How free admittance affects charged visits to museums:

An analysis of the Italian case

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Abstract: This study evaluates the effects of free visits to museums upon charged visits. We take the Italian State museums and monuments as the case study, and we consider monthly data, aggregate at the national level, from January 1996 to December 2015. Within a multivariate analysis, which takes into account the seasonal structure of data, we document a positive influence of the number of free visits to museums and monuments upon the subsequent charged visits. We also analyse the effect of a recent policy change (July 2014), consisting in an extension of free admittance. We show that the new rule has entailed an increase in both free and charged visits, as well as a stronger link between the patterns of free and charged visits. Our results can be informative in the ever-green debate on the museum attendance and its relations with individual choices and public policies concerning cultural consumption.

Keywords: Museums, Free attendance, Cultural consumption, Seasonal time series.

JEL Classification: Z11, C22.

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1. Introduction

The BBC website, on December 1st 2011, the day marking the 10th anniversary of the government’s decision to end charges at England’s national museums, reported that: "Government-sponsored museums that have stopped charging since 2001 have seen combined visitor rates more than double in the past decade, figures show. [...] Almost 18 million people visited the 13 attractions in 2010-11, compared with 7 million in 2000-01".[1]

In different recent interviews and statements, the Italian Minister for Culture and Tourism underlined the spectacular increase in numbers of museum attendance since 2014, also thanks to the fact that free admission was established for each first Sunday every month in all Italian State museums and monuments, starting from July 2014.[2] The official website of the Italian Ministry for Culture and Tourism stresses that free visits have increased by 5%, and charged visits by 7% in the second semester 2014, with respect to the previous year. In 2015, the variation is about +4% for free visits, +6% for charged visits and +14% for revenues, while in 2016 the variation (w.r.t. 2015) is +4% and +12% for total visits and revenues, respectively (MIBACT, 2016, 2017a). Such data would suggest, according to the Italian Government, that the policy of promoting free admission to museums and monuments, among other reforms, has benefitted charged visits too.

Across countries, and across museums in any country, the rules concerning free *vs.* charged admission to museums differ and have been changing over time, often according to the prevailing political view: roughly speaking, ‘market-oriented’ governments are more prone to consider museums as any other private cultural agencies that have to compete in the market choosing the optimal pricing strategy to maximize revenues; ‘welfare-oriented’ governments are more prone to favour free-of-charge admission rules, consistent with a social role of museums, useful to improve people's cultural formation, to reinforce local identity of cities and regions and to stimulate economic local development (Santagata, 2007).

[1] Some effects of the 2001 reintroduction of universal free admission to the government-sponsored museums in the UK are analysed by Cowell (2007); see also the previous analysis by Martin (2003).They show that the number of *visits* to free-admission museums in the UK has been increasing since 2001, but it is less clear whether the number of *visitors* has increased or the same people go more often to museums.

[2]See, among many others, the statement of Minister Dario Franceschini published in the official website of the Ministry (MIBACT, 2017b)

Nowadays, all possible combinations of rules seem to be present, in any country (Chen et al., 2016): there are cases in which the admission fee is required without exception; museums where charged admission joins with strict or large policy concerning free or reduced admission to certain sub-groups of people; museums where free admission is reserved to people subscribing a membership (Rushton, 2017) and museums with free admission for all, sometimes joint with a plea for voluntary contribution. This variety of admission rules holds also within a group of museums which are similar in nature or even managed by the same company. For instance, within the Smithsonian group in the US, some museums require admission fee while others are free. It is also possible that a museum offers free entry to permanent exhibition and charges for temporary exhibitions, or vice versa. Moreover, free entry, especially for special events, is used in several circumstances as a marketing tool to promote regular charged visits (Kotler et al., 2008).

A recent study of Chen et al. (2016) shows that free entry to public museums can also benefit private museums, increasing their paying visitors: Chen et al. (2016) examine the effects of the introduction of universal free admission to public museums in Taiwan, and they find that the new free-admission policy in public museums leads to larger number of visits to both public and private museums. In other words, they document a positive externality from the free visits to public museums upon the charged visits to private museums. In this article, we specifically revisit this point, aiming to assess whether the dynamics of free visits affects current and future dynamics of charged visits. We take Italy as the case study, and examine aggregate data on monthly visits to State museums and monuments over the period 1996-2015, with the final aim of detecting the relation between free and charged visits to museums over time.

The outline of the article is as follows. In Section 2 we briefly mention some relevant literature contributions. In Section 3 we present the data and discuss the statistic properties of the time series at hand: we show that the series of free and charged visits to museums and monuments show strong seasonal patterns, and the nature (stochastic or deterministic) of the seasonal pattern is debated. More importantly, we show that the shape of seasonal components differ between free and charged visits; this aspect, overlooked by available analyses, can provide some marketing and policy suggestions. In Section 4, we investigate the relation between the dynamics of charged visits, free visits, and tourism flow series. We document that the new rule concerning free admission to State museums in Italy (dated July 2014) has entailed a structural break in the behaviour of both free and charged visits to these museums, and a new, stronger, relation has established. Section 5 concludes, proposing some reflections on theoretical underpinnings and policy implications.

2. Free *vs.* charged admission to musuems: a brief literature review

The debate on the issue of free *vs*. charged admission to museum is of interest for managers, policymakers and academics (Cowell, 2007). The economic literature, based on theoretical and empirical research, mainly concerns the pros and cons of charging museum visits and the effect of entrance fee policies on museum attendance, considering the public and private nature of different outputs offered by museums (say, identification, preservation and exhibition of the collection; see Fernandez-Blanco and Prieto-Rodriguez, 2011).

The public good nature of the museums' output and its educational content, and the merit good nature of cultural heritage, are theoretical reasons supporting the free attendance to public museum (Peacock and Godfrey, 1976; O'Hagan, 1995). However, pricing is not Pareto-efficient from a social-welfare perspective, as the marginal cost of an additional visitor is close to zero; moreover, if the admission fee is set equal to the average cost, all potential visitors, who are willing to pay more than the marginal cost but less than the average cost, will be excluded from the visit, thus entailing a violation of the equality opportunity principle (Santagata, 2007). On the other hand, free admission policy has regressive effects, as benefits go to individuals who are able to pay the entrance fee, and museums are subsidized by public grants coming from general fiscal entrances.

The private nature of the cultural services supplied by museums can justify the introduction of an entrance fee, both to avoid congestion (Maddison and Foster, 2003) and to get revenues to invest in increasing the quality of the services supplied, as also Sir Alan Peacock suggested (Peacock, 1969; Towse, 2005). However, it is well-known that the museums' competition for visitors cannot be based on the entry ticket (whose price is in most cases regulated, at least in public museums) but it is based on the quality of the collection and the related services useful to appreciate the collection. In any case, pricing is a relevant element of the marketing strategy, and it can avoid that individuals undervalue free-of-charge cultural entertainment and postpone its consumption, while preferring other cultural activities that have a price and are offered for a limited period of time (Kotler et al., 2008).

Museums' managers are aware that the revenues from entrance fees cannot cover the high maintenance and management costs of museum: public grants are the main source of entrance, and the introduction of a pricing system could partially crowd out other financing sources, such as voluntary contributions (see Santagata and Signorello, 2000, on the case of Naples museums). Therefore, an optimal financing schedule of museums, consistent with an objective function taking into account the utility of visitors and the goals of managers and stakeholders, usually combines the different sources of entrance: fees, public grants, voluntary contributions (Prieto-Rodriguez and Fernandez-Blanco, 2006).

In available economic literature, large part of evidence concerning the effect of tickets on museum attendance is based on individual surveys, or research at specific museums, so that the conclusions are typically based on case-studies (see the comprehensive review in Frateschi et al., 2009). Several contributions in literature have resorted to contingent valuation and stated preferences techniques to assess the willingness to pay for visiting specific museums (Santagata and Signorello, 2000; Sanz et al., 2003; Bedate et al. 2004, 2009; Lampi and Orth, 2009, among others); only a few studies resort to aggregate data (e.g., Cowell, 2007, on visits to museums in UK).

Available empirical research generally suggests that price is not a serious barrier to visit to museum, and the price elasticity of museum visits is low. Some researchers openly suggest that charged admission does not hurt museum attendance, and may have positive effects in terms of revenues, especially if the quality of the services increases (see O'Hagan, 1995; Steiner, 1997; Luksetich and Partridge, 1997). However, a side effect of price could be given by the composition of museum attendances, as price represents a perceived subjective barrier that is mainly related with the individual income, education and occupational status (Kirchberg, 1998). On the other hand, the pieces of evidence collected in the UK case, after the 2001 reintroduction of universal free admission to government-sponsored museums, seem to suggest that the increase of attendance has concerned all segments of visitors, without a significant change in the profile of the typical visitor, especially as far as income and education levels are concerned (Cowel, 2007; Martin, 2003).

Moreover, addiction is a relevant feature of cultural consumptions (Stigler and Becker, 1977), including museum attendance (Brida et al., 2016). This suggests that promoting the free admission of (young, but not only) people will enhance future demand (Brito and Barros, 2005, among many others).

3. Data and methods

3.1 *Data*

We aim to analyse the dynamics of free and charged visits to Italian State museums in aggregate terms. The data we consider are provided by the Italian Ministry of Culture and Tourism, and they are freely available from the www.statistica.beniculturali.it website. In particular, we consider the monthly series of free and charged visits to all State museums, monuments, historical parks and gardens and archaeological areas. The group of sites is very large (made by more than 400 spots), and heterogeneous: it includes superstar museums (like Uffizi in Firenze), superstar monuments (i.e., Colosseo in Rome), superstar archaeological areas (i.e., Pompei, Foro Romano) but also minor heritage attractions, spread over Italy.

It is very informative to take a preliminary look at the series under scrutiny. Figure 1 and 2 show their patterns over time, while Table 1 gives some statistics.

Both the free attendance and the charged attendance show strong seasonal pattern. The amount of free visits is clearly larger than the amount of charged visits, especially due to attendance at peak seasons; the seasonal variation of free attendance is clearly larger than the seasonal variation of charged attendance; the peaks occur at different months, for free and charged attendance.

Figure 1 - Patterns over time of free and charged visits to museums and monuments

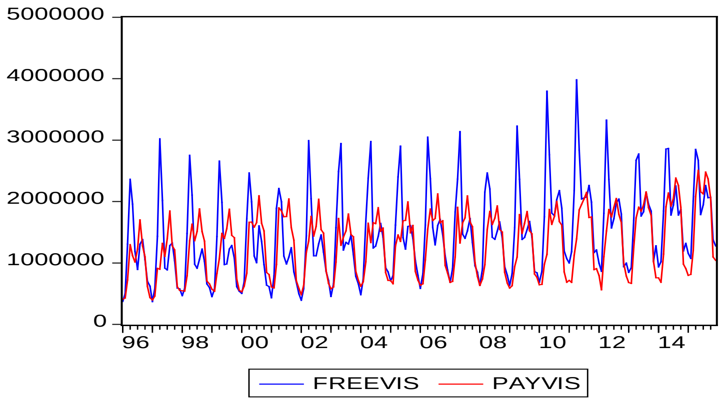

Figure 2 - Patterns over time of free and charged visits to museums and monuments by season

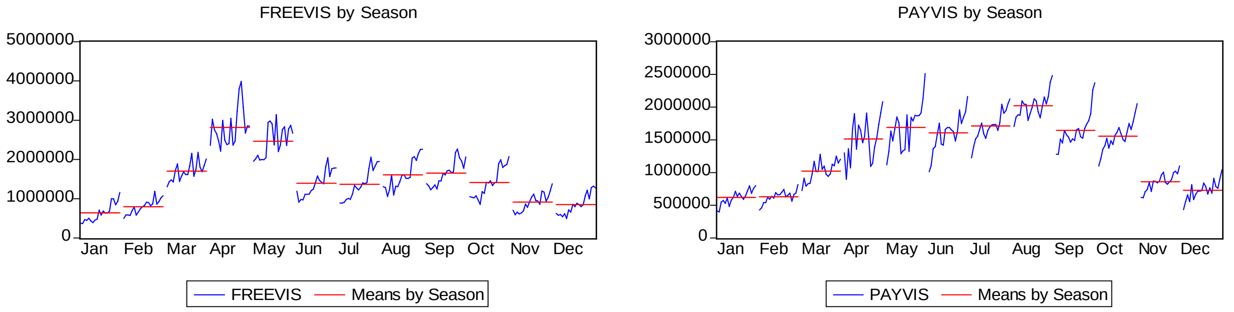

Table 1 – Descriptive statistics on time series

	FREEVIS	PAYVIS
Mean	1,468,755	1,300,212
Median	1,344,276	1,360,045
Maximum	3,981,811	2,511,003
Minimum	371,681	398,435
Std. Dev.	709043.4	519583.9
Month with min average	Jan (640,482)	Jan (620,815)
Month with Max average	Apr (2,816,942)	Aug (2,0200,039)
F test on seasonality	$F_{11,228}$=213.95**	$F_{11,228}$=371.24***
K test on seasonality	K=222.55**	K=214.83**
F test on moving seasonality	$F_{19,209}$=2.47**	$F_{19,209}=1.25^{n.s.}$
SF (min-Max,1996) SF (min-Max,2015)	0.96-1.01 0.96-1.02	0.95-1.04 0.95-1.03
Observations	240	240

Note: ***/**/*= significant at 0.1/1/5%; n.s.: not significant at the 5% level.
FREEVIS denotes the free visits to museums and monuments; *PAYVIS* denotes the charged visits.

These simple pieces of evidence, perhaps overlooked by available analyses in literature, provide valuable elements for reflection and policy implications. First, the peak months for free visits are the spring months (April and, in the second place, May), due to the visits of school students in organized tours which typically take place in spring. Second, the peak months for charged visits are in summer (August, and in the second place, July): this clearly suggests that tourist flows (whose peaks are in August and July) have an effect on the size of visits to museums and monuments. The fact that tourist arrivals drive visits to museum and monuments is widely documented (see Cellini and Cuccia, 2013, for a specific analysis of the Italian case). Third, descriptive statistics concerning the measure of seasonality confirm what is already clear from the graphical inspection: if we rely on standard analysis of seasonal components, the usual tests in Table 1 (based on the X12-Arima seasonal adjustment programme, assuming a multiplicative datum structure), drive to the conclusion that the presence of significant seasonal components cannot be rejected; however, seasonality appears to be more limited and more stable over the years for the charged attendance as compared to the free attendance; more formally, the appropriate *F*-test on moving seasonality detects moving seasonal factors for free visits with a clear tendency to reduce over time (as shown by the change of seasonal factors), while it rejects the presence of moving seasonality for charged visits.

3.2 *The nature of seasonality*

Seasonality may have a stochastic or a deterministic nature; that is, the time series can be characterized by the presence of seasonal unit roots, or by the presence of deterministic seasonal components. Several tests have been proposed to detect the presence of seasonal unit roots. In particular Dickey, Hasza and Fuller (1984), provide an extension of Dickey Fuller test (originally proposed for evaluating the unit root in yearly data) to the case of seasonal series. Hylleberg et al. (1990) and Beaulieu and Miron (1993) offer contributions for additional test procedures, still following a regression-based approach, focussing on quarterly and monthly data, respectively. Tests along these lines have been largely employed to analyse monthly time series in the field of tourism (see, e.g., the recent application in Cellini and Cuccia, 2013, referred to Italy).[3]

However, both Smith and Taylor (1998), analysing quarterly data, and Taylor (1998), dealing with monthly data, observe that the Dickey-Hasza-Fuller procedure do not allow for different time trends across the seasons, and they show that the null of the presence of seasonal unit root is easily rejected, if one allows for different trends across seasons. In simpler words, Smith and Taylor (1998) and Taylor (1998) point out that seasonal unit roots disappear from the data generation process, if one accounts for different time trends for seasons across years.

In more formal terms,[4] let Y_t denote a monthly time series, and let $Y_t = a + \rho Y_{t-12} + v_t$ be the representation of the data generating process. The series possesses a seasonal unit root if the null hypothesis $\rho = 1$ cannot be rejected. Operationally, this amounts to considering the regression equation $\Delta_{12} Y_t = a + \alpha Y_{t-12} + v_t$, and to evaluating the null hypothesis $\alpha = \rho - 1 = 0$ (the symbol Δ_{12} denotes the 12-th difference, that is $\Delta_{12} Y_t \equiv Y_t - Y_{t-12}$). However, more complex deterministic components of the data generation process of Y_t should be taken into account. Specifically, 12 different constant terms (one for each season) instead of one constant term should be taken into account; in such a case, *a* has to be interpreted as a twelve-component vector, $a = \{a_i\}_{i=1}^{12}$.[5] Second, a number of autoregressive terms of $\Delta_{12} Y_t$ should be considered in order to have white noise regression residuals; in most cases, the 1st, 2nd and 12th lags of the dependent variable are statistically significant and sufficient to make white noise residuals. Third and most important, a deterministic trend (*T*) should be appropriately considered as well, even if the inclusion of a trend

[3] Comprehensive reviews of theoretical aspects and applied investigations of seasonal integration and co-integration are offered by Hylleberg (1995), Fransen (1996) and Ghysels and Osborn (2001).

[4] This paragraph concerning the method follows Cellini and Cuccia (2013, Section 4).

[5] Operationally, one can evaluate 11 additional seasonal dummy variables beyond the constant term, and evaluate whether the additional seasonal dummy variables are significant (Fransen and Kunst, 1999).

makes the test for seasonal unit roots less powerful. Accordingly, a procedure should be used, in which the following regression equation is considered:

[1] $$\Delta_{12}Y_t = \sum_{i=1}^{12} a_i + \tau T + \alpha Y_{t-12} + \sum_j \beta_j \Delta_{12} Y_{t-j} + \varepsilon_t$$

and specifically the significance of the coefficient α is evaluated, in order to test for the presence of the seasonal unit root. To this end, the distribution of the Student-*t* statistics are non-standard, and specific tabulations of critical values are provided by Dickey, Hasza and Fuller (1984). If the null of seasonal unit root is not rejected (i.e., $\alpha = 0$), the series is seasonally integrated. Seasonally integrated series possess *s* unit root processes, specifically one unit-root for each of the *s* seasons. Taylor (1998) observes that the appropriate inclusion of 12 different trend terms (one for each season) leads to reject the null of seasonal unit root, whereas the same null hypothesis cannot be rejected in the presence of only one trend, common to all seasons. He also shows that the evaluation of the presence of a seasonal unit root in the presence of 12 time trends corresponds to evaluate the auxiliary regression:

[2] $$\Delta_{12}Y_t = \sum_{i=1}^{12} a_i + \sum_{i=1}^{12} b_i Y_{t-i} + \sum_{i=1}^{12} c_i T_i + \varepsilon_t;$$

(where T_i , *i*=1,2,…12 is a deterministic trend specific for month *i*) and to test the null $\sum_{i=1}^{12} b_i = 0$.

Table 2 reports the results of both the standard Dickey-Hasza-Fuller procedure, and the procedure suggested by Taylor (1998), as applied to the series under consideration in the present analysis. Both procedures lead to reject the presence of seasonal unit roots for both the series of free attendance and the charged attendance.[6] However, in the cases of both charged visits and free visits, some components of the vector $\{c_i\}_{i=1}^{12}$ are statistically significant, while others are not, so that the consideration of different time trends across seasons appears appropriate, and the conclusion is that seasonal unit roots are absent, in the presence of different seasonal trends.

[6] It is worth reporting that Cellini and Cuccia (2013) find the opposite result, that is, the presence of seasonal unit root cannot be rejected, with reference to the series of total visits (the sum of free and charged visits) over the shorter time span 1996-2011. Clearly, we cannot say that our present results are inconsistent with Cellini and Cuccia (2013), since the series and the time spans under consideration are different. In other words, the availability of longer time series here leads us to judge the Data Generating Process with different trends for different months but without seasonal unit roots as the most appropriate one, while a different conclusion was reached on the basis of a shorter time-span.

As underlined by Taylor (1998), the interpretation of a time series as a seasonally integrated series (and hence the consideration of seasonally differentiated series for inference and regression analysis), in the face of a true data generating process which includes different seasonal deterministic time trends and no seasonal unit root, leads to errors due to the over-differentiation of the series at hand.

Table 2 – Test on seasonal unit roots

	FREEVIS	PAYVIS
Hasza-Dickey-Fueller test (critical value Student-t 5%: -6.13)	-0.665 (-8.19)***	-0.55 (-8.68)***
Taylor $F_{1,2,...12}$ test (critical value 5%: 7.240)	10.321 (p=.000)***	7.534 (p=.000)***

Note: Hasza-Dickey-Fuller test report the estimate of the alpha coefficient (and its Student t) in [1]; only significant lag terms of $\Delta_{12}Y_t$ are considered. Taylor $F_{1,2,...12}$ test considers eq. [2] and provides the result of the *F* test on the null $b_1=b_2=...b_{12}=0$. In both cases, the null is the presence of a seasonal unit root.

For the above mentioned reasons, we consider the time series of free and charged attendance to Italian State museums and monuments, as seasonally stationary in the presence of different seasonal constant and time-trend components.

The same conclusion –that is, the rejection of seasonal unit root, in the presence of different seasonal constant and time-trend terms– is reached for the series of tourist arrivals and overstays. The $F_{1,2....12}$ Taylor tests provide in any case values well above the critical value (which is 2.3 at the 0.05 significance level): the test statistics are 17.701 for arrivals, and 9.469 for overstays.

3.3 *Research design*

The aim of the present study is to evaluate the effect of free visits to museums and monuments upon (contemporary and subsequent) charged visits. Taking into account the seasonal nature of the series at hand, largely discussed in the previous section, we opt for considering the following general specification.

[3] $$Y_t = \sum_{i=1}^{12} a_i + \sum_{i=1}^{12} c_i T_i + \beta X_t + \gamma Z_t + \sum_{i=1}^{12} \lambda_i Y_{t-i} + \sum_{i=1}^{12} \varphi_i X_{t-i} + \varepsilon_t \, ;$$

Variable Y denotes the charged visits to museum and monuments; variable X denotes the free visits, and variable Z is a control variable corresponding to the tourist arrivals (or tourist overstays, depending on the specification). The a_i coefficients correspond to the seasonal dummy variables; the terms c_iT_i represent the seasonal trend terms; polynomial terms $\sum_{i=1}^{12} \lambda_i Y_{t-i}$ and $\sum_{i=1}^{12} \varphi_i X_{t-i}$ represent the lags of the dependent variable Y and independent variable X, respectively.

Noteworthy, we proceed from the general to the particular specification, and we maintain only the significant terms in the regression specification. Thus, only a sub-set of the 12 seasonal dummy variables, and only a subset of seasonal trends, are statistically significant (at the 10% level), and are kept in the final specification, beyond a constant term and a time trend. Similarly, only the significant lags of variables X and Y are kept in final specification: usually, the lags of 1^{st}, 2^{nd} and 12^{th} order.

4. The dynamic effects of free attendance upon charged visits to museums and monuments

This section provides the core findings of the present study. Results of regression equation [3] are reported in Table 3 - Column 1.

Some comments are in order. First, the amount of tourist arrivals is significant, and hence its inclusion is appropriate. This piece of evidence confirms what is intuitive and already known: the amount of tourist arrivals affects attendance at museum and monuments. It is important to report that the deterministic trend is not significant, if tourist arrivals are considered in the specification, whereas the time trend would be significant in the absence of tourist arrivals among regressors. This clearly means that the time trend captures the increase of tourism flows. Second, the contemporary free entrance emerges to exert a negative impact on charged visits. So, there is a certain degree of crowding out between free and charged entrance (the coefficient is equal to -0.20, and it is statistically significant); in other words, contemporary free and charged visits appear to behave as *substitute goods*, at this stage of analysis. Third, the most important piece of evidence, in our reading of results, is the positive and significant effect of the 12^{th} lag of free entrance (the slope-coefficient is +0.14, statistically significant): the amount of free visits affects charged visits, with a lag of one year. Verbally, an increase in the number of free visitors may have a negative effect on the contemporary number of charged visits, but it has a counterbalancing positive effect, with a one year lag. Free visits and 1-year-later charged visits behave as *complement goods*.

Table 3 – Regression results

Dependent variable: *PAYVIS*	[Column 1] (OLS)	[Column 2] (OLS)	[Column 3] (IV)
Constant ($\times 1{,}000$)	110.3 (1.66)*	162.2 (2.50)***	141.8 (2.23)**
Seasonal constant dummy ($\times 1{,}000$) [month number in brackets]	[1] -224.8 (-4.78)*** [6] 19291 (1.75)* [7] 42356 (3.49)*** [8] 53320 (4.29)*** [11] -242.2 (-4.49)***	[1] -257.2 (-4.59)*** [4] 152.5 (3.21)*** [7] -105.9 (-1.99)*** [8] 23065 (1.88)* [11] -317.9 (-5.10)***	[1] -216.1 (-4.54)*** [4] 102.5 (2.68)*** [11] -313.7 (-5.79)***
Seasonal deterministic trends [month number in brackets]	[2] -111.8 (-4.93)*** [6] -9772.7 (-1.78)* [7] -21304.5 (-3.50)*** [8] -26756.6 (-4.30)*** [9] -155.3 (-5.52)*** [12] -84.1 (-3.61)***	[2] -122.3 (-4.60)*** [8] -11486 (-1.88)* [9] -59.0 (-2.93)*** [12] -117.3 (-4.50)***	[2] -99.8 (-4.22)*** [9] -56.3 (-2.77)*** [12] -101.6 (-4.44)***
TOURARRIVALS	0.115 (6.39)***	0.043 (4.11)***	0.021 (3.00)***
FREEVIS	-0.203 (-5.87)***	-0.03 (-0.98)n.s.	
FREEVIS(-1)	0.084 (3.10)***		
FREEVIS(-2)	-0.084 (-2.50)**		
FREEVIS(-12)	0.136 (3.74)***		
CUM_FREEVIS		0.112 (2.29)**	0.100 (2.46)**
PAYVIS(-1)	0.269 (5.81)***	0.249 (5.54)***	0.253 (5.93)***
PAYVIS(-12)	0.216 (3.70)***	0.368 (5.94)***	0.485 (7.98)***
R2	0.96	0.94	0.93
F	248.3***	231.3***	305.1***
Durbin *h*	2.84***	-1.12	-1.11
Observations	228	228	228

Note: *t*-stat (Column 1 and 2) or *z*-stat (Column 3) in parenthesis; ***,**,* denote significance at the 1%, 5%,10% level, respectively; n.s. stays for not-significant at the 10% level.
TOURARRIVALS denotes the tourist arrivals
CUM_FREEVIS is the monthly average of free visits, computed over the previous 12 months.

If we consider the effect of the number of free visits, as measured as the cumulated (or monthly average) datum over the previous twelve months,[7] upon the current charged visits, we obtain an

[7] The variable under consideration is $CUM\_FREEVIS_t = \sum_{i=1}^{12}(FREEVIS_{t-i})/12$, indifferently labelled as 'cumulated' or 'average' free visits over the past 12 months: note that the cumulated value is divided by 12, so

even clearer result, as shown by Column 2 of Table 3: the contemporary free visits are no longer significant, while the free visits during the previous twelve months have a positive and significant effect upon the number of current charged visits. In other words, contemporary free and charged visits appear to behave as substitute goods if the relation is conditioned on selected lagged values of free visits, while this links disappears, in the relation conditioned on the average free visits over the twelve previous months. There is no doubt about the fact that the *average past free visits* are *complement* with *current charged visits*, that is, a positive externality is at work between free and subsequent charged visits.

With respect to the results reported in Column 2 of Table 3, we observe that the contemporary free visits can be omitted from the specification, as insignificant; moreover, tourist arrivals can be endogenous. Indeed, the Hasuman exogeneity test as applied to this explanatory variable rejects the null of exogeneity (Chì-sq=33.17, p=0.000). This result is interesting *per se*, as it is a signal for a possible influence of museum attendance upon tourism arrivals. Hence, we have also run the regression with the Instrumental Variable (IV) method, with the tourist arrival variable instrumented by its own 1st and 12th lags;[8] however, the IV estimatates are substantially similar with the OLS estimates (see Column 3 of Table 3): maintaining only the significant dummy variables in the specification, no changes occur in the statistical significance of the economic variables under scrutiny; simply, tourist arrivals and past cumulated free visits show slightly smaller coefficients.

It is easy to compute some elasticity coefficients, basing on the estimates at hand; in particular, the elasticity of the charged visits with respect to the average past free visits (over the twelve months before) turns out to be 0.13 or 0.11 (according to the OLS or IV estimates, respectively).[9] Apart from the specific numerical value, the meaning is that the increase of free visits make a small but statistically significant contribution to the increase of subsequent charged visits, ceteris paribus.

The substantive results remain unchanged if we substitute tourist arrivals with tourist overstays in the specifications of Table 3: this outcome is unsurprising, as the correlation between the time series of tourist arrivals and overstays is 0.924 (the results, not reported for the sake of brevity, are available from Authors upon request).

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that the average number of monthly free visits over the past 12 months is obtained; of course, the cumulated value or the monthly average value over the 12 past months have the same statistical properties in the regression analysis, as they differ for a constant multiplying factor.

[8] These instruments are strong $F_{2,\ 213}$=414.8, p=0.000 and appropriate according to the Sargan test: LM=0.007, p=0.930.

[9] If we resort to a log-log specification, the estimate of the same elasticity coefficient emerges to be 0.18 (with standard deviation equal to 0.06; Student-*t*=3.03); the slight differences are also due to the fact that the set of seasonal dummies do vary across the different specifications, under the criterion to keep only significant regressors.

4.1 *The 2014 policy intervention*

A point worth investigating, also for the political debate in Italy, consists in evaluating whether the governmental decision (in July 2014) of permitting universal free admission to State museums and monuments on every first Sunday of any month, entails a significant structural break in the relation between free and charged visits. The answer is positive: taking July 2014 as the breakpoint, the Chow breakpoint test provides the statistics: $F_{15,228}$=2.09 (p=0.01), LR=33.57 (p=0.003), which mean that the absence of structural break has to be rejected.

In order to establish which specific coefficients show structural instability, we investigate possible breaks involving the constant term and the slope coefficients of contemporary and past free visits, as well as the tourism variable. The results (see Table 4 - Column 1) show that a significant structural break affects the impact of contemporary free visit upon charged visits: this coefficient turns out to be positive and significant after the breakpoint, while it was not significant before. The same result –that is, the structural break occurs in the relation between contemporary free and charged visits– is obtained, if we start by considering a segmented slope coefficient for each regressors (i.e., a pair of coefficients applied to each variable, as considered before and after the breakpoint), and then we test for the equality of the pair coefficients for each regressor before and after the breakpoint: the coefficient equality is rejected only in the case of the contemporary free visits, which are not significant before the breakpoint, and significant in the sub-period after July 2014.

Elaborating on the regression analysis in the presence of the structural break specifically concerning the effect of contemporary free visits upon charged visits, we come to the conclusion that the inclusion of a general deterministic trend is appropriate, in this specification (Table 4 - Column 2). Moreover, all results are robust to the consideration of tourist overstays instead of arrivals.

In sum –even if caution is necessary, in front of the limited number of observations available for the period in which the new governmental policy is operative– it seems to be correct affirming that the decision of promoting free visits to State museums and monuments emerges to have a structural effect, that strengthens the positive relation between free and charged visits. More specifically, our analysis suggests that a stronger link establishes between contemporary free and charged visits, which start to behave as complementary goods under the new, larger free admission policy. In other words, the positive externality from free to charged visits to museum appears to emerge even without time lag, after the governmental decision of promoting free visits to State museums and monument through free admission on the first Sunday of each month has come in place. At the same time, the effect of past free visits upon current charged visits remain positive and significant.

Table 4 – The effects of governmental decision in July 2014

Dependent variable: *PAYVIS*	[Column 1] (OLS)	[Column 2] (OLS)	[Column 3] (IV)
Constant ($\times 1{,}000$)	260.0 (3.85)***	18125.9 (1.97)*	17926.7 (1.92)*
Trend (year)		-9042.3 (-1.93)*	-8936.2 (-1.90)*
Seasonal constant dummy ($\times 1{,}000$) [month number in brackets]	[1] -283.2 (-5.19)*** [4] 147.9 (3.23)*** [7] -104.9 (-2.03)** [8] 30660.0. (2.50)** [11] -326.5 (-5.40)***	[1] -249.8 (-4.41)*** [4] 141.4 (3.07)*** [7] -125.2 (-2.43)** [8] 2754 (2.32)** [11] -289.4 (-4.66)***	[1] -245.3 (-4.88)*** [4] 103.2 (2.78)*** [11] -302.6 (5.59)***
Seasonal deterministic trends [month number in brackets]	[2] -135.46 (-5.21)*** [8] -15268.7 (-2.50)** [9] -54.94 (.2.82)*** [12] -128.9 (-5.06)***	[2] -121.2 (-4.53)*** [8] -13730 (-2.31)** [9] -54.1 (-2.79)*** [12] -117.2 (-4.52)***	[2] -116.1 (-4.71)*** [8] -59.3 (-2.70)* [12] -116.4 (-4.93)***
TOURARRIVALS	0.045 (4.36)***	0.048 (4.74)***	0.019 (2.56)*
FREEVIS	-0.029 (-1.10)$^{\text{n.s.}}$	-0.027 (-1.02) $^{\text{n.s.}}$	
CUM_FREEVIS	0.081 (1.63)$^{\text{n.s.}}$	0.226 (2.42)**	0.252 (2.66)***
PAYVIS(-1)	0.238 (5.42)***	0.209 (4.75)***	0.197 (5.29)***
PAYVIS(-12)	0.324 (5.34)***	0.377 (6.02)***	0.470 (7.53)***
DU(Since07-2014)	-898498 (-0.41)$^{\text{n.s.}}$		
*DU(Since07-2014)*TOURIST_ ARRIVALS*	-0.003 (-0.24)$^{\text{n.s.}}$		
DU(Since07-2014) FREEVIS*	0.200 (2.40)**	0.086 (4.48)***	0.081 (4.17)***
*DU(Since07-2014)*CUM_FREEVIS*	0.376 (032)$^{\text{n.s.}}$		
R2	0.94	0.94	0.94
F	195.3***	222.1***	276.1***
Durbin *h*	-2.57**	-1.90	-1.30
Observations	228	228	228

Note: *t*-stat (Column 1 and 2) or *z*-stat (Column 3) in parenthesis;; ***,**,* denote significance at the 1%, 5%,10% level, respectively; n.s. stays for not-significant at the 10% level.

Also in this case, the substantial evidence does not change if one takes into account that tourist arrivals are not exogenous: the IV estimates (taking the 1st and 12th lags as the instrumental variables for the tourist arrivals) are reported in Column 3 of Table 4; [10] Under these specifications, we obtain that, under the new free admission policy, the elasticity coefficient of monthly charged visit with respect to contemporary free visit is equal to 0.07 (irrespective of OLS or IV), and the elasticity to the average monthly free visits over the previous twelve month equal to 0.25 or 0.28 (according to OLS or IV, respectively). The quantitative dimension of these effects, though limited, is statistically significant.

5. Theoretical underpinnings, policy implications and concluding remarks

The fact that opportunity cost of cultural consumption is decreasing in the stock of consumed cultural services and commodities, and cultural consumption is characterized by addiction are milestones in cultural economics, since the Becker and Murphy (1988) analysis, not to mention Stigler and Becker (1977) and even the intuition in Chapter 3 of Book 3 by Marshall's *Principles* (Marshall, 1890). These arguments provide support for the point that enhancing free visit to museums today drives to increase demand for museum tomorrow.

This theoretical prediction is supported by our present analysis. More interestingly, our analysis provides a further piece of evidence: a new free admittance policy for Italian State museums, consisting in enlarging the opportunity of museum free visits, has led to higher positive effect of free visits upon both subsequent and contemporary charged visits.

We would like to underline that our findings are fully in line with the results recently presented by Chen et al. (2016), on the case of Taiwan, even if our present research design, method (and data, of course) differ from theirs. Chen et al. (2016) show that the introduction of the free admittance to public museums has entailed a significant difference in both free visits to public museums and charged visits to private museums, in Taiwan. They employ a difference-in-difference specification approach, which is appropriate in the analysis of panel data. Here, we have analysed aggregate time series data, with no panel structure, limiting our attention to public museums and monuments. We have documented a structural break over time, due to the enlargement of free-admission policy. In both cases, Italy and Taiwan, the substantial evidence is the same –although the institutional

[10] In this case, the Hausman exogeniety test rejects the null with Chì-sq=25.9 (p=0.000); the considered instrumental variables are strong and appropriate according to the Sargan test, *LM*=0.70 (*p*=0.400).

differences between the cases, and the methodological differences in the analysis designs: the enlargement of museum free-admission policy leads to an increase of charged visits.

We can suggest that these pieces of evidence are in line not only with the addiction-in-cultural-consumption argument, but also with the points of the consumption framing theory (Tversky and Kahneman, 1981; Thaler, 1985). Substantially, framing theory states that consumers make their choice on the basis of a mental accounting system: they firstly allocate income to specific expenditure categories (for instance: food; clothes; culture and so on), and in a second stage they make the choice within each expenditure category. If the museum entrance is free instead of charged (in a given day, or in a given place), consumers who use this opportunity remain with a higher disposable income to spend for other goods and services within the expenditure category to which museum visits belong. Possibly, this expenditure category includes not only museum visits, but also other cultural (and perhaps recreational and tourist) goods and services. This may explain why the increase in the demand for museum entrance does occur, when a larger free-admission policy is introduced, but with a pretty low sensitivity (the elasticity of charged visits with respect to free visits is less than one). The possibility of free visit to a museums entails a saved sum of money, which will be devoted by consumers to other museum visits or to other goods within the same expenditure category. The expenditure category can be more or less wide, depending on the mental structure of specific consumer. Consumers who are usual museum visitors, and do have a specific mental accounting expenditure area for museum visits, simply use the saved money deriving from free admittance rule, to visit other museums. Other consumers may re-allocate expenditures, mainly within the same expenditure category. The wide area of cultural, recreational and tourism expenditures is perhaps the relevant mental accounting area for people who are not usually museum visitors.

From a policy-making perspective, we could suggest that the free admission policy to public museums has beneficial effects not only on subsequent charged visits to public (and private) museums, but also on the whole cultural and entertainment industry, as well as on tourism and hospitality markets. Under these perspectives, it would be interesting to analyse how strong is the effect of the museum free entrance policy enlargement upon the demand for related goods. This is left to our future research.

Moreover, it has to be noticed that our aggregate data do not permit to distinguish additional visits of usual visitors from new visitors; nor are we able to distinguish among different types of visitors, and different motivations for visit.[11] Thus, we are not able to assess whether or not the new policy

[11] Brida et al. (2016) and Lattarulo et al. (2017) are examples of studies concerning the motivation of visitors to Italian museums.

rule concerning the free admission has entailed a change in the characteristics of population attending museums, as, e.g., the levels of income and education are concerned. Under this perspective, the effects of free admission policy in modifying the socio-economic characteristics of museum visitors can be questionable.

However, we have taken into account the seasonal nature of data, and we have conditioned on the dynamics of tourism flows, which clearly affect the monthly dynamics of visits to museums. From a methodological point of view, our analysis shows that monthly data on tourist arrivals and visits to museums can be considered stationary around deterministic seasonal trends (rather than seasonally integrated), provided that different deterministic monthly trends are accounted for. The theoretical and political investigation on the reasons why different months have shown markedly different trends in Italy, in the period under scrutiny, is left to future analysis. For sure, there is a very large room for public policies aimed to reduce the seasonality of both tourism flows and museum attendance.

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