other, influence and characterise the consumption levels and behaviour.

The data obtained have been elaborated by a Factorial Analysis in order to identify the main aspects that influence the habits of Italian Household. Starting from these results, we hypothesised the relationship among latent variables and we used structural equation model to analyze the data gathered.

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Research Projects Evaluation. A Small Case Study on “Ideas” Competition from National Research Program of Romania

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In this paper we will briefly present an analysis of the evaluation process for the research projects from “Ideas” 2008 Competition held in Romania within the National Research Program. We will focus on the socio-economic domain. The competition started in 2008 and there were 675 submitted grants. The projects were constructed on a multiannual scheme (36 months). After the initial evaluation there were accepted for financial support 208 grants. After the first year of implementation (2009) there was a yearly evaluation and, subsequently, 68 projects were selected for receiving financial support for the second year of implementation (2010), while from 75 projects that had been receiving a “promise” for financial support and had to be delivered in 2011, 45 projects were “suspended” and the rest of 19 projects were stopped. At the end of 2010 there was another yearly evaluation and, according to the outcomes of this process, for final implementation year – 2011 – a number of 186 projects will be receiving financial support.
Particularities and typologies of the development level of Romanian’s villages from the ethnic affiliation view point

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This paper is using a quantitative methodology and aims to analyse the way in which the ethnic affiliation of Romanian villages has an impact over their development level. The development level used (measured by Communes Development Index – CDI) was designed by Dumitru Sandu (2009). The CDI was build, for all 3000 Romanian villages, on a similar structure with Human Development Index (HDI) having three components: life expectation, education and economic level.
Contributed session 11

Ordinal data and latent variables
Performance Assessment of Social Agents. A goal-planned approach

Giulio D’Epifanio

In evaluating social agents, an approach is outlined to construct a performance index, which is based on goal planning. Goal planning should be grounded on specifications of requirements, from some policy-commitment (PC) (e.g., a certain institutional stakeholder), at which the policy-maker (PM) would respond. In a simplified version, goal-planning sheets might be depicted by Pert-like (direct acyclic graphs) DAG diagrams (D’Epifanio, 2010), where nodes are testable binary goals and the ultimate node is identifiable with the complete attainment of the overall-goal. Using logical operations, taking into account specifications of priorities and preferences from the PC, a sequence of binary testable goals may be distilled, which is Guttman’s ordered and value-increasingly. Data are provided by sensors, which check the goals across the planned Guttman-ordered sequence, possibly conditional on context and subject conditions. Then, over such a sequence of goals, a graduated scale of performance may be operationalized, by using the “intrinsic worthiness” criterion (D’Epifanio, 2008), which is calibrated on statistical behaviour of reference gold-standards, to graduate the worthiness of subjects on the decision-maker's goal-oriented trait. Formally provided by a Choquet's integral, an index is finally proposed which may be practically useful in referenced monitoring of advance of subjects against the programmed path of operative goals, towards the decision-maker's overall-goal. Examples of distilling processes are outlined, over various types of Pert-like diagrams, to construct types of ordinal performance scale, e.g., in educational evaluations. Finally, based on the programmed goal-planning, a social index may be derived which uses the Quiggin-Yaari functional from the “rank dependent expected utility” theory.

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The EN index for the use of the normal, exponential, beta or gamma distribution in the indirect quantification

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The evaluation of capabilities, attitudes, customer satisfaction, in different fields of the real life, is one of the problems that, during the last years, have been studied in social sciences. In fact, these qualities are not directly observable, but they are expressed with the modalities of ordinal scales. In these circumstances, if we want to perform the evaluation, it is necessary to assign some scores to the categorical modalities of the analysis.

A simple technique is the direct quantification: this technique hypothesizes that the modalities of a qualitative character are at the same distance, but this hypothesis is not respected in many situations. For this reason it is preferable to use an alternative technique that consists in assigning real numbers to the categories of the qualitative variable. In this type of quantification the numbers are not equidistant but they depend on a latent variable. Different measurement techniques have been developed during the years, based on the hypothesis that the model is normally distributed.

This assumption is not realistic when the judgments are all extremely positive or extremely negative. In this case the assumption that the latent variable is exponentially distributed could be a solution.

Obviously the choice between the two distributions is not easy, but the EN index (introduced by Portoso in 2003), can be a good instrument to detect the right assumption.

The EN index assumes values between -1 and 1 and, in previous works, it has been showed that if the absolute value of the index is between 0 and 0.30, the normal distribution is the better one; instead if the index has values between 0.60 and 0.90, the exponential distribution seems to be the more appropriate.

It is clear that there are intermediate values of the index (0.30-0.60) for which neither the normal distribution nor the exponential distribution can be considered adequate. In this paper we will show how, in this case, the beta or the gamma distribution could be the most appropriate latent variables in the indirect quantification.

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A PLUM model for the evaluation of university teaching

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The teaching evaluation by students attending the course, conducted using questionnaire in the Italian universities might seem like just a bureaucratic process, aimed at simple compliance with ministerial duties. This form of assessment is, however, an important monitoring tool, available to the institutions responsible for governance and management of formative processes: Faculty Councils, degree course Councils and individual teachers (Chiandotto et al, 2005).

The need for teaching evaluation, in addition to being perceived as very important by the university system itself, is also required by law; in particular we refer to Law 370/99, art. 1 (Internal Evaluation of Universities).

The aim of this paper is to show the phases of the statistical detection which led to the satisfaction of knowledge needs on the students, shared for their Faculties and for degree courses. By using appropriate statistical methods, it is possible to identify factors that facilitate / hinder learning by students. This monitoring process is aimed at the adoption of correction measures, where such evidence is necessary. This study takes into account the evaluation of the “internal effectiveness” of teaching, based on the opinions of students, using the evaluation questionnaires, completed by students attending the courses.

Data were collected from the academic year 2009/2010 by the Evaluation Group of “Magna Graecia University” of Catanzaro. We consider twenty-four courses belonging to the Degree in Business Administration; in order to protect their privacy, only their codes are shown (EC09001, EC09002, EC09024 ...). The questionnaire is structured in the following five sections: Section 1: Course organization; Section 2: Teaching organization; Section 3: Educational activities and studies; Section 4: Infrastructure skills; Section 5: Interest and satisfaction.

The response is measured on an ordinal scale with four categories: Definitely not, More no than yes, More yes than no, Definitely yes.

From a methodological point of view, given the nature of the data, we decided to use the Polytomous Universal Model (or “PLUM” procedure), that is the procedure for the estimation of ordinal regression models (implemented in SPSS); it allows to model the dependence of an ordinal response on a set of categorical and scale independent variables (Marija Norusis, 2010). In particular, we used the logit as link function and, so, we estimated an ordinal logit model.

The preliminary descriptive analysis shows that most of the students consider red insufficient the background knowledge; they perceived as too high the overall study load and, therefore, don’t consider it apprropriate to the claim assigned to the matter subject. They retain useful interim tests and supplementary educational activities; they declare to attend more than 75% of the teachings lessons. Finally, they often don’t feel involved by the teacher during lessons but they judge largely positive the teacher’s availability for clarifications and explanations.

References

Complementary use of different methods to evaluate Customer Satisfaction of Services with subgroups data

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A lot of different models and methods have been purposed in last years to measure Customer Satisfaction (CS) in various contexts. Satisfaction is strictly linked to quality and it is necessary to refer to an abstract construct to measure service quality. Often different approach to measure problem are suggested as alternative: in this contribute we suggest the complementary use of different methods to evaluate services quality with the aim to create a synergic tool of analysis in situation in which data are collected in subgroups and the objecti ve is not only to evaluate a single subgroup to improve the service for less satisfactory aspects but also to compare performances and to monitor the whole service supplier during the time.

To analyze data separately by subgroup, we use a method of items ranking based on median and heterogeneity index (median-HI criterion) similar to the so called scorecard method (Giudici 2007, Rampichini et al., 2000). After his preliminary analysis we use Rasch Model for the whole service to obtain an overall measure of item quality level (Rasch items parameters) to compare previous subgroups items order with the overall items order and to calibrate the questionnaire (Pagani and Zanarotti, 2003).

The last method of analysis we consider is based on a Dissimilarity Index between ordinal distributions. The observed distribution of responses is compared with a theoretical one, selected as comparative model. Capursi and Porcu (2001) suggested to use as theoretical distribution the optimal one, so called because is the distribution in which all subjects choose the higher response category. A dissimilarity index is obtained for each item and a comparative performance indicator (CPI, in Capursi e Porcu) for each subgroup is then calculated as simple mean of the complement to one of each dissimilarity index (one for each item). Through these CPI indexes it is possible to compare global satisfaction for different subgroups and to range subgroups according to global satisfaction. Finally, a global satisfaction index (taking values between zero and one) for the whole supplier of the service is obtained as arithmetic mean of subgroups-CPIs.

An application of the above procedure to public services data is then proposed.

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