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Article

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The Effect of Tourism on Crime in Italy: A Dynamic Panel Approach

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Abstract The purpose of this paper is to demonstrate that, for the case of Italy, *ceteris paribus*, tourist areas tend to have a greater amount of crime than non-tourist ones in the short and long run. Following the literature of the economics of crime à la Becker (*Crime and Punishment: An Economic Approach*, 1968) and Enrlich (*Participation in Illegitimate Activities: A Theoretical and Empirical Investigation*, 1973) and using a System GMM approach for the time span 1985–2003, the authors empirically test whether total crime in Italy is affected by the presence of tourists. Findings confirm the initial intuition of a positive relationship between tourism and crime in destinations. When using the level rather than the rate of total crime and controlling for the equivalent tourists (i.e. the number of tourists per day in a given destination) the effect of the tourist variable is confirmed. Overall results indicate however that the resident population has a greater effect on crime than the tourist population. Therefore, the main explanation for the impact of tourism on crime seems to be agglomeration effects.

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Keywords Tourism; crime; externalities

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Introduction

Tourism demand has grown overtime. In 2010 international tourist arrivals reached 940 million, and tourism receipts generated US\$ 919 billion; in the 1975–2000 period, international arrivals have increased at an average pace of 4.6 per cent per year (UNWTO, 2011). With approximately 43 million international tourists, Italy is the fifth most visited country worldwide and within Europe, it ranks third (UNWTO, 2011).

Academic literature confirms the impact of the tourism sector on the economy; a wide strand of research finds a positive linkage between tourism and growth for developed and developing countries, in the short and in the long run¹.

Why does the tourism sector have a strong impact at national and regional level? It has to do with the characteristics of the product demanded: a bundle of goods and services, most of which are non-traded and include both man-made and natural amenities (Sinclair and Stabler, 1997).

On the one side, the increasing demand for the tourism good and the intrinsic characteristics of the tourism product boost local economy and make residents better off. On the other side, the same features might generate negative environmental or social externalities that make residents worse off. When these negative impacts are not properly taken into account, tourism-led development becomes unsustainable. This paper investigates a possible source of unsustainability, which can occur when criminal activity is stimulated by the presence of tourists. In this case tourism not only imposes a social cost on residents, but also generates a detrimental effect on the tourism market as a whole, negatively affecting potential tourism demand.

Why should crime increase with the presence of tourists? Following Fuji and Mak (1980), many reasons can be found: tourists tend to carry valuable objects and money; the attitude of holidaymakers tends to be less prudent; tourists are perceived as “safer” targets by criminals because they rarely report crime to the police; the presence of tourists alters the local environment, for instance, by generating a reduction of social responsibility for surveillance. Ryan (1993) and Kelly (1993) add that in some cases crime is driven by (tourism) demand for illegal goods or services in destinations.

¹ For an extensive literature review on tourism led-growth hypothesis see Bimonte et al. (2012).

According to the Routine Activity Theory of Cohen and Felson (1979), crime depends on the opportunities; as a consequence, the presence of tourists increases the set of available occurrences.

Overall, there are not many studies that explore this topic with the aid of econometric models. The assumption is usually that criminals are rational à la Becker (1968) and Ehrlich (1973) and respond to incentives; as such, the presence of tourists is seen as a further incentive for illegal activities. The seminal work of Jud (1975) investigates the impact of foreign tourist business on total crime per capita in a cross-section of 32 Mexican States for the year 1970 (controlling for urbanization). The study confirms that total crime and property-related crime (fraud, larceny, and robbery) are strongly and positively linked to tourism, while crime against persons (assault, murder, rape, abduction, and kidnapping) is only marginally linked to it. Along the same line as Jud (1975), McPheters and Stronge (1974) use time series analysis to investigate whether seasonal crime reacts to seasonal tourism in Miami. They find that the tourism-crime relationship is significant and that economics – related crime such as robbery, larceny and burglary follow a similar seasonality to tourism. Fuji and Mak (1980) reach the same conclusions for the case of Miami. For a cross section of 50 US States, Pizam (1982) finds a weak relationship between tourism and crime, suggesting that perhaps the relationship is not supported at the national level. Van Tran and Bridges (2009), controlling for the degree of urbanization, the rate of unemployment, and the spatial position of the each state within Europe, analyse the relationship between tourist arrivals and crime against persons in 46 European countries. They find that, on average, an increase in the number of tourists reduces the rate of crime against persons.

More recently, using panel data on crime and visitors of National Parks in every county in the US, Grinols et al. (2011) conclude that for some tourist type there is no impact on crime. Campaniello (2011), again using a panel approach, explores the case of the 1990 Football World Cup in Italy; the results indicate that hosting the Football World Cup has led to a significant increase in property crimes. Along the same line, Biagi and Detotto (2012) find a positive relationship between tourism and pick-pocketing for a cross section of Italian provinces.

The main aim of the present paper is to test whether the positive tourism-crime relationship found in Biagi and Detotto (2012) for a cross-section of Italian

provinces², is persistent over time. Applying a System GMM approach to a panel of Italian provinces for the time span 1985–2003, we empirically test whether total crime in Italy is affected by tourist arrivals. In other words, the purpose of the paper is to demonstrate that, all else being equal, in the long run tourist areas tend to have a greater amount of crime than non-tourist ones – for the case study of Italy.

A connection between tourism and crime does not tell us whether the victims are tourists or residents; it merely indicates the presence of a link between tourism and crime as a potential source of negative externalities. Knowing which group of people is more affected may give essential information to better quantify the externality and to identify possible solutions. For instance, criminal activity that mainly targets tourists would impact on the image of a tourist destination as a whole, decreasing its future tourism demand; if on the contrary, the crime is largely committed against residents, the externality affects the quality of life of locals. Unfortunately, due to the scarce availability of crime data worldwide, this analysis is not often undertaken; the few papers available use descriptive statistics (for the case of Hawaii see Chesnay-Lind and Lind, 1986; for the case of Barbados see de Albuquerque and McElroy, 1999). Since data on the victimization rate of visitors and residents are not provided by the National Institute of Statistics (from now on ISTAT) we can just re-estimate the model using the level of total crime instead of the rate, and controlling for population, size of the province and equivalent tourists (i.e. the number of tourist per day in destinations). Although the effect of tourism on crime is confirmed, results cannot be interpreted unequivocally and depend on the (unknown) propensity to report and to be victimized of the two sub-groups.

We find that the effect of the presence of residents on crime is higher than the effect of the presence of tourists, and that the difference between the two coefficients is significantly different from zero. These results should be further investigated by using the propensities to be victimized and to report of the two populations, which are not available at the moment.

² The analysis focuses on the tourism-related crime in the Italian provinces for the time span 1985–2003. The number of provinces has changed overtime; from 1974 until 1992 the national territory was divided into 95 provinces, which become 103 in 1992 and 107 in 2006. To have a balanced panel, the study considers the classification at 95.

The paper is structured as follows. Section 1 offers a descriptive analysis of the evolution of tourism and crime in Italy. Section 2 focuses on the data and empirical model; Section 3 describes the results. Section 4 highlights the main concluding remarks.

1 Tourism and Crime in Italy

Tourism and crime are two relevant phenomena in Italy. As reported by the National Institute of Statistics (ISTAT) the number of tourists in Italy has constantly increased: 57 million arrivals (international and domestic tourists) were counted in the official tourist accommodations in 1985³, while they reached 83 million in 2003 (a growth rate of 47%); the number of nights in official accommodations was about 333 million in 1985, and reached 344 million in 2003 (+3%)⁴. During this time span tourist arrivals have increased on average by 2.2% and tourist nights by 0.5%. As a result, the average length of stay decreased from about 6 days to 4. This downward trend of tourist nights is in line with the EU trend where the number of nights has decreased more than the number of trips (–1.6 % and –1.0 % respectively; Eurostat, 2011).

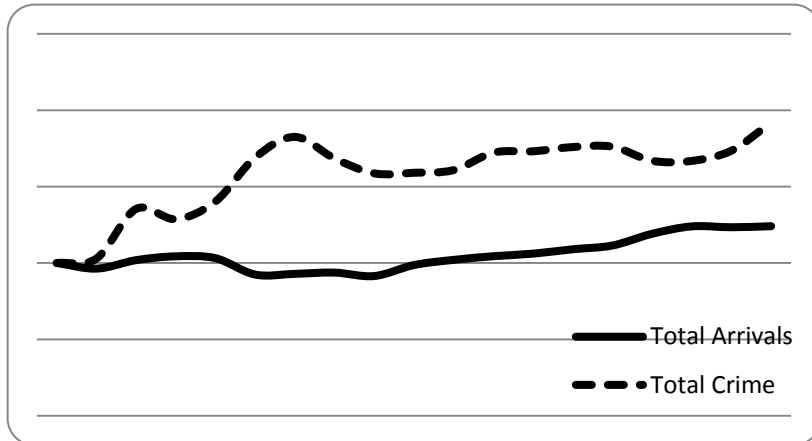
In 2003, more than fifty per cent of tourist arrivals and nights are accounted for by the Northern part of the country. As far as crime is concerned, Italy experienced a rather exceptional increase over the last 25 years (+35.7%); this trend is in contrast with what occurs during the same time span in many other Western countries such as the US (–20.4%), Canada (–15.8%), the UK (–10.9%), France (–7.5%) and Germany (–6.9%; Eurostat, 2009).

The comparison of tourist arrivals and total crime series for the time span 1985–2003 highlights a common upward trend of the two variables (Figure 1), even if crime increases at a higher pace than tourism. Furthermore, a counter cyclical relationship can be observed between the two series indicating a possible negative correlation among them.

³ Official accommodations include: hotels, campsites, guesthouses, Bed & Breakfasts, and other types of accommodation.

⁴ Tourist arrivals are the number of visitors – domestic and foreign – registered in official accommodation; tourist nights are the total number of nights spent by visitors in official accommodation (ISTAT).

Figure 1. Tourism and crime series (base year=1985)



Notes: we use index numbers with a fixed base value 1985=100

Source: our elaboration on data from ISTAT

In order to better understand the underlying tourism-crime relationship, we follow three main steps. Firstly, the location quotient (LQ) of tourism ($LQ_{Tourism}$) and crime (LQ_{Crime}) are calculated for each Italian province. LQs allow computing the shares of tourism and crime of each province with respect to the national ones.

$$LQ_{Tourism} = \frac{\left(\frac{Total_Arrivals_i}{Total_Arrivals} \right)}{\left(\frac{Area_i}{Total_Area} \right)} \quad (1)$$

$$LQ_{Crime} = \frac{\left(\frac{Total_Crime_i}{Total_Crime} \right)}{\left(\frac{Population_i}{Total_Population} \right)} \quad (2)$$

where:

$i = 1, 2, \dots, 95$ provinces

$Total_Arrivals_i$ = tourist arrivals in each province in 2003

$Total_Arrivals$ = tourist arrivals in Italy in 2003

$Area_i$ = Surface in km^2 of each province

$Total_Area$ = Italian surface in km^2

$Total_Crime_i$ = total crime in each province in 2003

Total_Crime = total crime in Italy in 2003

Population_i = inhabitants in each province in 2003

Total_Population = Italian population in 2003

Secondly, the results of each LQ are divided in quartiles. Finally, the obtained quartiles are matched in order to check how the levels of tourism and crime are combined. Table 1 shows the cross tabulation of the quartile distribution of the two LQs. The first quadrant in the table displays the number of provinces with low level of crime and tourism (14 in total). The principal diagonal contains 47% of the Italian provinces, indicating a positive correlation between tourism and crime. The chi-squared test ($\chi^2=45.5$) indicates that the k groups are dependent.

As a result, crime and tourism seem to move in the same direction: low levels of tourism correspond to low levels of crime and vice versa. This descriptive analysis gives a first hint at the relationship between the two phenomena; this relationship needs to be further explored by using appropriate econometric techniques.

Table 1. Number of Provinces for quartiles

LQ _{Crime} \ LQ _{Tou}	1 st Quartile	2 nd Quartile	3 rd Quartile	4 th Quartile	Total
1 st Quartile	14	6	3	1	24
2 nd Quartile	7	7	8	2	24
3 rd Quartile	3	7	9	5	24
4 th Quartile	0	4	4	15	23
Total	24	24	24	23	95

2 Data and Empirical Model

Following the empirical literature on crime, this study proposes the use of the dynamic panel data approach illustrated below to explore the relationship between tourism and crime for Italian provinces in the time span 1985–2003:

$$CRIME_{i,t}^* = \beta_0 + \beta_1 CRIME_{i,t-1}^* + \beta_2 GROWTH_{i,t} + \beta_3 INCOME_{i,t} + \beta_4 UNEMPL_{i,t} + \beta_5 DENSITY_{i,t} + \beta_6 TOURISM_{i,t} + \beta_7 DIPLOMA_{i,t} + \beta_8 DETERRENCE_{i,t} + \beta_9 SOUTH_t + \beta_{10} YEAR_t + \eta_i + \varepsilon_{i,t} \quad (3)$$

$CRIME_{i,t}^*$ is the number of total crimes per 100,000 inhabitants in the i -th province at time t . $GROWTH$ and $INCOME$ indicate the growth rate and level, respectively, of Gross Domestic Product (GDP) per capita at 1995 constant prices; $UNEMPL$ is the unemployment rate. Cantor and Land (1985) theorize the macroeconomic relationship between the economic performance and criminal activity, indicating two opposite sources of incentive to criminal behaviour: opportunity and motivation effect. The former is linked to fluctuations in $INCOME$ and $GROWTH$: the opportunities to commit crime increase with economic performance, which leads to widespread availability of goods and profitable illegal activities. The latter works in the opposite way: the incentive to commit crime is caused by bad economic conditions. In other words, during recessions, the unemployment rate raises inducing individuals to increase their disposable income via illegal activities.

$DENSITY$ refers to the population per square kilometre; it is used as an indicator of urbanisation. According to Masih and Masih (1996), crime rises with urbanisation. $TOURISM$ measures tourist arrivals (nationals and foreigners) per square kilometre; tourist arrivals, weighted by province size, gauge the attractiveness of a given destination. According to the empirical literature on the crime-tourism relationship, a positive correlation is expected⁵. $DIPLOMA$ indicates the average level of education in the i -th province at time t ; a higher level of education might indicate a higher level of social cohesion, which could reduce crime offences.

$DETERRENCE$ is the ratio of recorded offences committed by known offenders over the total crime recorded; it is a proxy of the deterrence effect “stemming from the efficiency of criminal investigation of the local police and from their knowledge of the local environment” (Marselli and Vannini, 1997; p.96). The expected sign is negative, therefore, a rise in the share of known offenders, due to an increase in deterrence or a higher level of efficiency/efficacy of police activity, reduces the crime rate.

⁵ See Biagi and Detotto (2012) for an extensive literature review on this topic.

All variables are expressed in log-level terms, so that the coefficients can be interpreted as elasticities.

SOUTH is a control variable which equals 1 if the province is located in the South of Italy and zero otherwise. *YEAR* is a set of time dummy variables; the inclusion of time dummies makes the assumption of no correlation across individuals in the idiosyncratic disturbances more likely to hold (Roodman, 2006). Finally, η_i and ε_{it} are the province fixed effect and the error term, respectively; we assume that $E(\eta_i) = 0$, $E(\varepsilon_{it}, \eta_i) = 0$ and $E(\eta_i) = 0$.

Tables 2 and 3 provide detailed information and some descriptive statistics of the variables in use, respectively.

Table 2. List of explanatory variables

Name	Definition	Type of variable	Source
<i>Crime</i>	Total crime offences per 100,000 inhabitants	Crime	ISTAT, Statistiche Giudiziarie Penali
<i>Growth</i>	Growth rate of real value added per capita	Economic	Istituto Tagliacarne
<i>Income</i>	Value added per capita at a base prices (Year = 1995)	Economic	Istituto Tagliacarne
<i>Unemployment</i>	People looking for a job/labour force * 100	Economic	Istituto Tagliacarne
<i>Density</i>	Density of population per square kilometre	Demographic	ISTAT, Atlante statistico dei comuni
<i>Tourism</i>	Tourists official arrivals per square kilometre (tourists choosing official accommodations)	Tourism	ISTAT, Statistiche del turismo
<i>Diploma</i>	People with Italian diploma per 10,000 inhabitants	Human capital	ISTAT, Atlante statistico dei comuni
<i>Deterrence</i>	Ratio of incidents with unknown offenders over the total recorded per total crime	Deterrence	ISTAT, Statistiche Giudiziarie Penali
<i>South</i>	Dummy variable that values one if a province is located in the South and zero otherwise	Geographic	Our elaboration

Table 3. Descriptive statistics of variables

Name	Mean	SD	Min	Max
Crime	3,091.80	1,374.01	745.48	13,255.08
Growth	0.01	0.07	-0.81	0.77
Income	14,113.17	3,925.78	4,517.04	26,025.37
Unemployment	10.94	6.71	1.7	33.2
Density	248.58	345.04	34.47	2,647.02
Tourism	283.65	392.85	14.76	2,529.23
Diploma	0.06	0.03	0.002	0.17
Deterrence	0.32	0.12	0.09	0.83
South	0.36	0.48	0	1

As analysed by Buonanno (2006), crime series show strong persistence over time, indicating that the level of crime activity at time t affects crime behaviour at time $t+1$. To confirm this, we start our analysis running a basic Ordinary Least Squares (OLS) model, both random and fixed effect, and we apply the Wooldridge test (Wooldridge, 2002) to check for serial correlation in panel data; we find that the null hypothesis of no serial correlation is strongly rejected⁶. This suggests the use of the lagged dependent variable ($CRIME_{i,t-1}^*$) to remove serial correlation in the residuals. A panel unit root test (Levin, Lin and Chu, 2002) is also performed to see whether stationarity of the dependent variable in (1), and the null hypothesis of non-stationarity are rejected².

As pointed out in the previous section, a reverse causality between crime and tourism is strongly expected. For example, high crime rates in a given region could reduce tourism inflow; as a result, a drop in the economic performance can be observed. Unfortunately, criminal activity could directly impact the other explanatory variables. As shown in economic literature, crime is detrimental for the legal economy, discouraging investments, affecting the competitiveness of firms, reallocating resources and creating uncertainty and inefficiency (Detotto and Otranto, 2010). Through the economic channel, in a given province, crime could affect the density of population, increasing the incentive to move away from crime hot spots (Mills and Lubuele, 1997; Cullen and Levitt, 1999), and could also

⁶ The statistic tests are available on request.

impact the human capital, reducing the expected human capital returns (Mocan et al., 2005). Finally, the reverse causality between crime rate and its deterrence variables has been already investigated in the economic empirical literature (see Dills et al., 2008).

The presence of the lagged dependent variable and the lack of strict exogeneity between the crime variable and the explanatory variables, do not allow to use the ordinary least squares (OLS) method to estimate model (3) (Roodman, 2006). A possible solution is given by the Generalized Method of Moments (GMM), which yields a consistent estimator of β using the lagged value of the dependent and explanatory variables as instruments. In this analysis, the System GMM estimator is used, which performs better than the linear first-differenced GMM in small samples (Blundell and Bond, 1998; Roodman, 2006).

In general, the GMM estimator assumes that residuals are serially uncorrelated, i.e. $E(\varepsilon_{i,t} \varepsilon_{i,s}) = 0$ for $i = 1, \dots, N$ and $s \neq t$, and the initial conditions of $CRIME_{i,t}^*$ and all explanatory variables at time t_0 are predetermined. In addition, the System GMM estimator requires a mean stationary restriction on the initial condition of the variables in use, which implies that, in the period analysed, the units are close enough to steady-state: in other words, the changes in the instrumenting variables are assumed to be uncorrelated with the individual-specific effect.

It is well known in crime literature that the official crime data, coming from police reporting activity, suffer from underreporting and underrecording bias (Mauro and Carmeci, 2007). In other words, official data ($CRIME_{i,t}$) represent only the tip of the crime iceberg. The relationship between these two components can be represented as follows:

$$CRIME_{i,t} = \alpha CRIME_{i,t}^* + \delta_i + v_{i,t} \quad (4)$$

where $CRIME_{i,t}^*$ is the “real” unobserved crime rate, δ_i is a fixed individual effect and v is a vector of serially uncorrelated residuals. We assume that v_{it} is uncorrelated with ε_{is} for $s \neq t$. It is worth noticing that the expected value of the official data yields a downward biased estimate of the observed crime rate, and such bias depends on the α coefficient in (4). In fact, the underreporting problem becomes negligible when α is close to one and to zero. As shown in Fajnzylber et al. (2002), the measurement error does not modify the assumptions and the properties of the GMM approach, which can still provide consistent parameter

estimates in panel data models with lagged variables and unobserved time-invariant individual-specific effects. In addition, the System GMM approach reduces the problems of measurement errors (Griliches and Hausman, 1986), which makes it preferable to alternative methods.

Notably, substituting equation (4) in Model (3), we obtain:

$$CRIME_{i,t} = \tilde{\beta}_0 + \beta_1 CRIME_{i,t-1} + \tilde{\beta}_2 GROWTH_{i,t} + \tilde{\beta}_3 GDP_{i,t} + \tilde{\beta}_4 UNEMPL_{i,t} + \tilde{\beta}_5 DENSITY_{i,t} + \tilde{\beta}_6 TOURISM_{i,t} + \tilde{\beta}_7 DIPLOMA_{i,t} + \tilde{\beta}_8 DETERRENCE_{i,t} + \tilde{\beta}_9 SOUTH_{i,t} + \tilde{\beta}_{10} YEAR_t + \tilde{\eta}_i + \mu_{i,t} \quad (5)$$

where $\tilde{\beta}_j = \alpha\beta_j$, $\tilde{\eta}_i = \delta_i(1 - \beta_1) + \alpha\eta_i$ and $\mu_{i,t} = -\beta_1 v_{i,t-1} + v_{i,t} + \alpha\varepsilon_{i,t}$.

Since, by construction, α is between zero and one, the sign of all $\tilde{\beta}$ coefficients is still correct but their absolute values are lower than the “real” ones. Hence, this should be taken into account when deriving policy implications using the latter estimates; basically, we can easily infer that the estimated elasticities are lower than the “real” ones, and such discrepancy becomes seriously large as α approaches zero.

A crucial assumption for the validity of GMM estimates is that the instruments are exogenous. The Sargan (1958) test of overidentifying restrictions tests the overall validity of the instruments: failure to reject the null hypothesis gives support to the model. But if the errors are (suspected to be) non-spherical, the Sargan test is inconsistent; in our case, since the robust standard errors are estimated, in order to correct for heteroskedasticity or cross-correlation in the residuals, the Hansen (1982) test is performed under the null hypothesis of the joint validity of the instruments. An other important issue is the Arellano-Bond (1991) test for autocorrelation of the residuals, which checks whether the differenced error term is first and second order correlated. Failure to reject the null hypothesis of no second-order autocorrelation indicates that the residuals are not serially correlated.

3 The Impact of Tourism on Crime: Results

This section is divided into three main parts. The first one presents the results obtained when a set of OLS panels is performed (Section 3.1). The second one illustrates the outcomes of GMM models (Section 3.2). Finally, the third part

shows the findings obtained discriminating tourism and residents for victimization rates (Section 3.3).

3.1 Basic Results

In a first stage, equation (5) is run excluding the lagged dependent variable ($CRIME_{i,t-1}$). Initially, random and fixed effects models (from now on FE and RE respectively) are performed, and results are showed in Columns 1-2-3 of Table 4. The first column represents the coefficients obtained employing FE, while columns two and three illustrate the coefficients of RE models. Since FE drops the time invariant dummy SOUTH, two different REs are regressed (Column 2 and 3).

As one can see, except for the variables TOURISM and DENSITY, the coefficients remain stable. The Hausman test indicates FE as the preferred model. In this model, TOURISM has a negative impact on crime and is significant at 10% level; such puzzling outcomes might be due to bi-directional causality between crime and tourism. Therefore, an important issue to check at this point is the exogeneity between tourism and crime rate. If tourism is not exogenous, we expect that a shock in crime rate would impact tourist arrivals. The goal is to identify an instrument variable correlated with TOURISM but not with CRIME. To do so, the provinces are divided according to their characteristics: arts city, mountain and coastal provinces and all other types of destinations. The first group contains the provinces with arts city⁷; the second includes provinces with more than fifty percent of mountain in their territory; the third considers the provinces on the coast; and the fourth consists of provinces not included in any of the previous categories. We use the yearly average of arrivals per group to instrument the tourism variable. The motivation is that a crime shock in an art city probably affects that city's tourism flows but it does not impact the average level of tourism in arts city as a whole. In this sense, the variation of arrivals in a given province has a negligible effect on the average arrivals in the related group.

The results of the two stages least square are showed in Columns 4–5 and 6 of Table 4. Overall coefficients are stable. Again, the Hausman test suggests FE effects (Column 4) as the preferred model. After correcting for endogeneity, the sign of the tourism variable turns out to be positive, although not significant.

⁷ For details of art cities in Italy see <http://www.discoveritalia.it/cgwe/index.asp?lingua=en>.

Table 4. OLS results

VARIABLES	(1) FE	(2) RE	(3) RE	(4) FE-IV	(5) RE-IV	(6) RE-IV
Growth	-0.11 (0.071)	-0.050 (0.072)	-0.087 (0.072)	-0.098 (0.075)	0.020 (0.077)	-0.059 (0.074)
Income	0.23*** (0.056)	0.16*** (0.050)	0.23*** (0.054)	0.21*** (0.069)	0.0076 (0.064)	0.17*** (0.057)
Unemployment	-0.11*** (0.021)	-0.047** (0.019)	-0.072*** (0.020)	-0.11*** (0.022)	-0.042** (0.020)	-0.084*** (0.021)
Density	-0.57*** (0.19)	0.16*** (0.031)	0.15*** (0.031)	-0.56*** (0.19)	-0.033 (0.058)	0.0049 (0.050)
Tourism	-0.050* (0.028)	0.041** (0.019)	0.062*** (0.019)	0.028 (0.20)	0.27*** (0.059)	0.24*** (0.050)
Diploma	-0.028 (0.018)	-0.028 (0.019)	-0.027 (0.019)	-0.030 (0.019)	-0.041** (0.020)	-0.036* (0.019)
Deterrence	-0.26*** (0.022)	-0.28*** (0.021)	-0.28*** (0.021)	-0.26*** (0.022)	-0.28*** (0.022)	-0.28*** (0.022)
South			0.21*** (0.054)			0.35*** (0.068)
Constant	8.89*** (1.18)	5.20*** (0.51)	4.00*** (0.54)	8.55*** (1.42)	6.32*** (0.61)	4.67*** (0.57)
Observations	1,710	1,710	1,710	1,710	1,710	1,710
R-squared	0.529	0.518	0.519	0.527	0.483	0.496
Number of provinces	95	95	95	95	95	95

Robust standard errors are in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1%, respectively.

At this stage, we perform the Wooldridge test in order to check for possible serial correlation in the residuals (Wooldridge, 2002); this statistic test strongly suggests the use of the lagged dependent variable ($CRIME_{i,t-1}$). The presence of

the lagged response variable requires a GMM approach that allows having consistent estimates.

3.2 System GMM Approach: Results

In a second stage, the coefficients of Equation (5) are estimated using System GMM. Results are shown in Table 5 (Columns 1, 2 and 3). The Hansen (1982) test for the joint validity of the instruments gives support to the model. In addition, the Arellano Bond (1991) indicates that residuals are not serially correlated. As the diagnostic tests support the final specification, we can present the findings in further details. Since the variable SOUTH is never significant and the estimates in Columns 1, 2 and 3 are almost similar, we focus on the first column.

The coefficient of the lagged response variable ($CRIME_{i,t-1}$) is highly significant and equal to 0.83, indicating strong persistence in crime series. INCOME and UNEMPLOYMENT are significant and positively correlated to CRIME, hence a one per cent increase in these variables raises the crime rates by 0.089% and 0.041%, respectively.

The variable DETERRENCE is significant and has the expected sign: an increase of the effectiveness of Police activities reduces the crime rate by 0.083%. As expected, TOURISM positively affects criminal activity: a one per cent increase in arrivals leads to a 0.018% increase in total crime. It is worth noticing that results do not change when the model is re-estimated using different measures of tourism (arrivals or nights per population, per square meters, etc.)⁹.

As discussed in Section 2, coefficients might underestimate the underlying relationship due to a measurement error in the dependent variable. As a consequence, the “real” impacts should be even higher than those reported here. However, given the results, if the long-run equilibrium is assumed, the elasticities may be obtained by dividing each of the estimated coefficients by $(1 - \beta_1)^{-1}$, where β_1 is the coefficient of the lagged dependent variable. Following this reasoning, the long run impact of tourism on crime in Italy is about 0.11%.

⁹ We have tested the tourism-crime relationship using also the quadratic form of the tourism variable (TOURISM_SQ) and we have found confirmation that, in the model in which total crime and tourism arrivals are considered, this relationship is linear (Model 3).

In a time series analysis on the case of Miami, McPheters and Stronge (1974) find that the short run elasticity of crime with respect to tourism is 0.03%. Jud (1975) in a cross section analysis on 32 Mexican States reports 0.34%. In a recent cross-section application on property related crime and tourism in Italy, Biagi and Detotto (2012) estimate the short run elasticity to be 0.22%.

Table 5. GMM results

Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Crime per 100k inh.	Crime per 100k inh.	Crime per 100k inh.	Crime	Crime	Crime	Crime	Crime
Crime _{t-1}	0.83*** (0.018)	0.83*** (0.018)	0.83*** (0.017)	0.82*** (0.020)	0.82*** (0.021)	0.82*** (0.017)	0.82*** (0.019)	0.82*** (0.020)
Growth	0.091 (0.12)	0.090 (0.12)	0.065 (0.11)	-0.036 (0.064)	-0.038 (0.063)	-0.022 (0.051)	-0.026 (0.062)	-0.034 (0.063)
Income	0.089*** (0.023)	0.093*** (0.025)	0.081*** (0.023)	0.078*** (0.027)	0.084*** (0.027)	0.069*** (0.024)	0.076*** (0.025)	0.076*** (0.027)
Unemployment	0.041*** (0.009)	0.040*** (0.010)	0.038*** (0.009)	0.031*** (0.010)	0.029** (0.011)	0.029*** (0.010)	0.031*** (0.011)	0.030*** (0.010)
Density	0.007 (0.006)	0.006 (0.006)	0.007 (0.006)					
Population				0.19*** (0.024)	0.19*** (0.025)	0.15 (0.091)	0.20*** (0.030)	0.19*** (0.024)
Population_sq						0.001 (0.003)		
Tourism	0.018*** (0.005)	0.019*** (0.005)	0.023 (0.018)					
Tourism_sq			-0.0004 (0.002)					
EqTou				0.015*** (0.004)	0.016*** (0.004)	0.025 (0.024)	0.035 (0.032)	0.015*** (0.0037)
EqTou_sq						-0.0005 (0.001)		
EqTou*Pop							-0.0015 (0.0024)	
Diploma	-0.006 (0.006)	-0.007 (0.006)	-0.005 (0.007)	-0.011 (0.007)	-0.011 (0.007)	-0.007 (0.007)	-0.008 (0.007)	-0.012 (0.007)
Deterrence	-0.083*** (0.015)	-0.083*** (0.015)	-0.087*** (0.015)	-0.085*** (0.016)	-0.086*** (0.016)	-0.094*** (0.015)	-0.088*** (0.015)	-0.086*** (0.016)

Table 5 continued

South	0.0041 (0.015)			0.009 (0.014)				
Area				-0.027*** (0.0066)	-0.028*** (0.0068)	-0.026*** (0.0065)	-0.027*** (0.0064)	-0.082 (0.053)
Area_sq				0.004 (0.004)				
Constant	0.34 (0.22)	0.31 (0.24)	0.43 (0.24)	-1.52*** (0.35)	-1.57*** (0.34)	-1.17* (0.67)	-1.64*** (0.47)	-1.31*** (0.40)
Observations	1,710	1,710	1,710	1,710	1,710	1,710	1,710	1,710
N. of provinces	95	95	95	95	95	95	95	95
Arellano-Bond ¹	0.74	0.74	0.79	0.71	0.71	0.72	0.72	0.71
Sargan test ²	954.38	954.44	948.11	854.24	855.25	1020.36	970.82	855.28
Hansen test ²	62.64	64.30	73.62	63.98	64.39	71.40	65.02	67.89
df; ³	1022	1021	1123	881	880	1079	1017	881
$\chi(df)$ critical value at 95%	1097.48	1096.45	1202.07	951.16	950.12	1156.53	1092.30	951.16
Test on joint significance ⁴	36.33***	34.51***	35.93***	40.75***	38.62***	38.90***	40.23***	40.96***

¹Arellano-Bond (1991) statistic test under the null hypothesis of no second-order autocorrelation in the residuals.

²Sargan (1958) and Hansen (1982) statistic tests under the null hypothesis of the joint validity of the instruments.

³Degrees of freedom. ⁴Test on joint significance of time dummies. Robust standard errors are in parenthesis. *, ** and *** indicate significance at the 10%, 5% and 1%, respectively.

3.3 Comparing the Impact of Tourists and Residents on Crime

In a further step, we investigate whether the effect of tourists on crime is significantly different from that of residents. At this stage, the variables of interests are population, tourism nights and size of the province. In order to compare resident and tourist populations, the “equivalent tourist population” of each province is calculated considering the share of yearly number of nights spent by tourists in the official accommodations (ISTAT) over 365 days (Equation 6):

$$EqTou = \frac{1}{365} NIGHTS_{i,t} \quad (6)$$

for $i = 1, \dots, 95$ and $t = 1985, \dots, 2003$.

As anticipated above, *EqTou* measures the total number of tourists in a given province per day. This variable is substituting the tourist arrivals used in Models 1, 2 and 3.

The new specifications of equations 3 and 4 are the following:

$$y = m^k n^h d^v g(.) \varepsilon \quad (7)$$

where:

m = is equivalent tourists (night of stay in a year/365);

n = is resident population

d = area of the province in square kilometre

$g(.)$ = controls

k, h, v = parameters

The equation to be estimated will become:

$$\lg(y) = k \lg(m) + h \lg(n) + v \lg(d) + \dots + \varepsilon \quad (8)$$

where:

$$h = f(\alpha_1; \beta_1) \quad (9)$$

$$k = g(\alpha_2; \beta_2) \quad (10)$$

α_1 = propensity to be victimized of resident population;

β_1 = propensity to report of resident population;

α_2 = propensity to be victimized of tourists;

β_2 = propensity to report of tourist.

$$\frac{\partial h}{\partial \alpha_1} > 0; \frac{\partial h}{\partial \beta_1} > 0$$

$$\frac{\partial k}{\partial \alpha_2} > 0; \frac{\partial k}{\partial \beta_2} > 0$$

We can compare the effect of resident and tourists on crime by means of the \hat{h} and \hat{k} parameters. If $\hat{h} > \hat{k}$, the elasticity of crime with respect to the number of residents is higher than that related to the number of tourists.

The results are shown in Columns 4–8 of Table 5. The outcomes are quite stable and similar to the ones obtained before (see INCOME, UNEMPLOYMENT

and DETERRENCE in Models 1, 2, and 3). The coefficient of POPULATION and TOURISM have the expected sign and are strongly significant, therefore a one per cent increase in population and nights spent leads to a rise on total crime respectively by 0.19% and 0.015% in the short run, and by 1.06% and 0.083% in the long run. Such results indicate that crime is affected more by resident population than tourists. Unfortunately, we cannot estimate α and β of equations 9 and 10 that represent the victimization and reporting rates of the two sub-groups, since no data or publications on those rates are available. Since α and β are unknown and $\hat{h} > \hat{k}$, we can hypothesize the following three scenarios:

1. $\alpha_1 > \alpha_2$ and $\beta_1 > \beta_2$; both the propensity to be victimized and to report are higher for residents than for tourists.
2. $\alpha_1 \gg \alpha_2$ and $\beta_1 \leq \beta_2$; residents' propensity to be victimized is much higher than tourists', while the propensity to report is slightly lower.
3. $\alpha_1 \leq \alpha_2$ and $\beta_1 \gg \beta_2$; the propensity to be victimized of residents is slightly lower than that of tourists, while the propensity to report of residents is much higher.

We would indicate scenario 2 as the least common since it seems unlikely that tourists have higher propensity to report than residents. On the contrary, the opportunity cost of tourists is expected to be higher than non-tourists given the relatively short time they spend in the destination. Scenarios 1 and 3 have different policy implications, in the former residents are the main target of criminal activity, while in the latter the opposite is true. Unfortunately, we cannot indicate which scenario fits the results of the present paper.

In Columns 6 and 7 we test the robustness of \hat{h} and \hat{k} , and specifically in Column 6 we add the variables in square form, POPULATION_SQ and TOURISM_SQ; both are not significant supporting the (log) linearity hypothesis. In Column 7, an interaction variable (EQTOU*POP) is included in order to check the extent of any agglomeration effect on crime, the coefficient is not significant; the same effect is indirectly checked using the area of the province (in square kilometres), the coefficient is significant and equal to -0.027 . This means that a 1% increase in the province area (holding constant the number of tourists and population) leads to a 0.027% reduction of crime. Even for the variable AREA the (log) linearity hypothesis is confirmed (Column 8).

This outcome gives a first suggestion on the possible source of the negative externality found when total crime is analysed: the impact of a rise in residents and tourists on crime is quite significant, which may indicate that the main forces driving tourism-crime relationship is the agglomeration effect. Therefore, when total crime is considered, irrespectively of the subtypes of crime offences, overcrowded cities give criminals more opportunities to commit illegal activities. Probably, as the previous studies suggest, the presence of tourists provides an incentive for certain illegal activities; therefore, the substitution among crime types should be further explored.

4 Concluding Remarks

The tourism-led growth hypothesis has been widely analysed by scholars, who overall agree on the significant role of the tourism sector in enhancing economic growth. While many studies focus on the short run relationship, a small number of them analyses the relationship between tourism and growth in the long run. There is also a wide concern about the negative impact of tourism activity in the host community in terms of social and environmental degradation.

A possible source of negative externality exists when criminal activity develops in response to the presence of visitors. As Grinols et al. (2011) highlight, there are many reasonable theories stemming from economic and sociological studies of crime determinants that may explain the relationship between tourism and crime. The economic literature barely explores this issue and when it does, it produces controversial results.

The main aim of the present paper is to test whether the positive tourism-crime relationship that Biagi and Detotto (2012) find for property-related crime in a cross-section of Italian provinces, is persistent over time and holds when total crime is analysed. In other words, this study analyses the dynamic relationship between tourist population and total crime. To do so, the OLS and System GMM approach are applied.

We find that tourism positively affects criminal activity; in the short run, a one-per-cent increase in arrivals leads to a 0.018% rise in total crime, while, in the long run, the impact is about 0.11%.

We further compare the crime elasticity of residents and tourists, by re-estimating the model using the level of total crime instead of the rate of crime (Models 4–8) and equivalent tourist population. We obtain that the impact of resident population is higher than the one of the tourists (i.e. $\hat{h} > \hat{k}$) and the difference between the coefficients associated with residents (h) and tourists (k) is significantly different from zero. The results do not allow identifying which factor (i.e. the propensity of residents and non-residents to be victimized and to report to police) plays the main role in \hat{h} and \hat{k} .

This represents the limitation of the analysis. Also, aggregate crime data such as total crime rate, could fail to signal the presence of differences among crime typologies. In fact, it is reasonable to argue that the impact of tourists is higher for some types of crime, such as pick pocketing, bag snatching and fraud, and less for other types of illegal activity, such as financial crimes, handling and extortion. Finally, it is possible that the coefficients might underestimate the underlying relationship due to measurement errors in the dependent variable. The crime data used in this paper are the total offences recorded by the Police, this probably represents just the tip of the iceberg of this phenomenon. As a further development, a state space approach (Hamilton, 1994) can be applied in order to estimate the unobservable component of crime series. In addition, other improvements may go in the direction of exploring how the tourism-crime relationship changes according to the types of tourists (national and foreign) and type of crime (against property or individuals).

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