11th Scientific Meeting of the SIS Group
"Statistics for the Evaluation and Quality in Services"

BOOK OF SHORT PAPERS

Editors
Andrea Bucci
Alfredo Cartone
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STATISTICAL METHODS FOR EVALUATION AND QUALITY: TECHNIQUES, TECHNOLOGIES AND TRENDS (T^3)

EDIZIONI Il Viandante

IES 2023 - Statistical Methods for Evaluation and Quality: Techniques, Technologies and Trends (T^3)

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Book of Short papers
11th International Conference **IES 2023**
Statistical Methods for Evaluation and Quality: Techniques, Technologies and Trends (T^3)

University 'G. d'Annunzio' of Chieti-Pescara

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Preface

Statistical thinking, design and analysis play a crucial role in social life and are useful to society at large. Besides, promoting advanced methodological research is useful to facilitate the dissemination of ideas related to various fields of interest. For this purpose, experts in statistics, data analysis, data mining, statistical methods for decision making, machine learning and related methods come together to understand and analyse phenomena through data.

In line with this objective, the Statistics Group for the Evaluation and Quality of Services (SVQS; www.svqs.it) of the Italian Statistical Society (SIS) has been organizing the Innovation and Society (IeS) conference biennially since 2009, focusing on new developments and ideas in statistics applied to the evaluation and quality of public and private services, attracting national and international statisticians and data scientists. The meeting contributes to spot light on the main statistical approaches and methodologies for the evaluation of public services currently in use in different contexts, as well as to facilitate discussion on the impact of innovative statistical evaluation systems for these services, involving various economic and social policy actors.

The conference "Statistical Methods for Evaluation and Quality: Techniques, Technologies and Trends (T^3)" recorded valuable contributions that are reported in this volume. The papers underscore how the growing availability of data has tasked social and economic actors, organizations, and researchers with the management and analysis of large volumes of unstructured and heterogeneous data. In recent years, many tools for both qualitative and quantitative models have been developed to better describe and understand complex systems and their underlying behaviors, and the papers reported in this volume bear witness to this.

Techniques, technologies and trends: the study of data complexity presents the potential to provide analyses with increased frequency and timeliness, accuracy and objectivity, and to define sustainable models. Traditional quantitative methods for capturing socioeconomic data have often shown limitations in their ability to examine underlying systems, and with the three 'T' just mentioned, the outlines of future developments are starting to emerge.

The volume reports 127 contributions in the following areas:

- Advanced statistical methods for pattern recognition
- Advances in statistical learning from high-dimensional data
- Data analysis for web sources
- Distance and depth-based statistical learning methods for robust data analysis

- Economics and environment
- Education and labour
- Inequalities in the labour market
- Innovations and challenges in official statistics
- Labour market: trends, perspectives and new challenges
- Methodological and applicative contributions for evaluating sustainable development
- Methodological developments and applications for the assessment of student competencies
- Networks data analysis: new perspectives and applications
- New advanced statistical methods for data science
- Recent advances in statistical learning and data analysis
- Statistical analysis and modeling of environmental pollution data
- Statistical methods and complexity for evaluation in finance
- Statistical methods and composite indicators for healthcare
- Statistical methods and models for land monitoring with spatio-temporal data
- Statistical methods for environmental monitoring and sustainability
- Statistical methods for the analysis of university student choices and academic performance
- Statistical methods for the assessment of transport services and sustainable emissions
- Statistical methods for education and educational services
- Statistics in sports
- Tourism and territory.

The Conference event attracted many contributions as well as numerous Authors, not just from Italy but also from abroad. Over the three-day meeting, the Community has the opportunity to witness some of the state-of-the arts, new trajectories, and methodological challenges in 24 solicited sessions, 7 sessions of free contributes, two round tables - organized by Maurizio Vichi and Matilde Bini respectively - and three keynotes sessions with Ron S. Kennet of Samuel Neaman Institute of Israel, Luigi D'Ambra of Federico II University of Naples, and the former Minister Enrico Giovannini from University of Tor Vergata.

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The effect of pricing policies on students' use of university canteens

L'effetto delle politiche di prezzo sull'uso delle mense universitarie da parte degli studenti

Lucio Masserini, Matilde Bini and Valentina Lorenzoni

Abstract University canteens play an important role in academic life; they not only allow students to benefit from subsidised food services and meals at lower prices than those commonly available at other local eateries but also affect other aspects, such as students' health, social relationships and academic achievement. Using a quasi-experimental design and a difference-in-differences approach, this study aims to evaluate the impact of an income-based pricing policy on students' frequency of using university canteens and their meal choices. Using data from an Italian university, this study shows that users who experienced a meal price increase significantly reduced their use of university canteens.

Abstract *Utilizzando un disegno quasi sperimentale e un approccio basato sulla differenza nelle differenze, questo studio si propone di valutare l'impatto di una politica dei prezzi basata sul reddito sulla frequenza di utilizzo delle mense universitarie da parte degli studenti e sulle loro scelte di pasto. Utilizzando i dati di un'università italiana, questo studio dimostra che gli utenti che hanno subito un aumento del prezzo dei pasti hanno ridotto significativamente l'uso delle mense universitarie.*

Key words: difference-in-differences, food choice, price change, pricing policies, university canteen meals, university finance

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1 Introduction

Universities and related facilities play a strategic role in the promotion of students' well-being by ensuring their academic achievement and enhancing their social life, overall health status and human dignity [3].

Although the literature in the field of university facilities is sparse [1], some studies have revealed that easy access to high-quality food is an important aspect of students' well-being with relevant short- and mid-term consequences. Research has shown that adequate access to food has an impact on students' performance and retention, potentially contributing to their general health and having considerable implications for long-term health preservation and the reduction of the collective health care burden [4,5]. University canteens are generally able to offer low-cost meals and play an important role in the promotion of students' university careers and general well-being from a public health perspective, since they allow students to benefit from subsidised food services and meals at lower prices than those commonly found among their competitors. Using a difference-in-differences (DID) approach, this study aims to evaluate the effect of introducing an income-based pricing system on students' use of university canteens and their meal choices at these canteens. DID is a statistical technique used for policy evaluation in quasi-experimental designs with panel data. Two aspects were analysed as outcome variables to evaluate the impact of the new pricing system on students' eating habits: 1) the frequency of university canteen use and 2) the proportion of light and large meals consumed. The study was carried out in a university in Central Italy that has three university canteens administered by the Financial Aid and Scholarship Office.

2 Method

Given that this study used panel data and involved a natural experiment, where the treatment consisted of the introduction of a new income-based pricing system, a DID approach [2,6] was employed. The DID estimator is a popular tool in quasi-experimental designs for evaluating the impact of a treatment or intervention using a repeated cross-sectional or panel design. In our setting, the same students belonging to the treated and control groups were observed for two periods, before and after treatment, in such a way that the students were made into their own controls. The basic idea behind the DID technique is that in the absence of treatment, the change in the treated outcome would have been the same as the change in the non-treated outcome. Thus, although the outcome levels may differ between the treated and control groups even in the pre-treatment period, the impact of the treatment could be measured by the DID estimator as the difference in average outcomes in the treatment group before and after treatment minus the difference in average outcomes in the control group before and after treatment [6]. The DID estimator can be easily implemented using a regression approach, which can obtain the estimates and corresponding standard errors in one step:

$$y_{it} = \beta_0 + \beta_1 t_{it} + \beta_2 T_{it} + \beta_3 (t_{it} \times T_{it}) + X_{it}\delta + \varepsilon_{it}$$

where y_{it} represents the relevant outcome variable (the frequency of canteen use and the proportions of FM, LM1 and LM2); t_{it} is a binary variable for the period of observation, where $t_{it} = 0$ stands for the period before April 1, 2018, and $t_{it} = 1$ stands for the period from April 1, 2018, onwards; T_{it} is a binary treatment variable, where $T_{it} = 0$ indicates students in the control group (those with unchanged meal prices) and $T_{it} = 1$ stands for students in the treatment group (those whose meal prices increased or decreased); X_{it} is a vector of covariates, entered in the model as control variables; and ε_{it} is the error term. β_3 is the coefficient of interest and represents the DID estimator. It results from the interaction term obtained by multiplying the treatment indicator and the period of observation; it takes a value of 1 for students whose meal prices changed after the treatment. For the frequency of canteen use, the regression equation was estimated with the ordinary least squares technique; for the proportions of meal types, a beta regression approach was carried out (for more details, see [7]). In both cases, robust clustered standard errors were used to control for heteroskedasticity and clustered data.

3 Results

Two outcome variables were used to assess the impact of the new pricing system on the students' eating habits: 1) the frequency of university canteen use and 2) the proportion of meal types (large and light meals) consumed.

Taking the number of accesses as a dependent variable, the effect of price variation was evaluated using two DID models: one for students whose meal prices increased and the other for those whose meal prices were reduced. Taking the proportion of meal types consumed (FM, LM1 and LM2) as a dependent variable and the two intervention groups, additional DID models were also estimated. In both cases, analyses were carried out separately for all students, as well as for frequent and non-frequent users. The general DID model used in our analysis allows for the inclusion of both fixed and time-varying covariates. For each model, we present only the DID estimates summarised as β_3, which represents the main parameter of interest and measures the magnitude and direction of the effect of the price variation.

Table 1 shows the results of the DID linear regression models that were estimated using the frequency of university canteen use as a dependent variable. With regard to the students whose meal prices increased (Table 1), the DID estimate (β_3) indicates a significant decrease in the total number of accesses; this effect was also observed among both frequent and non-frequent users. Given the logarithmic scale of the dependent variable, results can be interpreted more effectively in terms of percentage change. On average, the price increase produced a 29.9% (95% CI: 23.2%–36.0%) reduction in the number of accesses. The magnitude of the effect produced by the price variation is higher among frequent users, whose canteen use was reduced by 36.3% (95% CI: 25.2%–45.7%) as compared to the 20.2% (95% CI: 7.0%–31.5%) decrease among non-frequent users. No effect was detected among the students whose meal prices were reduced.

Table 1 DID estimates on the number of accesses according to the type of price change

	Overall	Non-frequent users	Frequent users
Price increase	-0.356 (0.046)***	-0.225 (0.078)**	-0.450 (0.081)***
Price reduction	0.043 (0.041)	0.071 (0.075)	0.096 (0.065)

The dependent variable is the log-transformed frequency of canteen use. Models also include the individual-level covariates (age, gender, course year and faculty). Robust standard errors are in parentheses. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Other results we obtained show the effect on FM consumption. DID estimates show significant effects only for students whose meal prices increased. Among these students, the probability of always choosing and never choosing FM increased by 40.9% and 87.8%, respectively. This effect was not observed when the sub-groups of frequent and non-frequent users were evaluated. Among frequent users, the price increase was associated with a 12.9% reduction, on average, in choosing FM.

Among the students whose meal prices increased, results show a rise in the proportion of those who chose LM1, both overall (+15.8%) and in the two-subgroups of frequent (+21.9%) and non-frequent users (+29.3%). On the other hand, the probabilities of never and always choosing LM1 were not affected by the price variation. When the effect of price reduction on LM1 selection was analysed, the only significant effect observed was a threefold increase in the probability of always choosing LM1 among non-frequent users.

With regard to the proportion of LM2 consumed, the analysis of students whose meal prices increased shows that the intervention produced a higher probability of not choosing LM2 both overall (+42.2%) and among non-frequent users (+42.8%). Conversely, the probability of always choosing LM2 decreased significantly in the same groups. Overall and among non-frequent users, price reduction had a significant negative effect on the probability of always choosing LM2. No other significant effect was associated with price reduction.

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