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Working Paper

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Economics Discussion Papers, No. 2012-4

Provided in Cooperation with:

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Biagi, Bianca; Brandano, Maria Giovanna; Detotto, Claudio (2012) : The effect of tourism on crime in Italy: A dynamic panel approach, Economics Discussion Papers, No. 2012-4, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:

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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, all else being equal, for the case of Italy, tourist areas tend to have a greater amount of crime than non-tourist areas in the long run. Following the literature of the economics of crime à la Becker (1968) and Ehrlich (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 tourist arrivals. Findings confirm the initial intuition of a positive relationship between tourism and crime in destinations. When controlling for the difference between tourists and residents in the propensity to be victimized, no relevant differences are found: the likelihood to be victimized is quite similar for the two groups. As a consequence, agglomeration and urbanisation effects seem to be the main explanation for the impact of tourism on crime. One can image that overcrowded cities provide more opportunities to criminals to commit illegal activities regardless of the number of visitors and residents in destinations.

Paper submitted to the special issue

[Tourism Externalities](#)

JEL D62, K00, L83

Keywords Tourism; crime; externalities

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Maria Giovanna Brandano acknowledges the financial support provided by Regione Autonoma della Sardegna ('Master and Back' research grant).

Introduction

Tourism demand has grown overtime. In 2010 international tourist arrivals reached 940 million, and tourism receipts generated US\$ 919 billion; in the time span 1975-2000 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, within Europe, Italy 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 tourist sector have a strong impact on national or regional environments? It has to do with the characteristics of the product demanded: a bundle of goods and services (Sinclair and Stabler, 1997); most of which are non-traded and include manmade and natural amenities.

On one side, the increasing demand for the tourism good and the intrinsic characteristic of the tourism product boosts local economy and makes 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, development-led tourism 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 imposes a social cost on residents, but it is also detrimental for the tourism market as a whole, negatively affecting potential tourism demand.

Why should crime increase with the presence of visitors? Following Fuji and Mak (1980) many reasons can be found: tourists carry valuable objects and money; the attitude of holidaymakers is more imprudent; tourists are

¹ For an extensive literature review on tourism led-growth hypothesis see Brida et al. (2011).

“safer” targets for 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 (1990) and Kelly (1993) add that in some cases crime is driven by demand for illegal good or services in destinations.

According to the Routine Activity Theory of Cohen and Felson (1979), crime depends on the opportunities; as a consequence, the presence of visitors 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 tourism is seen as a further incentive for illegal activities. The seminal work is due to Jud (1975) who, controlling for urbanization, investigates the impact of foreign tourist business on total crime per capita in a cross-section of 32 Mexican States for the year 1970. 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 of Jud (1975), McPheters and Stronge (1975) 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 have 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 at national level the relationship is not supported. 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 nations. They find that, on average, the 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 some tourist type has no impact on crime. Campaniello (2011) again using a panel approach explores the role 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. On the same line, Biagi and Detotto (2012) find for a cross section of Italian provinces a positive relationship between tourism and pick-pocketing.

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, for the case of Italy in the long run, tourist areas tend to have a greater amount of crime than non-tourist ones.

A connection between tourism and crime does not tell us whether the victims are visitors 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 target tourists would impact on the image of a tourist destination as a whole, decreasing its future tourist demand; if on the contrary, the crime is largely committed against residents, the externality affects the quality of life of locals. Unfortunately, due to shortage 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). In this paper we investigate whether the propensity to be victimized is higher for tourists than residents. Since data on the victimization rate of visitors and residents are not provided by the National Institute of Statistics (from now on ISTAT), we apply a method that indirectly estimates such propensities: we calculate the “equivalent population” of each province as the total number of individuals actually present in the territory. Therefore, re-estimating the model using the crime index corrected for the equivalent population, we obtain that the difference

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 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.

between the coefficients associated with residents and tourists is not significantly different from zero; hence, the probability to be victimized is quite similar for the two groups.

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) tourists in Italy have constantly increased: 57 million of arrivals (international and domestic visitors) were accounted in the official tourist accommodations in 1985³, and 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 concentrated in 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 for the same time span in many other Western countries such as US (-20.4%), Canada (-15.8%), the UK (-10.9%), France (-7.5%) and Germany (-6.9%; Eurostat, 2009).

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

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

The comparison of tourism arrivals and total crime series for the time span 1985- 2003 highlights a common upward trend of the two variables (Figure 1). Even though, as the Figure clearly shows, 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.

[FIGURE 1 HERE]

To better understand the underlying tourism-crime relationship, for each Italian province we calculate a tourism index and a crime index as follows:

$$LQ_{Tourism} = \frac{\left(\frac{Total_Arrivals_j}{Total_Arrivals} \right)}{\left(\frac{Surface_j}{Total_Surface} \right)} \quad (1)$$

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

where $j= 1, 2, \dots, 95$

Quartiles are the values used to divide each index into four equal groups. Table 1 shows the cross tabulation of the quartile distribution of the two indexes. 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.

[TABLE 1 HERE]

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 on the relationship between the two phenomena; this relationship needs to be further explored by using appropriate econometric techniques.

2 Data and empirical model

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

$$\begin{aligned}
 CRIME_{i,t} = & \beta_0 + \beta_1 CRIME_{i,t-1} + \beta_2 GROWTH_{i,t} + \beta_3 INCOME_{i,t} + \beta_4 UNEMPL_{i,t} + \beta_5 DENSITY_{i,t} + \\
 & \beta_6 TOURISM_{i,t} + \beta_7 DIPLOMA_{i,t} + \beta_8 DETERRENCE_{i,t} + \beta_9 SOUTH_i + \beta_{10} YEAR_t + \eta_i + \varepsilon_{i,t}
 \end{aligned}
 \tag{3}$$

$CRIME_{it}$ 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.

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 $E(\eta_i) = 0$, $E(\varepsilon_{i,t}\eta_i) = 0$ and $E(\eta_i) = 0$.

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

[TABLE 2 HERE]

[TABLE 3 HERE]

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 serial correlation in panel data; we find that the null hypothesis of no serial correlation is strongly rejected⁶. These arguments strongly suggest the use

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

⁶ The statistic tests are available on request.

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 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 $CRIME_{i,1}$ 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:

$$CRIME_{i,t} = \alpha CRIME_{i,t-1}^* + \delta_i + v_{i,t} \quad (4)$$

where $CRIME_{i,t-1}^*$ 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 δ_i 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:

$$CRIME_{i,t} = \tilde{\beta}_0 + \tilde{\beta}_1 CRIME_{i,t-1} + \tilde{\beta}_2 GROWTH_{i,t} + \tilde{\beta}_3 GDP_{i,t} + \tilde{\beta}_4 UNEMPL_{i,t} + \tilde{\beta}_5 DENSITY_{i,t} + \tilde{\beta}_6 TOURISM_{i,t} + \tilde{\beta}_7 DIPLOMA_{i,t} + \tilde{\beta}_8 DETERRENCE_{i,t} + \tilde{\beta}_9 SOUTH_i + \tilde{\beta}_{10} YEAR_t + \tilde{\eta}_i + \mu_{i,t} \quad (5)$$

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

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 tests 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 panel are performed (section 3.1). The second one illustrates the outcomes of GMM models (section 3.2). Finally, the third one 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 ($CRIME_{it-1}$). Initially, random and fixed effects models are performed (from now on FE and RE respectively) 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 RE are regressed (column 2 and 3).

[TABLE 4 HERE]

As one can see, except for the variables TOURISM and DENSITY, the coefficients remain stable. 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 might expect that a shock in crime rate would impact tourism 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; 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 a city art probably affects its own 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 suggest FE effects (column 4) as the preferred model. After correcting for endogeneity, the sign of tourism variable turns to be positive, although not significant.

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 and 2). 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 diagnostic tests support the final specification, we can present the findings in further details. Since the

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

variable SOUTH is not significant and the estimates in columns 1 and 2 are almost similar, we focus on the first column.

[TABLE 5 HERE]

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 both 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.).

As discussed in Section 2, coefficients might underestimate the underlying relationship due to 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%.

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 it to be 0.22%.

3.3 The victimization of tourists and resident

In a further step, we investigate whether the propensity to be victimized is higher for tourists than residents. Unfortunately, data about the victimization rate of visitors and residents are not available. For this reason, we apply a method that indirectly estimates such propensities.

To do so, the “equivalent population” of each province is calculated taking into account both the number of nights spent by visitors in the official accommodations (ISTAT) and the resident population, as follows:

$$\text{EqPOP}_{i,t} = \text{RESIDENT}_{i,t} + \frac{1}{365} \text{NIGHTS}_{i,t} \quad (6)$$

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

EqPOP measures the total number of people in a given province per year; it is worth noticing that the equivalent population is greater than resident population, especially in tourist destinations.

Then, a new crime index (*crime per equivalent population*) is calculated by dividing the number of total crime by the equivalent population, as follows:

$$\text{CRIMEpe}_{i,t} = 100,000 \frac{\text{TotalCrime}_{i,t}}{\text{EqPOP}_{i,t}} \quad (7)$$

where *CRIMEpe* represents the number of crime offences (against tourists and residents) per 100,000 people (both tourists and residents) in a given province at time t .

Then, Equation (5) is re-estimated by using a System GMM approach substituting *CRIME* with *CRIMEpe*. The underlying hypothesis is that if tourists have a higher probability to be victimized than residents, the coefficient of *TOURISM* should be higher than the coefficient associated with *DENSITY*, which means that n more visitors generate much more crime than n more residents. Such hypothesis is based on the assumption that tourists and residents have the same propensity to report crime offences across the provinces.

The results are shown in columns 3 and 4 of Table 5. As in section 3.2, since the variable *SOUTH* is not significant, we focus only on the third column. The outcomes are quite similar to the ones obtained before (columns 1 and 2), except for the coefficient of *DENSITY* that is significant at 10% level and positive. The latter result indicates that a one-per-cent increase in population density raises the crime rate by 0.011%. As before, *TOURISM* seems to positively affect crime: a one per cent increase in arrivals leads to a 0.015% increase in total crime per equivalent population.

Notice that the difference between the coefficients of DENSITY and TOURISM is not significantly different from zero. When we re-estimate the model using different measures of tourism density, we obtain analogous results. This outcome gives a first suggestion on the possible source of negative externality when total crime is analysed: the impact of a rise in residents and visitors on crime is quite similar, which may indicate that the main forces driving tourism-crime relationship are the agglomeration and urbanisation effects. Overcrowded cities give more opportunities to criminals to commit illegal activities, regardless of the share of visitors and residents in the tourism destinations. Probably, as the empirical studies suggest, the presence of visitors provides an incentive for certain illegal activities; therefore, it is a possible substitution among crime types that 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 in the short run relationship, a small number of them analyse 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. Economic literature barely explores this issue, finding 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 tourism arrivals 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 investigate whether the propensity to be victimized is higher for tourists than residents by re-estimating the model using the crime index corrected for the equivalent population; we obtain that the difference between the coefficients associated with residents (DENSITY) and visitors (TOURISM) is not significantly different from zero. As a consequence, when total crime is analysed, the probability to be victimized is quite similar for the two groups. One can imagine that overcrowded cities give more opportunities to criminals to commit illegal activities regardless of the share of visitors and residents in destinations. Unfortunately, this analysis has two limitations. First, it is based on the assumption that tourists and residents have the same propensity to report crime offences across the provinces. Second, aggregate crime data such as total crime rate, could fail to signal the presence of differences among crime typologies. In fact, it is reasonable that the impact of tourists is higher than the one of residents, on some typologies of crime, such as pick pocketing, bag snatching and fraud, and less on 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 error in the dependent variable. The crime data used in this paper are the total offences recorded by the Police, this represents the tip of the iceberg of this phenomenon. As 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 tourism-crime relationship changes according to the types of visitors (national and foreign) and type of crime (against property or persons).

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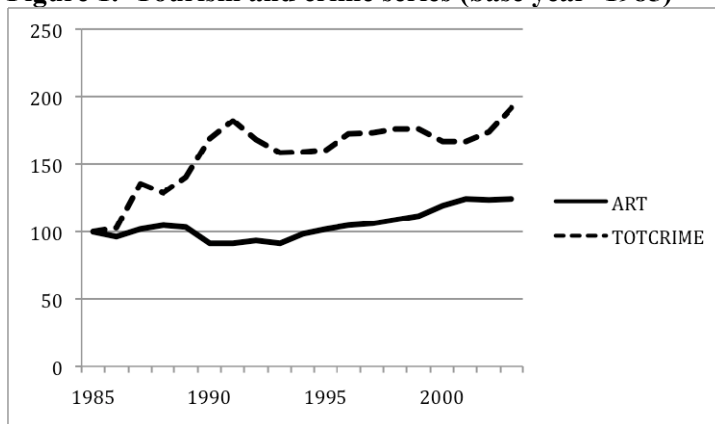
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Figure 1. Tourism and crime series (base year=1985)



Notes: we use index numbers with a fixed base value 1985=100
 Source: our elaboration on data from ISTAT

Table 1. Number of Provinces for percentiles

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

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 =	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

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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

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

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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.

Table 5. GMM results

VARIABLES	(1) CRIME	(2) CRIME	(3) CRIME _{pe}	(4) CRIME _{pe}
Crime _{t-1}	0.83*** (0.018)	0.83*** (0.018)		
Crime-pe _{t-1}			0.83*** (0.018)	0.82*** (0.018)
Growth	0.091 (0.12)	0.090 (0.12)	0.093 (0.12)	0.092 (0.12)
Income	0.089*** (0.023)	0.093*** (0.025)	0.090*** (0.023)	0.093*** (0.025)
Unemployment	0.041*** (0.0089)	0.040*** (0.010)	0.042*** (0.0089)	0.041*** (0.010)
Density	0.0066 (0.0055)	0.0064 (0.0055)	0.011* (0.0058)	0.011* (0.0058)
Tourism	0.018*** (0.0048)	0.019*** (0.0050)	0.015*** (0.0046)	0.015*** (0.0048)
Diploma	-0.0065 (0.0065)	-0.0067 (0.0065)	-0.0056 (0.0068)	-0.0057 (0.0068)
Deterrence	-0.083*** (0.015)	-0.083*** (0.015)	-0.084*** (0.015)	-0.084*** (0.015)
South		0.0041 (0.015)		0.0030 (0.016)
Constant	0.34 (0.22)	0.31 (0.24)	0.33 (0.22)	0.31 (0.24)
Observations	1,710	1,710	1,710	1,710
Number of provinces	95	95	95	95

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AR(2) Arellano-Bond test ¹	0.74	0.74	0.79	0.79
Sargan test ²	954.38	954.44	948.11	948.42
Hansen test ²	62.64	64.30	73.62	66.71
Test on joint significance ³	36.33***	34.51***	35.18***	35.18***

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.

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

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