VARIATION OF TOURIST FLOWS IN THE UMBRIA REGION AFTER THE SEPTEMBER 26, 1997, COLFIORITO (CENTRAL ITALY) EARTHQUAKE

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SUMMARY

Vulnerability studies have been extensively developed in Italy starting form residential buildings, in order to preserve its rich architectural patrimony. This paper presents some results of a CNR project aiming at the definition of a model for the evaluation of socio-economic vulnerability to earthquakes. The Umbria-Marche region has been selected, as case study, due to the long sequence of earthquakes that shaken the area starting on September 26, 1997 and because is one of the most important historic areas of Central Italy. The first step was to define the criteria for quantifying the socio-economic vulnerability of the region. Socio-economic vulnerability is evaluated through a selected set of indicators including population density, housing conditions, the structure of local economy, artistic and historical sites, etc. The dataset includes data on 254 variables organised in 9 groups and 48 indicators that are elaborated at the municipality level for the two regions (338 municipalities). The economic evaluation of the impact of the 1997, Colfiorito (Central Italy) earthquake on the tourist flows in the Umbria region is discussed to illustrate one of the various possible uses of the vulnerability indicators. Before the 1997 earthquake, the annual arrivals in Assisi were about 550,000 (1996), compared to a total population of about 25,000 people living in Assisi. After the earthquake, the tourist arrivals in Assisi fell down drastically to 9,205 arrivals in October '97, i.e. -83% on the same month of the previous year, followed by a similar trend in the subsequent months. A specific methodology, the Event Study, sometimes used in the studies on financial market shocks, is applied to evaluate if the shock effect due to the earthquake on tourist arrivals can be considered significant at a statistical level and is able to change the pattern and timing of tourist flows in the area. Finally, the role of media, in terms of intensity and quality of the information, is analysed because this factor can change the level of risk perception by people. Evolution of earthquake intensity is therefore analysed using indicators of the frequency and type of the news on the earthquake released by a popular television channel.

INTRODUCTION

From 26th September 1997, Central Italy has been affected by a long sequence of earthquakes with an intensity that in the first day reached magnitude 5.9 and that caused eleven death, more than 100 people injured and wide damages to the historical and monumental patrimony [Amato et alii 1998]. The area where the earthquake occurred in 1997 has been chosen as a pilot area in a project of the National Research Council (CNR) aimed at assessing the socio-economic vulnerability relatively to the seismic risk. By observing ex ante the infrastructural, social, economic and artistic aspects may be differentiated the areas in terms of vulnerability and of reaction in case of a seismic event. Socio-economic vulnerability can be considered as a multiplication factor of natural hazard for defining the risk associated to disasters and is the object of an increasing attention in Disaster Emergency Management (DEM). When integrated in a risk assessment and management model, the analysis ofsocio-economic vulnerability can contribute to implement prevention and mitigation measures, estimate the potential economic damage, identify the most critical uncertainties about impact and reaction. The analysis of socio-economic vulnerability is however still rough in many respects given the limited experience in socio-economic vulnerability evaluation on both theoretical and practical grounds [see Wisner 1997, Cella et alii 1998, Petrini 1996, Geipel 1979]. In this study, several indicators have been worked out, at a municipal level for the 338 municipalities in Umbria and Marche, relatively to specific aspects (e.g., residential structures, population

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and social structure, economic system, artistic and monumental heritage, infrastructures, etc.). Analysing and integrating the observed aspects that are in relation with the vulnerability has been achieved through a multivariate analysis, the *cluster analysis*. The identification of variables, indicators and clusters in relation with the socio-economic vulnerability, also allows to identifying some aspects that characterise the area and that are particularly sensitive to the seismic shock. Among these, the tourists' flow is particularly relevant. This variable has been analysed over a specific time period for assessing the effects of the earthquake on tourists' flows in the Umbria region. A specific methodology has been applied: the Event Study, that is frequently used in the analysis of financial market, to verify if the shock due to the earthquake may be statistically significant in terms of reduction of the tourists' arrivals and subsequently assess the economic loss that is due to the missing arrivals.

The shock effect of a seismic event on tourism generally goes along with the importance the media give it. The earthquake that affected Central Italy in 1997 also widely involved the media, that, in the initial phase, devoted large spaces to Assisi and the damages caused to its artistic and monumental heritage. Some aspects regarding the audience and the kind of the television reports, on a popular Italian TV channel, were at last analysed in relation with the intensity and the lasting of the seismic phenomenon.

2 SOCIO-ECONOMIC VULNERABILITY

At the conceptual level, there are two main relevant aspects of vulnerability. The first one is the potential sensitivity to damage of a local economy and social organisation. It corresponds to the concentration of population and economic activities as well as natural and man-made assets. It is the basis for traditional evaluation of economic damages associated to disasters. The second one is the social resilience to disasters. It is an intrinsically dynamic concept and corresponds to the features of a socio-economic system in terms of its ability to react to disasters. The two aspects are interrelated in a complex way. The possibility of their integrated representation through socio-economic models is still subject to various shortcomings. Various models of a local economy are available for depicting some of the aspects of damage-sensitivity and social resilience, but the integration of social and economic aspects is still poor, especially when the long-term reactions in condition of uncertainty are considered. Furthermore, most economic models of local development are unable to represent the impact of abrupt shocks as natural disasters. Given the above limitations, the approach to socio-economic vulnerability analysis can be based on the construction of indicators' system. Although it do not substitute for a model, if the indicators are defined in an appropriate way they can approximate the relevant features of both the damage-sensitivity component and the resilience component of the analysis.

2.1 The System of Indicators:

An essential requirement of a system of indicators for risk management is their flexibility in use [Grimaz et alii 1997, Zonno, et alii 1998b]. At the most general level, the indicators should be able to represent the two main aspects of vulnerability mentioned above. The first set of indicators (Set 1) is composed by variables that can suggest the size and significance of the socio-economic impact of earthquakes and disasters (indicators of socio-economic, cultural and historical assets and indicators of density of economic activities in the local area). Population indicators other than the number of people, should be instead excluded from this set, given the impossibility to associate different economic values to people belonging to different social groups. The second set of indicators (Set 2) is composed by variables able to represent the different capability of response to the disasters by the local socio-economic systems or, in other words, socio-economic resilience. They should be able to suggest the different path of reaction and post-earthquake recovery. The relationship between indicators and reaction ability can be only indirect in nature. Population and social structure variables are very important within this set of indicators. Among these indicators, population age-structure, degree of (formal) education, presence of disadvantaged social groups, etc can be included. It can be expected for example that an area with prevailing young population and strong economic activities, and well endowed with working local institutions can react in a better way both by self-organisation and by absorbing in a more efficient way the crisis and post-crisis intervention. Through these indicators[1], critical risk areas in terms of lacking reaction potential can be identified.

2.2 Assessing Socio-economic vulnerability of Umbria-Marche:

Among the various possibilities of mapping the data, *cluster analysis* (CA) has been considered for identifying the degree of homogeneity of different sub-areas. Clustering can be made according to single indicators and/or according to thematic groups of indicators. When a significant number of clusters is identified, a rank of

[1] Main indicators' thematic groups are: housing and residential structure, population and social structure, socio-economic structure, social services and health, infrastructures, historical and artistic heritage, tourism, environment, incomes. The full system of indicators is available from authors upon request.

vulnerability can be assigned to them according to the groups profiles. For example, one area can rank high for vulnerability in terms of industrial structures while ranking low for the endowment of art and cultural heritage. Some of the identified clusters are clearly weak relative to others in terms of social structure and economic activity and they can deserve a special attention in the development of risk management system. There are obviously various degrees of arbitrariness in both ranking and using the clusters in DEM cycle and they cannot be eliminated. The ranking is however in relative terms.

The definition of scores is one of the most delicate methodological problems in the whole procedure as it is impossible to use reliable reference criteria obtained from experience on literature and from other socio-economic applications. The procedure used in the CNR project and in this work provides a preliminary multivariate processing for the defined whole set of indicators-municipality in order to describe the area's socio-economic structure, by means *principal components* (PC)[2]. The variability share that is explained by the main components depends on the total number of those considered (we have selected components with an eigenvalue larger or equal to 1). The PC are then used in the *CA* to single out and give an interpretation to clusters. The advantage of using the PC comes from the fact that these are a linear combination of the original indictors but they are not correlated between themselves. Furthermore, the obtained clusters have profiles expressed in terms of standardised scores in the chosen PC. Hence, this allows an indication even if very simple of the vulnerability through a sum of the scores themselves in absolute values.

2.3 Clustering and Results:

The PC analysis and subsequently the CA has been carried out on several sub-sets of indicators, for defining the optimal one. The selected set is composed of 32 indicators out of the 48 defined. The analysis of the PC and of the respective eigenvalues, led to the selection of 8 PC enabling to explain 74.9% of the whole variability. The components' interpretation[3] is based on the observation of the sign and importance, at an absolute value, of the coefficients of the *p* indicators in the *k* selected PC. In order to avoid any subjective interpretation, the interpretation of the PC is subsequently given by considering the indicators which coefficients determine a contribution at least equal to 5% of the component's whole score. The first component, which explains about one third of the original components' whole variability, may be interpreted as a synthesis variable that is representative of a vulnerability mainly due to the high inhabitants' density. In correspondence of negative values, the importance of this component is mainly due to a quite old housing stock. The second component (about 15% of the whole variability) is an index of low house occupation, an old housing stock (often built before the second world war) and old age of the resident population. The vulnerability this component explains, is characterised by aspects related to the elderly population and to the old housing stock. The third component is a positively correlated indicator with high rates of entrepreneurship and tourists presence thus a possible high impact on tourists flow in case of seismic shock. The fourth component represents attractive centres, where an important historic and monumental heritage is located but where tourism is not particularly emphasised and where the housing stock is quite old and rarely renewed. The fifth component identifies small industrial centres with a low population density (at the opposite if values are negative). The sixth component is associated to a recent housing stock and positive migratory dynamic. The seventh component identifies the rurality, the marginality and the lack of historic and monumental heritage. The eighth component is characterised by a low population density and a tendency to emigrate. The last two components, to which a low variability is associated, are also those, as it will be shown later, with lower scores at an absolute value. They characterise the clusters and their corresponding vulnerability in a less evident way.

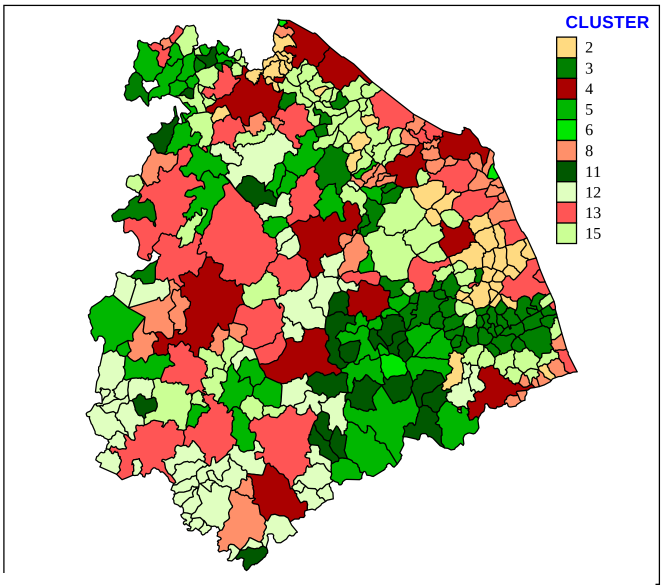
Table 1: Cluster characteristics and means.

Cluster	frequency	PRIN1	PRIN2	PRIN3	PRIN4	PRIN5	PRIN6	PRIN7	PRIN8	abs. sum
4	12	6.2544	3.4596	2.3599	3.2185	-0.5193	0.8188	0.1857	0.0257	16.84
8	38	3.124505	-0.05641	-1.10743	-1.21933	-0.04381	0.745437	0.53685	0.008258	6.84
13	27	3.0964	1.2481	1.8633	2.1893	-0.6556	-0.2481	-0.5951	-0.2527	10.14
2	34	2.0136	-2.774	0.1529	-0.4323	1.4069	-0.3128	-0.0652	-0.3453	7.50
6	3	0.2341	3.948333	3.1531	-3.4668	-0.4378	-1.21683	0.316267	0.403833	13.18
15	65	-0.1227	-1.3962	-0.1088	-0.0452	-0.1617	0.0369	-0.0987	0.0251	2.00
12	48	-0.2459	1.8297	-1.8538	-0.4626	-0.0271	-0.3618	-0.2213	-0.0637	5.07
5	40	-1.63439	0.73711	0.155935	0.007598	0.08232	-0.529	-0.31448	0.70261	4.16
3	49	-3.1244	-1.9263	0.9	0.7712	-0.7431	0.2483	0.3979	0.0448	8.16
11	22	-3.92304	3.374291	0.160118	0.261455	1.091073	0.308645	0.219509	-0.55206	9.89

Source: our processing on data from various sources.

[2] The principal components (PC) analysis is a methodology that enables to transform a set of *p* indicators collected on *n* statistical units into a set of *k* variables (where $k < p$), called PC, that are able to explain a significant part of the original indicators' observed variability [Mardia, Kent, Bibby 1989].
[3] The socio-economic interpretation is necessary even before plugging the components' scores for each municipality into the *CA*.

The *CA* carried out on the 8 PC' scores for each municipality has been made on a first step with a hierarchical aggregation of the 338 statistical units (municipalities). This allowed to single out an optimal number, avoiding any subjectivity (i.e. observing the local optimum of some statistics, pseudo-F and CCC, Cubic Clustering Criterion). This way, the number of clusters established through the above technique is introduced as being an exogenous variable in the subsequent application of the *CA* that leads to the final mapping according to a non-hierarchical aggregation method**.** Using this method lead to the choice of 15 clusters. Among these, 6 clusters were of small dimension (less than 3 units). So they were grouped into the closest clusters. The clusters that have been obtained are 10 (Table 1)[4]. The clusters' interpretation relies on reading the profiles of each cluster in terms of average score for the 8 selected PC.



,**Figure 1: Umbria and Marche Socio-economic Vulnerability Zonation**

Cluster 4 is the one where the values of the first 4 components are mostly relevant. Municipalities with a high density of population are concerned, with a slightly old population and with a demographic dynamic slightly positive. All the province council towns appear in this cluster (Perugia, Ancona, Terni, Pesaro, Macerata and Ascoli Piceno) and some particularly dynamic small towns that are attracting centres for neighbouring municipalities (Camerino, Fabriano, Fano, Jesi and Urbino). The housing stock is relatively recent and with relatively high levels of renewal. Several municipalities included in this cluster have an important historical and monumental heritage. Some municipalities have relevant tourists' flows; some others have a low tourists' flow related to business. This cluster is the one with the highest socio-economic vulnerability (Table 1, Figure 1).
Cluster 8, quite numerous, assumes the characteristics of the previous one as far as the first principal component is concerned, the artistic and cultural heritage is not important but a certain housing renewal is observed. Towns with strong service sector mainly constitute this cluster. In cluster 13 are concentrated the towns where art and tourism are present, the housing stock is not recent and the renewal is not particularly evident on total. In decreasing order, if we exclude the small cluster 6, this cluster is ranked second for the socio-economic vulnerability. The following municipalities are included in this cluster: Assisi, Gubbio, Orvieto, Todi and some less tourist towns but important on a historical and monumental point of view (Osimo, Recanati. Spello, Spoleto and Urbania). Cluster 2 have opposite characteristics: positive for the first component but negative for the second one. In this cluster are concentrated small industrial centres located in some cases in largest towns neighbourhood. As far as the first principal component is concerned, a small cluster with three municipalities only is ranked fourth. This cluster is characterised by a wide tourists' flow in the summer not motivated by artistic, cultural reasons and not to be linked to the historical heritage.
The following cluster (15) is the largest one. It gathers municipalities for which the main characteristic is the marginality with respect to the main centres, with a resident population with low incomes. Marginality and aged population characterise cluster 12; the housing stock is not recent. In the last three clusters, 5, 3 and 11, the characters of an ancient housing stock are particularly important. Furthermore, only in cluster 11, characteristics of an aged residing population are also particularly relevant. A characteristic that the three clusters have in common is the low population density that goes along with an important proportion of inhabited houses (particularly in clusters 3 and 11). The municipalities belonging to these clusters are those where the main epicentres of the September 1997 earthquake are located and a large proportion of the neighbouring municipalities (Serravalle in Chienti). In cluster 11 and in cluster 3, the vulnerability is medium. This is mainly due to a quite ancient housing stock and to different factors that are related to the elderly resident population (difficulty to recover after a seismic shock).

3 ECONOMIC EVALUATION OF THE IMPACT OF THE SEPTEMBER 26, 1997 COLFIORITO EARTHQUAKE ON THE TOURIST FLOWS IN UMBRIA

3.1 Methodology and data:

[4] Three cluster, formed by single units and clustered considering the closest cluster, led to the identification of a new single cluster. A complete list of municipality included in each cluster is available from the authors upon request.

The attention is now focussed on the economic assessment of the earthquake's impact, that hit Central Italy in 1997, on the tourist flows in the Umbria region. The analysis has been carried out through a methodology, the Event Study that is widely applied in finance. The issues arising from the implementation to non-financial data and application' details are examined by Mazzocchi, Montini and Zoboli (1999).

Transposing the Event Study methodology from the financial field [see Campbell et alii 1997] to a generic target variable, the main steps are : (i) to identify the event, both with respect to the exact time period when the event occurred and the following period (*event window*) by including all the following observations of the *target variable* that could be still influenced by the event; (ii) to build a *benchmark* model (BM) for the target variable, using data through an estimation period not including the period affected by the event. The model must be independent from any other shock, so that it reflects the behaviour of the target variable in standard situations; (iii) to estimate the *excess residuals* (ER), calculating through the *event window* the distance (difference) between the actual values of the target variable and the ones the model estimates; (iv) to group the *ER* through time (within the *event window*) and through the different statistical units; (v) to perform statistical tests to detect the presence of significant abnormal residuals.

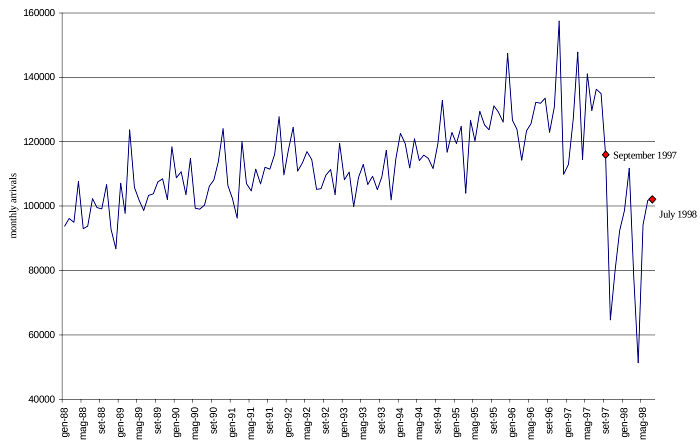


Figure 2: Tourist monthly arrivals in Umbria (seasonal

To carry out the analysis, the data set that has been used is a monthly time series of tourist arrivals and stays, subdivided into Italians and foreigners, in each of the 12 Umbrian districts from January 1988 to July 1998. Within Umbria region, the tourist flows may be subdivided as regards to the number of tourists and to their profile into three main typologies: cultural tourism, business tourism and seaside tourism (Trasimeno Lake). A simple descriptive data analysis has highlighted that the main historical, artistic and religious centre of interest is Assisi, that accounts on average for one third of total tourist arrivals and stays in the region. If minor shocks that occurred in September 1997 are excluded, the main seismic event in the region may be identified as the two main shocks that were observed on 26th September 1997 (at 2.33 am and 11.40 am local time). The *event window*, when forecasts and *ER* have been calculated is thus Oct.'97 - Jul.'98 (Jun.'98 for the districts' number of tourists subdivided into Italians and foreigners). To estimate the parameters of the BM, 117 monthly observations have been used (*estimation period*, Jan.'88 - Sep.'97) (Figure 2).

3.2 Results:

Estimation of the *BM* and subsequent calculation of the *ER* has been done for each of the 12 districts[5]. The *ER*, that are calculated both in absolute terms and in percentages, represent the missing arrivals or the loss in terms of tourists' arrivals in the area after the earthquake, referring to the dynamic forecast based on the *BM*. The t-distribution of test statistics enables to test the statistical significance of the distance between the actual values and the forecast values obtained through the *BM*. The results show that all districts assume significant values according to the missing whole arrivals with the exception of those geographically more distant form the earthquake epicentre (Amelia, Orvieto and Terni in the southern part of the region). The amount of the missing arrivals, in standard terms, is more evident in the Assisi district where they account for more than 50% of the forecast arrivals; Assisi is followed at some distance respectively by Perugia, Spoleto, Castiglione del Lago, Todi, Gubbio, Cascia, Città di Castello and Foligno. In absolute terms, the widest loss are for Assisi and Perugia districts, with respective values of 199 thousands and 47 thousands.

The assessed amount of missing arrivals in each district depends on the distance of these from the earthquake epicentre and also on the role played by the media. In this situation, as in other cases, the media associated the earthquake to the area that is most known to the public, hence usually the most attractive under a tourist perspective. In this case, the Assisi district was both one of the areas closest to the epicentre and particularly vulnerable under a structural point of view, and at the same time it was the most important area for tourism, hence in great evidence on the TV reports and newspaper headlines. An analysis of the *ER* for the Assisi district per month allows to better observe the difference between the values of the observed arrivals and the forecast values using the *BM*. It appears evident that during the first 5 months after the seismic event, from a situation of real collapse in October and November (relative loss of around 70-80%), a global reduction was observed for the

[5] Full results are available from authors upon request.

ER; they, furthermore, appear not to be significantly different from zero in January and February. In March and April, together with an evolution that, in standard conditions would present a slight increase for the tourists' arrivals, there was a sudden increase in the missing arrivals that become again significantly different from zero and also quite relevant in percentage terms. This also happens in correspondence with some seismic phenomena, with further important shocks recorded, with a magnitude above 5, at the end of March and beginning of April. Subsequently, from May, the standardised *ER* start to decrease even if remaining significantly different from zero.

3.3 Economic Impact Evaluation:

Once the event impact resulted to be significant, the Event Study allows to obtain a monetary assessment of the change in the target variable caused by the event being analysed. Some examples of monetary evaluation of damages can be found, among others, in the works of Broder (1990), Borenstein e Zimmerman (1988).

After obtaining the estimates of the *ER* according to the methodology proposed in paragraph 3.1, the passage to the economic values is very simple. In this application of the *Event Study*, where the *target* variable is represented by the tourist arrival, once that an estimate of the economic value associated to each tourist arrival is available, any monetary assessment can be derived simply by multiplying the *ER* by the average value imputed to each tourist arrival. In order to do that, some surveys on the average daily expenditure per tourist – available at regional and national level - are used. The derived monetary assessment gives an estimate of the "direct" loss due to the loss in tourists' expenditure because of the missing arrivals. However, the relevant effects induced on the economic system as a whole are not considered.

The estimated average daily expenditure per tourist in 1997 (our processing) is 92,300 ITL for Italian tourists and 113,600 ITL for foreign tourists[6]. The monetary loss for the tourism sector in each district over the *event window* was estimated assuming that the average stay would have not changed without the earthquake. Hence the monetary losses for each territorial district [see Mazzocchi, Montini and Zoboli, 1999] is given by:

$$L = DE \cdot \left(\sum_{l=1}^{L} y^{f}_{T+l} \cdot S_{ante} - \sum_{l=1}^{L} y_{T+l} S_{post}\right)$$

where: *DE* is the average expenditure per person per day; y^{f}_{T+l} are the forecast tourist arrivals in the *l-th* month of the *event window;* y_{T+l} are the actual tourist arrivals in the *l-th* month of the *event window;* S_{ante} is the average stay before the earthquake; S_{post} is the average stay after the earthquake.

The total loss estimate for the period following the earthquake from Oct. '97 to Jun. '98 is about 120 billion Liras, that is a 40% reduction with respect to the estimated expenditure in the same period in normal conditions (Table 2). The economic loss is sensibly more marked if the Italian component of tourist flows is considered.

In relative terms, at a district level, the economic loss due to the missing arrivals is particularly relevant in Assisi, Castiglione del Lago and Gubbio, whereas in absolute terms the loss is quantifiable (in the same period Oct '97-Jun. '98) in about 46 billion Liras for the Assisi district and respectively 23 and 19 billion Liras for the districts of Castiglione del Lago and Perugia.

Table 2: Monetary loss by territorial district (Million ITL and % with respect to estimated turnover)[ç]

Territorial District	Italians		Foreigners		Total	
Amelia	277.8	12.4%	(*45.7*)	-6.5%	232.0	7.8%
Assisi	32,793.4	73.8%	13,009.3	42.5%	45,804.4	61.0%
Cascia	2,992.8	31.6%	486.1	30.3%	3,480.6	31.4%
Città di Castello	3,997.1	34.6%	928.1	27.6%	4,925.3	33.0%
Foligno	5,350.4	32.8%	2,381.3	42.6%	7,731.7	35.3%
Gubbio	5,433.4	53.2%	1,324.5	37.8%	6,759.6	49.3%
Castiglione del Lago	12,734.9	52.5%	10,070.7	47.4%	22,807.4	50.1%
Orvieto	1,300.8	15.7%	(*35.6*)	-0.8%	1,265.2	9.9%
Perugia	17,097.9	36.6%	1,551.4	6.7%	18,649.3	26.7%
Spoleto	2,964.0	35.9%	934.9	29.8%	3,898.9	34.2%
Terni	2,244.2	15.3%	101.6	4.1%	2,345.8	13.7%
Todi	733.4	20.7%	1,614.1	47.1%	2,349.2	33.6%
TOTAL	87,921.7	44.0%	32,320.9	31.3%	120,242.5	39.7%

[ç] Oct.'97-Jun.'98; *Italics* and brackets: negative value of monetary loss
Source: our processing on Regione dell'Umbria, Assessorato al Turismo and UIC data.

[6] Currently, at regional level an index of the average national expenditure (source CISET on UIC, Italian Exchange Office data) is only available [see Ministero dell'Industria, 1997]. However it allows to estimate the daily average expenditure for foreign tourists in the Umbria region. For the Italian tourists, the average daily expenditure is only available at national level. However, this data has also been estimated for the Umbria region by using the expenditure index for foreign tourists and assuming that it represents a *proxy* of the regional differences in the average price level for the tourist structures and the expenditure patterns in the different regions.

4 TV NEWS AND EARTHQUAKE IN THE CENTRAL ITALY AREA

Mass media play the role of a link between the operators involved in the earthquake and the people not directly involved in the catastrophe in creating and maintaining alive the attention to the event. The attention that mass media addressed to the 1997 earthquake in Umbria-Marche evolved during time also following the features of the seismic event. At the beginning the earthquake was classified anomalous because the sequence of important shakes. Then data analysis has stressed out different seismic event on the same area [Pergalani et alii 1999, GNDT 1999, Decanini et alii 1997]. In the phase of the emergency, mass media usually employ high quality human and financial resources. Then, media attention on the disaster is gradually decreasing. A renewed interest usually arise during the reconstruction phase, but the information type become different.

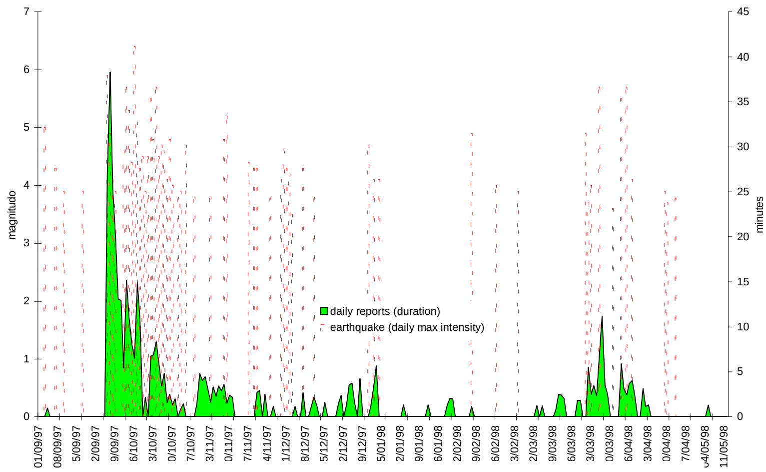


Figure 3: Earthquake intensity and daily reports

We have analysed the data about the frequency of reports on the 1997 Umbria-Marche earthquake in the daily television news (from 1st sep.'97 to 30 sep.'98) of an Italian popular channel (*Rete 4*). We classified the reports per kind of information contents[7]. Data about television reports on Umbria-Marche earthquake give the idea on how the interest on earthquakes develops. The interest is divided in: (a) a phase of emergency, in which the topics of the reports refer primarily to death injured and damaged buildings; (b) a phase of reorganisation, where the interest is on people and the quality of life after the catastrophe; (c) a subsequent phase is that of reconstruction where the topics of the report should refer to the reorganisation of the towns shaken from the earthquake. In the case of Umbria-Marche, the interest of the media was concentrated in the phase of emergency, while in the subsequent periods the interest was decreasing. A graph involving the magnitude shake and the duration of the news on the catastrophe (Figure 3) show how the interest of the media for the catastrophe is not addressing the real event in all the period. In fact just at the beginning the attention was on the real events while later the interest was not on the physical event. In the case of Umbria-Marche, at a later time the interest of the media was not related to the shakes but to the reorganisation of the people's life and the reconstruction of buildings and monuments in the area.

5 CONCLUSIONS

In this work some analytical methodologies frequently used in economic research are the grounds for a study on socio-economic vulnerability with respect to the seismic risk in two regions of Central Italy, Umbria and Marche. These regions were recently hit by a seismic event. The approach followed in this study is to define the relevant indicators for representing – on the one hand – the potential sensibility to the damage to houses and to the economic system and – on the other hand – the potentiality of the areas in terms of social resilience to the disaster, that is the ability to recover after a potential seismic shock. The indicators selected for the analysis at municipality level were first statistically processed in order to extract the PC, that is non correlated variables – differently from the original indicators –, characterised in different ways according to the socio-economic vulnerability. The PC were then used in the *CA*, in order to detect groups of municipalities that are homogeneous within themselves, but heterogeneous between each other. To these identified clusters, through the profile reading, a level of vulnerability was associated. This procedure led to the identification of 10 clusters.

Among the defined indicators, those regarding tourists' flows are particularly relevant for characterising the clusters. For this reason, this study has been subsequently oriented towards the analysis of the effects on tourist

[7] Information contents available from the authors upon request.

flows in Umbria region driven by the seismic event occurring on September 1997. The Event Study Analysis was used. A BM has been elaborated to produce efficient estimates over the observation period (October 1997-June 1998) and for assessing their distance from the observed data, that is evaluating the missing arrivals. This methodology also allowed, to give an estimate of the monetary loss in the local economical system due to the reduction of the tourists' arrivals after the earthquake. The monetary loss was quantified for the whole region, over the period Oct. '97-Jun. '98, as 120 billion Liras. This can be considered as a loss «directly» imputable to the tourist expenditure loss in the area and not to the effects on the whole economical system. The reduction of the arrivals through the whole *event window* appears particularly evident in the Assisi district, where the «missing arrivals» exceeded, in relative terms, 50% of the value the model had forecasted. The districts in the North-East of Umbria were affected by the highest impact. In this case several different factors added up, as the closeness to the epicentre, the renown under an historical-monumental perspective, hence the relevance that media gave to these areas, especially Assisi. The amplification of the events through the news in the emergency phase of the earthquake in Central Italy reached such a level that on a single national TV channel even 20 daily report were broadcast. This had an evident impact on the public opinion and consequently on potential tourists. The media attention and the involved resources are however decreasing together with the reduction of the seismic phenomenon and this become the subject of the TV report as time passes. No more alarm, victims and damages, but reconstruction, recover and return to normal life.

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