Economics Bulletin

Volume 34, Issue 2

Investigating informal learning at a cultural site

Juan Gabriel Brida
Free University of Bolzano

Marta Meleddu
University of Sassari & CRENoS

Manuela Pulina
University of Sassari & CRENoS

Vania Statzu
University of Cagliari & Crenos

Abstract

Based on a microeconomic theory framework, this paper explores in what extent the visit to a museum influences visitors' informal learning. Empirically, a Heckman selection model has been employed that allows one to draw causal inferences in the observational setting. Survey data were collected at the South Tyrol's Museum of Archaeology in Bolzano (Italy) in 2011. More than half of the sample declared they had the opportunity to learn. The empirical specification reveals that pull factors have a positive effect on the propensity to learn new things. However, completing a previous visit does not increase the probability to learn more; the propensity to learn is also reduced when experiencing a negative feeling such as boredom and a sense of wasting time. These findings provide a useful policy tool to plan educational activities in the museum contributing to improve visitors' human capital.

This research was supported by the Autonomous Province of Bolzano project 'Le attrazioni culturali e naturali come motore dello sviluppo turistico. Un'analisi del loro impatto economico, sociale e culturale'. We wish to thank the anonymous referees for their comments and suggestions.

Citation: Juan Gabriel Brida and Marta Meleddu and Manuela Pulina and Vania Statzu, (2014) "Investigating informal learning at a cultural site", *Economics Bulletin*, Vol. 34 No. 2 pp. 634-650.

Contact: Juan Gabriel Brida - JuanGabriel.Brida@unibz.it, Marta Meleddu - mmeleddu@uniss.it, Manuela Pulina - mpulina@uniss.it, Vania Statzu - vania.statzu@crenos.unica.it.

Submitted: October 25, 2013. **Published:** April 01, 2014.

Investigating informal learning at a cultural site

1. Introduction

According to previous research, there are several motives that influence the decision to visit a museum such as: to be entertained, to visit a particular exhibition, to be with people and enjoy social interactions, to do something worthwhile and especially to learn (Prentice et al., 1998; Kotler & Kotler, 2001). In previous studies (e.g. Briseño-Garzón, Anderson and Anderson, 2007), learning is defined as "an active and social experience through which learners construct and adapt meanings within social and physical contexts that intrinsically mediate and modulate the learning episodes". Through the learning process people accumulate cultural capital that can be regarded as an integration of human capital. Learning has been proved to have a key role in social interactions as well as in the economy. Blanden, Buscha, Sturgis and Urwin (2012), for example, find that the lifelong learning, defined as the further attainment of certified qualifications in adulthood, after the completion of the continuous full-time education, show a medium-run return for women of 10% on hourly wages.

A strand of the research examines the educational role of informal settings such as museums and exhibitions (for an extensive review, see e.g. Adams, Luke and Ancelet, 2010). Scott (2006) points out that museums help to increase intellectual capital in the community through supporting lifelong learning. Community members can gather and meet diverse groups sharing valued public spaces for entertainment as well as education without the formality of a classroom, contributing to support the education system. More recently, Griffin and Paroissien (2011) emphasise the role of museums in the learning process regarded as places to satisfy and enhance curiosity, educate formally and informally, extend the frontlines of knowledge and enable curious visitors to understand how some of the challenges to extend knowledge are achieved. Such a strand of literature links to the main definition of museum. As provided by the International Council of Museums (ICOM, 2007), a museum is defined as "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment".

Within this semantic perspective, the present paper explores the factors that influence visitors' learning experience at a museum. To date, the contribution that museums have on learning in many fields of knowledge (e.g. history, science, technology) is yet to be fully understood. Hence, the belief that museums can be a lifelong learning channel still needs to be addressed in a more structural manner (Falk and Dierking, 2000). Expanding the previous literature, the objective of the present paper is to provide a quantitative model that helps one to understand those factors that influence visitors' learning experience at any specific cultural site underpinning the empirical analysis to strong microeconomic foundations. It is worthwhile noticing that it may be not easy to fully analyze the causal relationship that exists between museums and the human capital impact they produce. Nevertheless, it is possible to examine how museums can contribute to the lifelong learning, rather than cause a cultural capital impact (e.g. Stone, 2001; Kelly, 2006). This aim is of a particular interest since human capital investment other than formal training include also informal learning (De Grip & Smits, 2012). In the economic literature, studies on the factors related to informal learning are mainly devoted to study the topic referring to working hours. However, informal learning during leisure time also contributes to improve human capital and this relationship is still under researched.

The South Tyrol's Museum of Archaeology in Bolzano (Italy) offers an interesting case study. This museum, known as "Ötzi", hosts a unique glacial mummy discovered more than 5,000 years ago in the Alps (Schnal Valley Glacier), together with his accompanying artefacts (clothing and equipment). The museum has a special educational and learning mission because of its unique scientific, historical and anthropological interest. Almost two decades after the Iceman's discovery, this mummy is the object of an intense research by biologists, anthropologists, pathologists who are still discovering unravel mysteries thanks to new-generation technologies and equipment. This new knowledge is also offered to the public that can value the up-to-date scientific achievements thanks to "explainers' within the exhibition that help even youngsters to gain insights from their experience.

The analysis is based on data obtained from individual interviews at the site during the time span June and December 2011. Theoretically and empirically, a Heckman selection model, commonly used in various fields of economics and statistics, is employed to understand in what extent the visit to a museum enhances individual informal learning perceptions. This specification allows one to overcome the limitation of the empirical sample characterized by data collected on a population intrinsically restricted to the museums' visitors. Such a sample is non random and this feature rises a selection problem since there is no information on the informal learning of those who do not visit the cultural site, hence leading to an omitted variable bias. In this respect, the Heckman specification is a novelty in this thread of research and provides more precise results than those obtained by previous studies that mainly employ more standard specifications such as stepwise regressions (e.g. Falk, 1983; Sandifer, 1997).

The findings may also provide useful information for the Ötzi museum managers as well as for the education institutions in the whole region of the Trentino Alto Adige, giving insight on how much this cultural attraction is able to enhance visitors' learning and how better exploit this ancient discovery. Furthermore, the results may help promoting marketing strategies to further improve the overall educational mission of this museum.

The paper is organized as follows. In the following section, a literature review is provided. In Section 3, the methodological framework is addressed. Section 4 provides a description of the case study and of the administrated questionnaire. In Section 5, the empirical results are presented. The last section provides concluding remarks.

2. Literature review

A number of studies investigate visitors' learning and educational experience at cultural attractions. Museum experience is widely recognized as an example of learning in an informal environment. Briseño-Garzón et al. (2007) confirm that the social aspects of the museum experience, the development of interest, enthusiasm, motivation, eagerness to learn, awareness, general openness and alertness play a major contribution to learning. These authors, through an empirical work, investigate how and what adults learn as part of a family group experiencing the intergenerational interactions at an aquarium. Their approach demonstrates that adults visiting the aquarium as part of a family group are active social learners and not merely facilitators of the experience for younger visitors or caregivers. An important outcome indicates that the adult members of the participant family groups tend to learn in a multiplicity manner including cognitive, social and affective domains.

Jay Rounds (2004) analyses the influence of curiosity in understanding learning behavior of visitors. When a curiosity-driven visitor enters in a museum, he/she is not motivated by the expectation of extrinsic benefits. Rather, he/she seeks intrinsic rewards,

that is the "interest" that comes with stimulating and satisfying curiosity. Visitors' evaluation of their museum experience reflects whether the amount of "interest" they gained is commensurate with the effort expended. In this sense, "interest" should be distinguished from "relevance." In fact, it is often asserted that individuals visit museums seeking relevant knowledge. Hence "relevance", in this context, refers to knowledge that one predicts will prove to be useful. Relevant knowledge may be found interesting, but interest can exist independently of relevance. Thus, the curiosity-driven visitor seeks interest as an objective, and is not concerned with whether the knowledge gained is relevant to some extrinsic benefit. This paper demonstrates that the curiosity-driven visitor seeks to maximize the Total Interest Value of his/her museum visit. Such visitors focus attention only on exhibit elements with high interest value and low search costs. Their selective use of exhibit elements results in greater achievement of their own goals than would be gained by using the exhibition comprehensively.

Packer and Ballantyne (2005) focus on the previous literature and suggest that the social dimension is an important aspect of museum learning. The findings challenge the assumption that social interaction is more beneficial to learning than a solitary experience and suggest that, for adult learners, solitary and shared learning experiences can be equally beneficial although in a different manner. More recently, Packer (2008) explores the beneficial outcomes that visitors seek and obtain from a museum visit, in terms that are not related to learning outcomes. Three different levels of the experience are considered, that is: the attributes of the setting that visitors value; the experiences they engage in; and the benefits they derive. The findings confirm the importance of the "satisfying experiences" framework and extend this understanding to the beneficial outcomes these experiences produce. The study also highlights the importance of "restoration" as an outcome of a museum visit. It is argued that the concept of the museum as a restorative environment, which enables visitors to relax and recover from the stresses of life, is worthy of further research attention.

The amount of time visitors spend at the museum can be considered as an indicator of learning. Studies on the educational role of informal settings such as museums and exhibitions are rather common in the literature (for an extensive review, see Adams, Luke and Ancelet, 2010). Falk (1983) indicates some of the factors that could possibly influence learning at a museum: behavior, time, health, motivation, literacy, age, gender, past museum experience(s), understandability of material presented, quality of presentation (e.g., lighting, legibility) and intelligence. Hence, this study aims at testing the feasibility of using observable behavior and time spent at exhibit as predictors of learning using a stepwise regression. Results clearly showed the importance of the interaction of time and behavior as distinct factors. Further, it showed that the learning process is a mix of the quality and quantity of interaction factors. Neither time nor behavior turned out to be good predictors of learning as their interactions. This is an important conclusion and meets the a priori expectation that both a certain quantity of interaction and a certain quality of interaction are required in order to produce learning. The author finds that those children who spent a reasonably time at the exhibit, and had a positive behavior in the visit, showed changes in scores from pre- to post- test. A further study by Sandifer (1997) evaluates whether time-based learning-associated visitor behaviors at interactive science museums differ across weekend/weekday groups and family/non-family groups. Results show that regardless of the day of the visit, families spent more time than non-family groups in individual exhibitions and in the science museum as a whole; weekend family and non-family visitors did not differ much in their average time spent per exhibit. These results are explained by a difference in visitor agendas and the crowded nature of weekend visits.

As it emerges from the literature, on the whole, museums have broadened the range of services they provide as well as the variety of collections and exhibits, aimed in particular at increasing visitors' length of stay. There are four main types of services: physical comfort and accessibility (well-designed galleries, lighted and safe parking lots, ramps, seating and rest areas, clean restrooms, etc.); hospitality (welcoming behavior on the part of guides, guards, and other employees); interpretive, narrative, and way-finding information (including the use of different media) that increase a visitor's awareness and knowledge; recreation and diversion, including shops and dining facilities. Museums are providing a greater variety of facilities, such as library and electronic-learning tools, folding chairs for galleries, gift shops, family activity areas, rest stops, web-sites and other internet facilities that improve knowledge of the exhibition before the visit and the possibility to have personalized on-site tours (e.g. Kotler, 1999; Wang, 2009). Nowadays, museums have to help visitors to develop skills through a learning process and a more participated and autonomous role (Rounds, 2004).

From an economic point of view, the reviewed studies highlight that income positively influences cultural participation. Also the employment status is found not to be an important predictor of time spent visiting exhibitions. Time pressure and financial resources are found to be related in most studies. Full-time working couples generally have more financial resources, but also are under more time pressure since they participate more in paid labor. As a result, part of the relationship between full-time working couples and cultural participation is interpreted through the abundant financial assets enjoyed by full-time workers.

Based on this wide literature review, the present paper investigates the determinants that influence visitors' learning experience in a museum, underpinned to sound microeconomic foundations. It differs from previous studies as this paper applies a structured methodology to analyze informal learning in a museum employing quantitative data.

3. The model specification

The museum incorporates a bundle of characteristics, perceived features and functions that lead individuals to visit it enhancing their human capital. Therefore, in this light, visitors/consumers choose to visit a museum if and only if they meet their learning satisfaction. In turn, learning is a function of personal characteristics, income, education, age, as well as entry fees, time spent at the museum and pull and push factors.

Visitors' latent learning is influenced by their perceptions of museum characteristics that contribute to maximize their utility. Hence, the actual improvement function in cultural knowledge for a museum visitor can be presented in the following form:

$$L_i=(p_j,x_j,\ e_i,\ t,\ \theta_i,\ \eta_i,\ \varepsilon_j) \qquad (1)$$

Specifically, the consumer-visitor i is supposed to have improved his/her human capital during the visit to the museum j as a consequence of a set of determinants. From an economic point of view, it is important to include into the equation prices. These variables represent the opportunity cost visiting the museum and the destination as a whole. Hence, p_j, is expressed both in terms of how much visitors spent for the visit at the site (*entrycost*) and the total travel costs for reaching the destination (*travelcost*). x_j is a set of pull and push factors that are identified from the tourism literature (see Yoon & Uysal, 2005; Mohammad & Som, 2010). These are defined as follows: "push factors" can be thought as endogenous incentives that motivate somebody to do something (*curiosity*); "pull factors" are exogenous incentives as perceived by visitors, such as the attractive features of a destination or a cultural site, recreation facilities and specific services. In this study, pull factors are defined as follows: to have a cultural experience

to tell about to friends and relatives (*tell*); to contribute to preserve the museum heritage (*preserve*); because individuals regard the visit as something worth to do (*worth*); because of visiting the city for its historical sites (*histsite*). e_i, is the education level attained by respondents. t time allocated to visiting the museum. θ_i contains the individual specific experience at the museum, expressed with a standard 5-point Likert scale. Finally, individual non-observable characteristics η_i and site non-observable characteristics ε_j. Since visitors-consumers do not share the same set of factors in their utility function, it is important to account for heterogeneity in a way to account for those who may prefer to visit other attractions. By using survey data, it is possible to identify those visitors who select themselves in the sense that autonomously decided (as they declare) to visit the museum to learn something new. In this respect, the sample cannot be regarded as random since it is chosen from the population of the actual visitors at the museum. This leads to the sample selection problem that according to Heckman (1979) can be thought of as a form of omitted variable bias.

To assess the informal learning role of a museum, the question to address is whether respondents have actually learned something during their visit, contributing to their lifelong learning process. In this case, a two-step approach is needed to deal with this issue and the Heckman two-step selection model can be regarded a more robust approach. The main theoretical framework consists of a model with two latent variables that are linearly dependent on observable independent variables:

$$Ed_i^* = x_i'\beta + v_i \quad (2)$$

$$L_i^* = z_i'\gamma + \varepsilon_i \quad (3)$$

The error terms (ε_i and v_i) are assumed to be independent and follow a bivariate normal distribution with zero mean and correlation ρ. The value of $L_i = L^*_i$ is only observed whenever Ed_i=1:

$$Ed_i = \begin{cases} 1 \; if \; Ed_i^* = 1 \\ 0 \; \; otherwise \end{cases} \quad (4)$$

and

$$L_i = \begin{cases} L_i^* \; if \; Ed_i = 1 \\ n.a \; \; otherwise \end{cases} \quad (5)$$

Since the latent variables are not observable, an indicator Ed_i is employed when Ed^*_i is greater than zero. Ed_i is a dummy variable that takes the value one whenever the respondents declare to visit the museum for a learning purpose, $\boldsymbol{X}_i$ are observed variables relating to the *i'*th individual and v_i is an error term. Hence, Ed_i is only observed for those interested individuals, who are actually visiting the museum for learning purposes (in this case the dependent variable is "new thing").

In addition, the museum sector contributes to develop individual human capital through its learning outcomes. Hence, in the second step of the Heckman procedure, this indicator is measured by the dichotomous variable *"learnt"* that takes the value one if the respondent declared to have learnt something during the visit. In other words, the second equation investigates the factors that influence the actual improvement in cultural knowledge expressed in terms of how much respondents learnt during their visit at the museum. The expected value of the variable L_i is the conditional expectation of L^*_i conditioned on it being observed:

$$[\![E(L)]\!]_i | Z_i, X_i) = E(L_i^* | Ed_i = 1, X_i, Z_i) = x'\beta + \rho\sigma_\varepsilon + \lambda(z'\gamma) \quad (6)$$

$$\lambda(\alpha) \equiv \frac{\phi(\alpha)}{\Phi(\alpha)} \quad (7)$$

where λ is the Heckman correction term called also *inverse Mills ratio* required for an estimation to be consistent. If the error correction terms are uncorrelated (i.e. $\rho = 0$), then $(L_i|Z_i, X_i) = x'\beta$. This specification occurs whenever x_i and z_i are correlated. One can estimate the above equation either via a two-step model (Heckman two-step procedure or a Heckit estimator) or a maximum likelihood (ML) estimation under the assumptions above defined. In the Heckman two-step procedure, a ML estimation has to be implemented whenever a test on $\rho = 0$ is rejected that, however, is usually implemented when dealing with sample selection issues (Greene, 2008). The Heckman two-step procedure relies on the assumption that the error terms are jointly normally distributed and involve the estimation of a standard probit model and a linear regression model. The first step estimates β through ML using the full set of observations within the standard probit framework. Then, ML will be used to estimate the *inverse Mills ratio* $\lambda(\alpha)$ for all observations. As a second step, the estimation is run on the regression equation with $\lambda(\alpha)$ as an additional variable:

$$L_i = z_i'\gamma + \alpha\hat{\lambda}_i + \varepsilon_i \quad (8)$$

In this manner, a latent variable is estimated that underlines the reason that drives individuals to visit a museum. This result may be interpreted as the net utility of visiting a museum. If the outcome is positive, then individuals tend to visit the cultural attraction and several items are likely to affect their net learning.

4. The case study and the survey

4.1 Ötzi the ice-mummy

The principal attraction in the city centre of Bolzano-Bozen (North-East of Italy), is the Archaeological museum, opened on March 1998. From a financial point of view, the museum has revenues from merchandising, sponsors, publishing and from tickets sales. Since its opening, it had around 250,000 visitors per year.

The museum is approximately 1,200mq and hosts an exhibition on the pre-historical period of South Tyrol, although the main mission of the museum is to host and preserve one of the world's most important and well-preserved mummies, Ötzi the Iceman, for 5,300 years. Visitors can decide their visiting path within the building and decide whether they want to view the mummy. All the exhibition rooms allocated to the "Iceman" are characterised by a sober atmosphere, with an intended aim to give dignity to these human remains and promote both scientific research and a cultural experience related to the man from the Chalcolithic Period.

Visitors can also admire and revive the mummy's pre-historical times thanks to a unique exhibition of his artefacts. The ice man carried a numerous possessions during his trip in the Alps: his axe, characterised by a copper blade, denotes Ötzi prestigious status in the society and is the only intact prehistoric axe ever found; his shoes represent an extraordinary finding, a unique example of this kind from the past, made of warm hay in the inner part and of deerskin on the outside; his leggings were practical and functional, and quite similar to those still used by native North Americans in the 19th century; his hunting and self-defence equipment comprise a flint-bladed dagger and arrows; his survive kit consists of flesh of birch fungus possibly used as an antibiotic to fight infections and a variety of medical conditions (Fleckinger, 2007).

4.2 The survey

To explore the determinants influencing the learning process experienced at the museum, a survey was administered at the site, from June to December 2011, via face-

to-face interviews on weekdays (except for the closing day on Mondays) and on Saturdays and Sundays, at different opening hours (between 10.00 am – 6 pm). Sergardi and Biraghi (2007), for Italy, found that cultural seasonality presents a rather stable distribution during the year (from a minimum of 25% to a maximum of 31%), nevertheless, the highest flows of tourist-visitors occur between June and August, that is the typical peak summer holiday in Italy. Hence, running the survey within such a wider span of time can provide a better insight on the heterogeneous characteristics of visitors, who can be either *serious* and *casual* cultural tourists (Brida, Pulina, and Riño, 2012).

The respondents were selected with a quota random sampling procedure based on age and gender trying to capture heterogeneous demographics features. As opposed to random sampling, quota sampling requires that representative respondents are chosen out a subset of individuals within a population. Notwithstanding this procedure may lead to bias because not everyone gets a chance to be selected, nevertheless, it overcomes the potential bias derived from a random sample procedure, as the trial may be likely to over-represent specific demographic characteristics, such as gender or age. Based on the visitors data of the previous year, provided by the administrative office of the museum, the sample size was determined according to a 95% confidence level with a 5% error. Overall, 1,052 complete interviews were successfully concluded.

In total, the questionnaire contained 36 questions, organized in four blocks: the first section included information about the trip, the next section concerned information about the city of Bolzano, then information on the visit to the museum were collected and the last section was devoted to a sequence of questions on socio-economics characteristics of the visitors. The qualitative questions related on how important was to visit Bolzano and the museum, as well as those about motivation, satisfaction and loyalty were quantified in categorical variables employing a 5-point Likert scale ranging from 'not important' to 'very important', 'strongly in disagreement' to 'strongly in agreement', or 'very unlikely' to 'very likely', respectively.

Table 1 provides main descriptive statistics to give a better picture of visitors at the Archaeological Museum and Bolzano as the hosting destination.

Table 1. Visitors profile, descriptive statistics

Residence		**Age**	
Italy	47%	>55	19%
Europe	48%	41-55	44%
Rest of the World	5%	26-40	29%
Civil Status		9 – 25	8%
Single/never married	19%	**Gender**	
Married or de-facto	72%	Female	51%
Separate/divorced	5%	Male	47%
Widow	1%	**Income (% in category)**	
Education		< € 25,000	10%
Below high school	12%	€26,000-€50,000	27%
High school	25%	€51,000-€75,000	14%
College/ degree or more	56%	€76,000-€100,000	7%
		>€100,000	9%

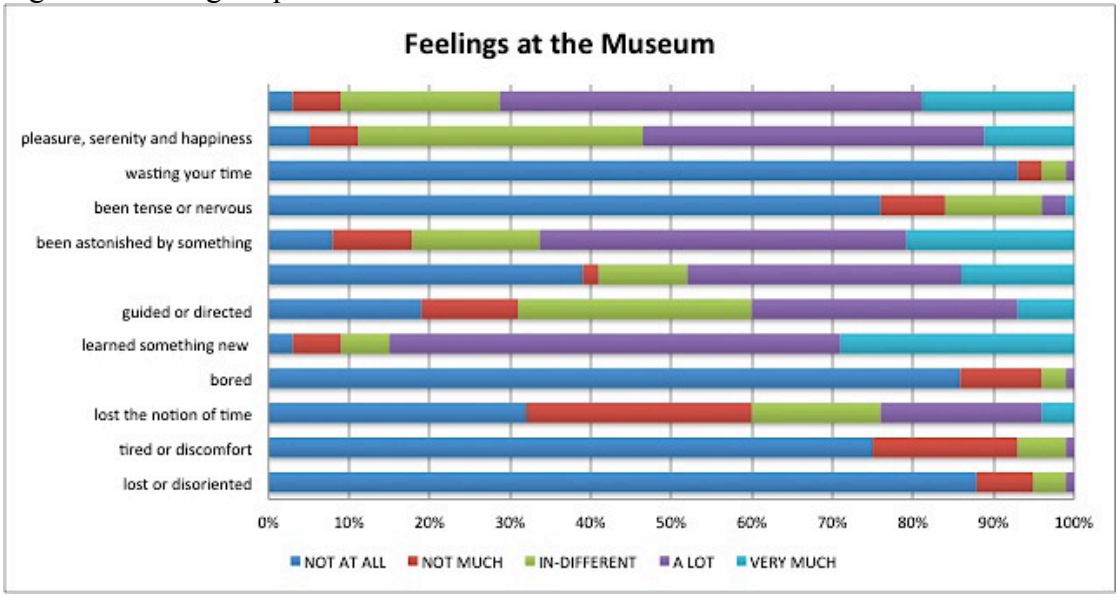
Source: Elaboration on sample data

The percentage of the visitors who came from European countries (48%) and Italy (47%) are approximately the same. Female account for 51% and the majority are married or de-facto (72%). A great quota of the sample (44%) are between 41 and 55 years old. Regarding the education level, 56% had a college degree or a higher degree.

Moreover, 57% of the respondents declared to have a middle-high income, while 10% had less than 25,000 euros per year.

Relating to the feelings experienced during the visit, overall there is a positive feedback (Figure 1). 87% of the sample never felt lost/disoriented while 85% never felt bored; 56% declared to have learned "a lot" of new knowledge and 29% "very much". The majority had fun from "a lot" to "very much" level (53% and 19%, respectively) and 93% never felt to have wasted their time.

Figure 1. Feelings experienced at the museum



5. Econometric results

The empirical estimation is based on the microeconomic foundations specified in the methodological section. The relevant variables included into the model, and obtained by the survey data, are described in details in Table 2.

Table 2. Variables used in the Informal learning regressions

NAME	DEFINITION	Summary statistics
Partecipation equation		
Dependent variable *New Thing*	This is a dummy variable that takes value 1 if the respondent went to the museum to learn something new, and zero otherwise	Mean=0.41 S.Dev.=0.49 Yes=41% No=59%
Explanatory variables		
timebeenmus	This continuous variable takes into account the number of times the respondent has been in the museum.	Mean=1.305714 St.Dev.=0.7680871 Min=1 Max=6
curiosity	This is a dummy variable that takes value 1 if the respondent was curious in visiting the museum, and zero otherwise.	Mean=3.54 S.Dev.=1.14 Mean=0.52 S.Dev.=0.49 Yes=52% No=48%
sayto	This is a dummy variable that takes value 1 if the main reason in visiting the museum, was to tell that to friends and relatives, zero otherwise.	Mean=0.09 S.Dev.=0.29 Yes=10% No=90%
preserve	This is a dummy variable that takes value 1 if the respondent had the aim to contribute to preserving the museum, and zero otherwise.	Mean=0.04 S.Dev.=0.21 Yes=5% No=95%
worth	This is a dummy variable that takes value 1 if the respondent felt it is worth visiting the museum and zero otherwise.	Mean=0.18 S.Dev.=0.39 Yes=19% No=81%
travelcost	This is a continuous variable that accounts for total travel costs, expressed in euro, undertaken by the	Mean=127.9018 St.Dev.=326.707

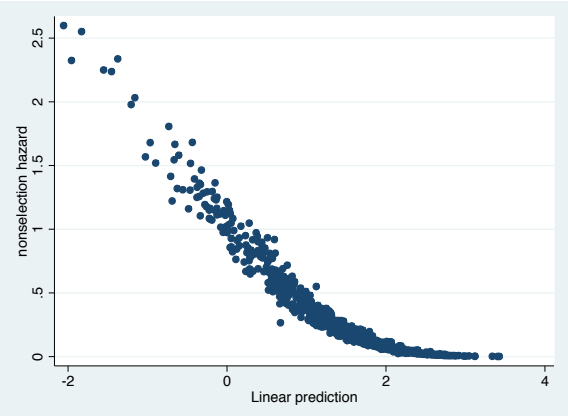
	respondents	Min=0 Max=4,000
children712	This is a dummy variable that takes value 1 if the respondent visited the museum with children between 7 and 12 years old, and zero otherwise.	Mean=0.25 St.Dev.=0.43 Yes=26% No=74%
education activities	This is a dummy variable that takes value 1 if the respondent declared that more educational activities would increase museums visitations, and zero otherwise.	Mean=0.09 St.Dev.=0.29 Yes=10% No=90%
histsite	This is a dummy variable that takes value 1 if the respondent declared that was visiting the city for its historical sites, and zero otherwise.	Mean=0.03 St.Dev.=0.18 Yes=3% No=97%
austriagerman	This is a dummy variable that takes value 1 if the respondent comes from Austria or Germany, and zero otherwise.	Mean=0.47 St.Dev.=0.50 Yes=48% No=52%
entrycost	This is a continuous variable that accounts for the ticket expenses to visit the Archaeological Museum.	Mean=12.93762 St.Dev.=10.42559 Min=0 Max=180
museumsvisited	This is a continuous variable that accounts for the number of museums the respondent visited during the last year.	Mean=4.61 St.Dev.=7.05 Min=0 Max=120
gender	This is a dummy variable that takes value 1 if male, 0 if female.	Mean=0.51 St.Dev.=0.49 Min=0 Max=120
age	This is a continuous variable that accounts for the respondents age.	Mean=44.82 St.Dev.=11.87 Min=19 Max=85
age squared	This is a continuous variable that is defined as the squared of the age variable.	Mean=2150.51 St.Dev.=1120.89 Min=361 Max=7225
Outcome equation		
Dependent variable *learnt*	This is a dummy variable that takes value 1 if the respondent declared that during his/her visit learned from "a lot" to "very much", and zero otherwise.	Mean=0.84 St.Dev.=0.35 Yes=85% No=15%
Explanatory variables		
time spent at the museum	This is a continuous variable that accounts the total minutes spent at visiting the museum	Mean=96.70701 St.Dev.=37.7883 Min=2 Max=420
pleasure	This is a categorical variable that takes values from 1 (not at all) to 5 (very much) attributing an increasing pleasant sensation felt by the respondent during his/her visit.	Mean= 3.47 St.Dev.=0.95 1=5% 2=6% 3=35% 4=43% 5=11%
wasting time	A discrete variable that takes values from 1 (not at all) to 5 (very much) if the respondent declared that during his/her visit felt wasting time.	Mean= 1.13 St.Dev.=0.53 1=93% 2=3% 3=3% 4=1% 5=0%
bored	A discrete variable that takes values from 1 (not at all) to 5 (very much) if the respondent declared that during his/her visit felt bored.	Mean=0.84 St.Dev.=0.42 1=85% 2=10% 3=3% 4=1% 5=0%
think	This is a dummy variable that takes value 1 if the respondent declared that museum is a place that makes one think, and zero otherwise.	Mean=0.76 St.Dev.=0.35 Yes=77% No=23%
complete	This is a dummy variable that takes value 1 if the respondent declared that he/she completed a previous visit to the museum, and zero otherwise.	Mean=0.01 St.Dev.=0.10 Yes=1% No=99%
guided	A discrete variable that takes values from 1 (not at all) to 5 (very much) if the respondent during his/her visit felt guided.	Mean=2.96 St.Dev.=1.21 1=19% 2=12% 3=29% 4=33% 5=7%

ease	A discrete variable that takes values from 1 (not at all) to 5 (very much) if the respondent during his/her visit felt ease/safe.	Mean=2.80 St.Dev.=1.56 1=39% 2=2% 3=11% 4=34% 5=14%
astonished	A discrete variable that takes values from 1 (not at all) to 5 (very much) if the respondent during his/her visit was astonished by something.	Mean=3.61 St.Dev.=1.14 1=8% 2=10% 3=16% 4=46% 5=20%
genuniv	A dummy variable that takes value 1 if the respondent is a male with a university degree, and zero if female with a university degree.	Mean=0.10 S.Dev.=0.31 Yes=11% No=89%
education level	A continuous variable that accounts for the education level of respondents: 1 (no schooling); 2 (middle school); 3 (high school); 4 (university degree); 5 (postgraduate)	Mean=3.54 S.Dev.=1.14 1=4% 2=11% 3=42% 4=25% 5=18%

Heckman's procedure was applied to estimate the economic return to the visit at the museum, that may be interpreted as an enhancement in an individual lifelong learning and, hence, an improvement in human capital. The first step of the analysis consists of the estimation of a Probit equation on the variables assumed to affect visitors learning at a museum, that is the time spent at the site (*timespentmus*), feelings experienced during the visit (*pleasure, wastingtime, bored, etc*), if the visitor is completing a previous visit and the total number of visits at the museum. The model is estimated with the following exclusion restriction $(z_i \neq x_i)$, hence only socio-demographics variables have been used in both the stages of the regression. This structure is essential because of the existence of collinearity problems between the Mills' ratio and the other regressors in the participation equation, particularly in small samples (Cameron and Trivedi, 2009). Therefore, the exogenous variables are gender, age, age squared and nationality. The dependent variable *Ed,* learning new things in the museum, is the dummy variable taking value 1 if respondents went to the museum to learn something new.

Prior to estimate the model using Heckman two-step procedure, the ML estimator model for discrete variables has been applied. In this case, the estimated correlation coefficient is statistically significant at 95% (LR test of indep. eqns. (ρ = 0): chi2(1) =4.78 Prob > chi2 = 0.0287). In this case the Likelihood Ratio test does not accept independence of the two error terms. This implies that a selection bias issue may occur. In fact, a plot of the inverse Mills Ratio suggests nonlinearity for the sample (Figure 2).

Figure 2 Plot of inverse Mills Ratio



Yet, conclusions solely based on the LR test need a particular care since the model is grounded on a bivariate normality assumption that is likely to cast some doubts. Conversely, the Heckman two-step estimation is expected to be more robust and rely on a univariate normality assumption. A prove of this hypothesis is given by the *t*-ratio test on the coefficient of the inverse Mills ratio, in the second stage of the two-step estimation, that turns out to be statistically significant. This statistical finding gives a further evidence of sample selection bias and therefore that the Heckman two-step procedure performs empirically better since it avoids such a problem. Besides, the Wald test for the Probit indicates that the model is well specified at the level of significance of 1% (Wald test chi2 = 140.14).

In Table 3, full results are reported for both the models that test the return to the visit at the museum on learning: in Column 1, the estimation without the Heckman correction for sample selection is presented; in Column 2, the Heckman procedure is presented. The first panel of results (*Ed: Learning new things*) is the participation equation for *Ed*, while the second panel is the outcome equation (*Outcome,* that is the actual learning at the museum*)*.

Table 3. Informal learning regression without correcting for sample selection bias and learning equation using Heckman two-step procedure

Variables	**No sample selection correction**		**Heckman Two-Step**	
Ed: Learning new things	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**
Timebeenmus	-0.2541388**	0.1096838	-0.0813235**	0.0345925
Curiosity	0.1913103	0.1213139	0.059802	0.0411966
Sayto	1.631868***	0.3461081	0.4244273***	0.0748943
Preserve	0.9126973***	0.3037139	0.2905788***	0.0907647
Worth	0.451389***	0.1600525	0.1704731***	0.0517836
Travelcost	0.00058*	0.0003379	0.0001312*	0.0000685
Children712	0.3253579**	0.1332643	0.1165825**	0.0449852
Education activities	0.469497**	0.197365	0.1550446**	0.0659499
Histsite	1.023255***	0.3609369	0.3324734***	0.1131426
Austriagerman	-0.3596097***	0.1367931	-0.1222677***	0.048204
Entrycost	0.0117877*	0.0065145	0.0038188*	0.001844
Museumsvisited	-0.003177	0.0090216	-0.0008044	0.0026595
Gender	-0.0031655	0.1209374	-0.0011093	0.0403652
Age	-0.0224225	0.0266323	-0.0093485	0.0088279
Age squared	0.0002248	0.0003164	0.0000967	0.0001039
Constant	0.3066556	0.6140481	0.6318588	0.2040147
Outcome				
Timespentmus	0.0046085**	0.0021764	0.0043484**	0.0021876
Pleasure	0.2396455***	0.0700479	0.2600266***	0.0707469
Wastingtime	-0.2134987*	0.1133833	-0.2003527*	0.1170907
Bored	-0.3566704***	0.1016261	-0.3578848***	0.1026977
Think	0.2318695	0.1433775	0.267207	0.1450805
Complete	-1.373588***	0.4821154	-1.303074***	0.4839432
Guided	0.2163877***	0.0619134	0.2113466***	0.0635708
Ease	0.2218811***	0.0692971	0.2148665***	0.0704387
Astonished	0.245543***	0.055712	0.2573288***	0.0566971
Genuniv	-0.6975569***	0.2536722	-0.6262283***	0.2570296
Museumsvisited	-0.0016744	0.0076669	-0.0022124	0.0075659
Gender	0.0738038	0.1438754	0.0522754	0.1445364
Education level	0.1994705**	0.0816914	0.1783252**	0.0828447
Austriagerman	0.1011541	0.1871043	0.1122178	0.1892731
Age	0.0225383	0.0253003	0.0280289	0.0254439
Age squared	-0.0003068	0.0003004	-0.0003676	0.0003019

Constant	-2,925355	0,6732784	-3.045294	0.6802435
/athrho	-0.5358552**	0.2527573	-	-
Rho	-0.4898441	0.1921089	-0.40012	-
Sigma	-	-	0.45085458	-
Mills Lambda	-	-	0.1803957**	0.0803641
Wald Chi2 (15)	90.04	Prob > chi2=0.000	140.14	Prob > chi2=0.000
LR test of indep. eqns. (rho = 0): chi2(1) =4.78 Prob > chi2 = 0.0287				

*Notes: *** , ** and * indicate statistically significance at the 1%, 5% and 10% level, respectively;*

Considering the "learning new things" equation, the signs of the coefficients and their statistically significance are rather similar, with and without Heckman two-step estimation. The propensity to visit a museum to learn something new is positively affected by pull factors that is: to have a cultural experience to tell about to friends and relatives, to contribute to preserve the museum heritage and because individuals regard the visit as something worth to do. Overall, travel and entry costs have a positive impact on the propensity to visit a museum as a place to learn; this outcome implies that only those really interested are willing to pay to improve their human capital. In addition, it should be noticed that the travel cost variable and the entry cost variable present a marginally statistically significant coefficient (i.e. 10%) and the magnitude is rather low. This finding is counterintuitive as according to the economic theory one would expect that an increase in price would lead to a decrease in demand. Nevertheless, although Lampi and Orth (2009) find that an increase of the entrance fees at a museum would discourage certain visitor segments, those who are regular culture consumers would be willing to visit the museum regardless of the fee level.

Besides, the propensity to consider the museum as an informal learning site is higher for individuals with children between 7 and 12 years old, for those who think that the museum should organise more activities (*education activities*) and for those interested in other historical sites of the city (*histsite*). Surprisingly, as the number of the visits to other museums in the past year increases, the propensity to learn decreases.

Nationality also matters, as the probability to visit the museum to learn new things decreases if the respondent is either Austrian or German. As a matter of interest, visitors from these countries represent a high quota of the sample (48 given that Bolzano province still preserves its Austro-Hungarian roots and German language, being annexed to Italy only at the end of World War I.

Considering the actual contribution to learning during the visit at the museum and only taking into account statistically significant coefficients (at least at the 10% level of significance), results, from the Probit equation, show that *ceteris paribus* the time spent at the museum, feelings of pleasure, ease, astonished and being guided denote a higher probability to improve knowledge. Visitors who perceive the museum as a place that helps them to think have a greater probability to learn more. The level of education also presents a positive and statistically significant coefficient confirming that more years of schooling increase the probability to get most the benefits in terms of contribution to human capital during a visit at a museum. The finding is coherent with the literature where the educational level is usually adopted as a proxy for the cultural consumption variable and represents a key determinant for cultural goods and the overall learning experience. However, male visitors, with at least a university degree, have a lower probability to acquire further learning at the museum if compared with their female counterpart. At the same time, completing a previous visit to the museum does not increase the probability to learn more. Same results are reached when visitors feel either bored or a sense of having wasted time. The exogenous factors (*museumvisited, gender,*

austriagerman, age, age squared) do not have a statistically significant effect, although the signs of the coefficients for age and age squared appear to be coherent with the human capital theory (e.g. Hoffman and Kassouf, 2005).

The coefficient of age and age squared are not statistically significant but the sign of age is negative and that of age squared is positive, in contrast with the selection equation. It denotes that as the age increases, the propensity to learn new things at a museum decreases but it doubles in older ages. Nationality also matters, as the probability to visit the museum to learn new things decreases if the respondent is either Austrian or German.

6. Discussion and conclusions

As emphasised in the literature, the contribution that museums, and more in general cultural sites, have on the lifelong learning still needs to be addressed in a more structural manner. The objective of the present paper has been to provide quantitative evidence on the role that museums may have on enhancing individuals' cultural capital, underpinning the empirical analysis to microeconomic foundations. In details, the analysis has focused on if and how the visit to a museum contributes to visitors' informal learning. The case study presented was the South Tyrol's Museum of Archaeology in Bolzano (Italy), best known as the Ötzi museum. Empirical data were obtained via a survey on 1,052 visitors at the museum from June to December 2011. Ötzi represents a unique finding since it is a well-preserved mummy for more than 5,000 years that still attracts scientists, historians, anthropologists from all around the world. Since its discovery in the Nineties, new knowledge has been enhanced and still nowadays new discoveries are made thanks to the new-generation technologies and equipment.

To establish the factors that influence museum visitors' propensity to consider a museum as a channel of informal learning, a Heckman two-step estimation has been applied. Evidence has been given that the propensity to learn at the museum is positively affected by several pull factors, such as having an experience to tell to friends/relatives and something worth to do, as well as to contribute to preserve the museum heritage. Also, it has been found that only those really interested in learning something new are willing to pay to improve their lifelong learning. The propensity to think about the museum as an informal learning place is greater for those with children between 7 and 12 years old and for those interested in other historical sites of the city (*histsite*).

The empirical investigation has revealed that, *ceteris paribus*, the time spent at the museum and positive feelings experienced during the visit at the site increase the probability to improve visitors' knowledge. Also, more years of schooling increase the probability to get the most benefits in terms of contribution to the human capital. Exogenous factors such as the number of museum visited, gender, nationality, age, age squared do not have a statistically significant effect.

Overall, there is empirical evidence that the key mission of the Ötzi museum as a learning site is fulfilled, although there has appeared ground for potential improvements. Enhancing educational activities, especially for children, may improve the outcome of the institution and the society as a whole in terms of enrichment of the cultural knowledge for visitors. There are virtuous examples worldwide that can offer a valid benchmark for other museums. As Des Griffin (2011) emphasises, positive education interventions in childhood have proved to be very important in the lifelong learning and in many cases go beyond the school group visits. In Australia, for example, museums have transformed visitor learning, public access and participation thanks to the growth and use of technological information. Colbert (2011) also highlights the importance of

children's museums as multifunctional places that help enhancing local communities economic, physical and social revitalisation. Families can share common spaces where, especially children from economically disadvantaged families, can develop a comprehensive learning experience.

In the case of the Ötzi museum, particular attention should be paid to non-Italian visitors. Although respondents of the sample coming from Austria and Germany represent a major proportion, the empirical evidence raises some doubts on the ability of the museum to contribute effectively to their learning during the visit. As a matter of interest, in 1991 it was assessed that the mummy was located only 92.56 meters (101 yards) inside Italian territory. Hence, the province of South Tyrol claimed property rights but gave permission to Innsbruck University to undertake further archaeological investigations at the find scene and delegated the finds to the Austrians to complete scientific examinations. South Tyrol still preserves its Austro-Hungarian roots and German language, being annexed to Italy only at the end of World War I. Hence, Ötzi is a symbol and a long-term consciousness of the social interactions between these two populations since the pre-historical times. These reciprocal roots and common cultural identity should be further strengthen via education schemes between the two countries, starting from this archaeological museum. Local communities, and in particular that of the city of Bolzano, can benefit of these strategic leaning synergies between museums as a driving force for raising visits and socio-economic spill over effects on the territory.

Besides, in South Tyrol, a very special geological area is located, the so-called *Dolomites,* that in 2010 was recognised by UNESCO as a world natural heritage property. The geological history of the Dolomites is exposed at the Bolzano museum of Natural Science where visitors can learn about the formation of this 3,000-meter-high mountains that were formed from the reefs of the warm Triassic seas. The museum also offers interactive activities such as the use of models, scenes, games, experiments, and as a real highlight the sea aquarium. Museums management and policy makers should view this unique patrimony as a single cultural product that may be jointly offered to visitors but also to the local community as a stimulus for education and a repository of the historical knowledge. Future research should also be aimed at investigating the role that the museum of Ötzi plays to the local community, analysing residents' perceptions and awareness about the importance of Ötzi and the other archaeological findings for cultural and education purposes.

This paper also presents some limitation. In fact, it likely that some of the experience items at the museum (e.g. "a place that makes you think" "not to be bored of") may have a reversed causality with the probability of learning. This potential causality issue needs further attention in future research by using either instrumental variables techniques or mixed-multivariate approaches that are out of the scope of the present investigation.

Finally, although the present research has involved a specific cultural site, it has offered a rigorous quantitative tool that can be easily generalized to other locations in order to find some common features on the determinants that influence visitors' lifelong learning process.

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