Valuating the effects of beach erosion to tourism revenue. A management perspective

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ABSTRACT

Coastal erosion, besides its various environmental impacts, poses a significant threat to coastal economies where the market for tourism services is a key factor for economic growth. So far, a common practise in evaluating the economic implications of beach erosion is to address the cost of coastal protection measures, abstaining from any revenue losses considerations. The present paper departs from this approach by relating the beach erosion vulnerability with the expected land loss and the relevant value from economic activities. The study employs a combined environmental and economic approach along the geographical space. The value of the eroded beach, capitalized in revenues from tourism business, is estimated through hedonic pricing modelling where the beach value is determined by its width and the tourism business located there. The study aims to provide realistic cost-benefit scenarios for the relevant stakeholders and policymakers so as to prioritize and allocate costs and benefits from a "beach governance" point of view, grounded on the Integrated Coastal Management (ICM) framework. The empirical investigation presented considers the highly touristic coastal city of Rethymnon on the island of Crete as the study area.

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1. Introduction

Coastal environment changes constantly as a result of the interaction between waves, wind, ocean currents and anthropocentric processes (Carter and Woodroffe, 1997). In this setting, the sustainability of coastal ecosystems depends on their utilization by stakeholders and the effects of exogenous natural hazards, relevant to global warming and sea-level rise (Berry et al., 2014; Ye et al., 2014). Therefore, the effect of climate change and the excessive exploitation of coastal areas' resources contribute significantly to coastal erosion (Granja and De Carvalho, 2000; Jensen et al., 2001; Vilibić et al., 2000). This results in three types of risks: (i) loss of land with economic value; (ii) destruction of natural coastal defences (e.g. dune system); and (iii) undermine artificial coastal defences, potentially leading to flood risk. In coastal areas, the economy of which is heavily -if not primarily-dependent on tourism (such as the Mediterranean and the Caribbean), resort beaches are considered as dynamic natural resources that generate value and capitalized in the relevant properties market, e.g. the tourism business market and the market for housing (Phillips and Jones, 2006). Consistent empirical studies suggest that property values increase with beach width (Brown and Pollakowski, 1977; Edwards and Gable, 1991; Pompe and Rinehart, 1995; Bin et al., 2008) which also increases the coastal capacity for biodiversity (Schlacher et al., 2007). In addition, beaches provide important coastal protection by limiting potential damages to coastal habitats due to waves and erosion. Costanza et al. (2006) found that beaches in New Jersey deliver $42,147/acre/year in economic/ecological services which can be broken in leisure and aesthetic value ($14,847/acre/year) and other services ($27,300/acre/year).

In this context, it becomes apparent that coastal erosion poses a significant threat for both the value created by the tourism industry and the coastal biodiversity and protection with further multiplying negative effects. For example, across the Mediterranean, coastal erosion has been a longstanding large-scale issue, (Pranzini and Williams, 2013) and the estimation of the vulnerability of the beaches has received much attention (e.g Jiménez et al., 2009;

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Bosom and Jiménez, 2011; Sousa et al., 2013; Vousdoukas et al., 2012; Hinkel et al., 2013).

Evidently beach erosion has been a concern for coastal managers for decades. Phillips and Jones (2006) argue that it is crucial, for the involved stakeholders and policymakers, to undertake coastal interventions, entailing costs and benefits from a "beach governance" point of view, grounded on the Integrated Coastal Management (ICM) framework. The later coordinates different policies affecting coastal areas, aiming to increase the efficiency of coastal resources in favour of socioeconomic development, while respecting the limits of ecosystems and ensuring their sustainability. This makes the identification of the involved stakeholder groups, their objectives and practices, as key prerequisites for the effective allocation of costs and benefits, in cases of coastal interventions with a long-term perspective (Ye et al., 2014). Consistent evidence across studies suggests that the stakeholder groups in coastal zones, locating beach tourism business and resident accommodation facilities, are: local, regional, national governance institutions; environmental NGOs; private sector; academic researchers; consulting industry (Ariza et al., 2014). It is also evident that, in such coastal zones, the relevant stakeholders' groups have incompatible objectives ranging from tourism development to ecosystems' sustainability. Hence, every intervention, within the "beach governance" context, aiming at the mitigation of beach erosion and its effects, needs an equilibrium allocation of costs and returns across the public and private stakeholders, taking into account sustainable governance, coastal environment sustainability and socioeconomic development, i.e., the three pillars of the ICM framework (Ye et al., 2014). Besides the direct costs, indirect losses, due to exogenous risks and hazards in property values and tourism revenues, should also be proportionally allocated. For the case of Spain, recent stylized facts suggest its loss of competitiveness as a tourism destination due to the ageing of its tourism infrastructures and the excessive exploitation of the relevant coastal environment (World Travel and Tourism Council, 2013). Focussing in Southern Spain, García et al. (2003) argue that coastal management should ensure erosion control as well as the protection of the landscape and the implementation of effective urban planning measures, aiming to strengthen the sustainable competitiveness of the relevant area within in the global tourism market.

In this framework, major issues to be addressed by stakeholders are the following: Firstly, to justify the cost for the mitigation of coastal erosion in order to avoid revenue losses from tourism business in resort beaches. Motivated by this, the present paper offers estimations considering economic and environmental factors along the geographical space and time. Secondly, stakeholders have to consider the sustainability of mitigation actions through time, and thirdly, the extent of capitalization of policy interventions into tourism related business and revenues. The present paper is placed within the ICM framework, for the control of beach erosion and suggests cost-benefit scenarios for planning sustainable protection measures in order to mitigate the negative economic impact of beach erosion. Interestingly, in the field of applied policy initiatives, the European Commission (2013), in order to further promote sustainable development of coastal zones, has recently adopted a proposal for a Directive establishing a framework for maritime spatial planning and integrated coastal management (European Commission, 2013).

2. Study area

The study area is the beach in front of Rethymnon city, in the north coastline of Crete Island. Crete is the largest Greek island and the fifth largest in the Mediterranean, with a population of approximately 603,000 inhabitants. Its coastline totals 1300 km,

15% of which consists of sandy beaches (Alexandrakis et al., 2013). The tourism industry in the island is playing a leading role to its economic growth during the last decades, with approximately 40% of the local population being involved, directly or indirectly, in the tourism industry (Manasakis et al., 2013). Recent evidence suggest that Crete holds a share of 25% of the total foreign guest nights in Greece, 27% of which corresponds to quest nights in Rethymnon. Moreover, the tourism industry has consistently acted as the interface for strong inter-sectorial connections with further multiplying growth effects (Andriotis, 2002). Tourism development in Crete started in the late 1960s when tourists were attracted to Greek destinations mostly for their natural and cultural attractions. The same period, local capital took advantage of state subsidizations for building large hotels (Briassoulis, 2003). By 1981 the number of hotel beds had almost tripled in the island. Today, Crete is one of the most developed tourism destinations in the Mediterranean, attracting almost 2.8 million tourists annually. Moreover, the "mass tourism" development paradigm followed in Crete, has led to sharp environmental stress, due to asymmetric seasonal and geographical distribution of activity, with 85% of tourist arrivals taking place from May to September on the north coasts of Crete (Andriotis and Vaughan, 2003).

Rethymnon is the third larger city of the island, with about 40,000 habitants. There is a sandy beach, in front of the city, with more than 200 accommodation establishments of all categories as well as various tourism facilities in the vicinity. The beach has length 7.5 km and its width varies from 20 to 110 m (Fig. 1). A part of the beach (5.5 km) is within the city's urban fabric, while the remaining 2 km hosts some houses and hotels, a few tens of meters from the shore. In the first 2 km, east of the city of Rethymnon, there is a coastal road, which was constructed as the city was being expanded to the east on the dune field that existed there. Half of the beach has been characterised as Natura area (code GR4330004). This is mainly due to the fact that the beach is one of the larger "*Caretta Caretta*" hatching areas in Crete. There are also the catchment areas of Geropotamos River and Sfakoriako torrent, in the Natura site, with irrigating dams constructed in both, allowing a limited sediments flow to the beach. The location of the study area is shown in Fig. 1.

The beach has a West − East direction and receives waves induced predominately by the Northwestern, Northeastern and North origin winds. Northern winds are the most frequent, with an annual frequency of occurrence of 15.5%. Northwestern winds have an annual frequency of occurrence of 13.8% while the respective frequency of Northeastern winds is 7.0% (Soukissian et al., 2007). For the Northeastern direction, waves with heights more than 5.5 m have an annual frequency of 0.7%, while for the North and Northwest origin wave the annual frequency is 0.1%. The frequency of winds per direction and the statistical description of waves are shown in Fig. 2.

The bathing spaces of the beach are under the management of the municipality of Rethymnon. Each year, specific sectors of the beach are put in a public auction in order to be rent for tourism purposes during the summer period. The minimum renting rates are proposed by the municipality, while the rates vary across sectors, with the sectors near the city having the highest values. The renting values for the summer period of 2013 were 40 €/m^2/month, from sector 1 to 7. The respective rate was 25 €/m^2/month from sector 8 to 18 and 15 €/m^2/month from sector 19 to 38. 5 €/m^2/month of these rental prices are used for maintaining the lifeguard services. The remaining revenues are used for beach cleaning, preservation and other non-related to the beach purposes. In the beach under study, there are not any natural or artificial coastal defences. In 2007, the municipality recognised the need for coastal defence in the area and requested a coastal defence study, which