The tourist area lifecycle and the unit roots test. A new economic perspective for a classic paradigm in tourism.

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Abstract

As many traditional tourist destinations have experienced a slow down in tourist arrivals and expenditure, Butler's (1980) Tourist Area Life Cycle (TALC) model seems to attract new attention from tourist researchers. The TALC describes the evolution of a tourist area from its discovery to its final stage picturing an evolutionary path represented with an S shaped curve associated to the logistic function. The limits of growth and the shape of the curve represent the existence of congestion problems and upper carrying capacity limits. But the TALC has been repeatedly criticized by its lack of operability and its departures from the anticipated curve. An alternative way to test its existence is to estimate its theoretical logistic curve and test the presence of unit roots. The application of this new technique to Majorca concludes that the evolutionary path predicted by the TALC does not apply in this particular case. Even more, the empirical results could imply that shocks that affect to this destination will have not temporary but permanent effects, encouraging the adoption of pro-active policy measures.

Keywords: Destination lifecycle, carrying capacity, logistic function, unit root test.

1. Introduction

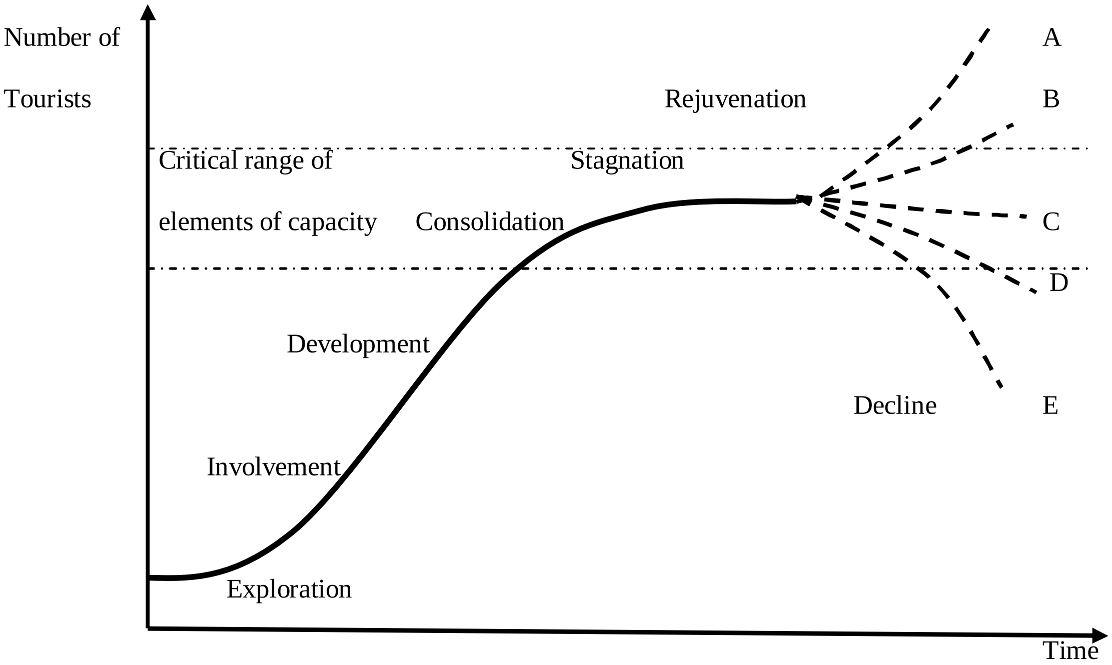
In recent years many traditional coastal tourist areas in Southern Europe have experienced difficulties to maintain or increase their level of arrivals, tourist expenditure and/or total number of stays average. In this context the concept “mature destination” has become increasingly used to qualify traditional destinations that experience difficulties to expand or even maintain their level of tourist activity. As many coastal areas of Southern Europe have developed local and regional economies strongly dependent on tourist activity, the possible stagnation and/or decline of their tourist activity has become a major issue from an economic, social and political point of view.

The concept of mature destination seems apparently linked to the evolutionary tourist authors and especially to the tourist area lifecycle model of Butler (1980). Early evolutionary authors focused their attention on change trying to determinate the factors and processes that rule the evolution of tourism or the development of their structures (Pearce, 1995), putting special attention in the investigation of tourist destinations. As Pearce (1995) points out, Cristaller (1963) was probably the first to describe the evolution of a tourist destination. Latter on, Miossec, (1977), Plog, (1973), Stansfield (1978) or Thurot, (1973) followed him presenting alternative theories to describe the evolution of tourist areas. For all of them the final step of the evolution consisted in the popularization of the destination and the decline of its tourist activity.

Probably, the most relevant of these authors was Butler (1980). His Tourist Area Lifecycle model (TALC hereafter) synthesizes the contributions of the main preceding evolutionary authors gathering together the main factors under destination dynamics and decline like: the changes in the type of visitor (Cristaller, 1963; Thurot, 1973; Plog,1972; Cohen, 1972), the possible degradation or change of the physical plant (Stansfield, 1978) and the replacement or even disappearance of the original natural and cultural attractions which were responsible for the initial popularity of the area (Cristaller, 1963; Cohen, 1972; Miossec, 1977).

In Butler's TALC (1980), traditional tourist areas traverse during its life span six stages: exploration, involvement, development, consolidation and stagnation, arriving to a final post-stagnation stage. However, it must be remarked that this last stage (post-stagnation) was in fact open (Butler admitted a final stage where sharp decline, rejuvenation or other intermediate solutions were possible). Each stage was characterized by a different rhythm of growth, the change of attitude and composition of the main actors (tourists, administration, local entrepreneurs, international corporations, local residents and immigrants) and the variation of the main attractions (original or human made). The result of this evolution was an S shape or logistic curve representing the arrivals of tourist or visitors until the stagnation stage (see figure 1). The upper limit of this curve was determined by the social, physical or economical carrying capacity of the tourist area destination.

Figure 1. Evolution of tourist area by the TALC



Mature destinations are normally described using TALC terminology and are normally associated to the post stagnation stage. Getz (1992) referring to Hovinen (1982) described maturity as the stage where “elements of consolidation, stagnation, decline and rejuvenation co-exist. It is a constant battle to remain competitive and profitable, both at the micro and macro levels” (Getz, 1992;762). The problem of this definition is the doubts and problems that rise the TALC model, specially its real nature and the need for a method to validate it and to determinate its level of irreversibility

Since 1980 many authors have applied the model to describe the evolution of a number of destinations including: Lancaster county (Hovinen,1982, 2002), Malta (Oglethorpe, 1984), Grand Island in Louisiana (Meyer Arendt, 1985), some Caribbean islands (Wilkinson, 1987, Debbage, 1990), small pacific nations islands (Weaver, 1990, 1998, 2000; Choy, 1992), the isle of Man (Cooper & Jackson, 1989; Lundtorp and Wanhill, 2001), Niagara Falls (Getz, 1992), Cyprus (Ioannides, 1992), Pattaya (Smith, 1992), Minorca (Williams, 1993), Italy (Formica and Uysal, 1996), Alpine areas of Australia (Digance, 1997), mountain regions of Tennessee (Tooman, 1997), Southern England resorts (Agarwal, 1997, 2002), North Wales (Galle and Botterill, 2005), Costa Brava (Priestley y Mundet, 1998) Kenia (Akama, 1999), Algarve (Gonçalves and Aguas, 1997), the Dead Sea (Karplus and Kranover, 2004), Tenerife (Oreja et al., 2007), Balearic Island (Picornell and Picornell, 2002) and other destinations (Leglewski, 2005)

The results obtained by most of the studies tend to support Butler’s model, although, many deviations from the idealized model have been noted (Prideaux, 2000). Departures from it (Hovinen, 1981; Haywood, 1986, Cooper & Jackson, 1989; Choy; 1992, Getz, 1992) and some of them criticized some of their aspects or see the TALC just a hypothetic model (Aguiló, Alegre and Sard, 2005). Eventhough, some authors express the idea that the TALC is provably the cornerstone in the research of tourism development (Prideaux, 2000; Karplus and Kracover, 2005) and that As Gonçalves and

Aguas (1997) explain the concept of life cycle can be used for both descriptive and prescriptive purposes. Most of the studies mentioned above focus on the descriptive component of the model (e.g., number of tourist, type of tourist, resident's attitude, etc.). Gonçalves and Aguas see two reasons to explain it. First, the descriptive component of the product life cycle concept focused on these studies can be seen as a support to the prescriptive one, because this latter needs the results given by the first one. And second, prescription as theoretical instrument is not sufficiently developed.

The idea that the TALC is more descriptive than normative was already present in Haywood (1981), Oppermann (1998) and still today some authors argue that the model doesn't need a quantitative approach to be accepted. Te critical realism of Gale and Boterill (2005) as opposed to the positivism or the Teleogical perspective (Oreja et al. 2007) are gaining support as an alternative to accept the usefulness of the TALC.

Some studies have tried to full this gap in a much different way using stochastic tools to explain some of the departures of the model. Gonçalves and Aguas (1997) use time series forecasting models using linear, exponential and third degree polynomial (cubic) and logistic (Pearl) models. Referring to the traditional critics to the TALC model Karplus and Kracover (2005) explain that "most of the critical studies have based their findings on interpretive analysis of the data and have not used statistical procedures to substantiate their findings. Without first translating Butler's model into a mathematical expression and then testing the correlation between the observed data and the conceptual model, it is hard to assess the significance of the deviations from the life cycle model. Nevertheless, only a handful of papers ventured into statistical testing (Foster and Murphy, 1991; Getz, 1992; Benedeto and Bojanic, 1993; Berry, 2001, Lundtrop and Wanhill, 2001; Moss et al., 2003).

As we can see, one of the main problems that can difficult the application of the TALC is the presence of elements initially no contemplated by the model that can affect its evolutionary path (Agarwal, 1994; Haywood, 1986; Hovinen, 1981; Knowles y Curtis, 1999). Butler wrote his article at the end of the seventies when the international economic environment was evolving from decades of recovery and stable growth to a more unstable and confusing situation. In parallel, most of the applications of the TALC normally obtained good results until the oil crisis at the beginning of the seventies presenting difficulties and discrepancies with the expected curve between the first and second oil crisis (1979) and at the beginning of the nineties. In many cases, these changes of behavior were attributed to an early transition to new stages (consolidation, stagnation, early decline) or as the crisis were resolved to rejuvenation process.

The importance of this problem is remarked by Gale and Botterill (2005). For these authors the TALC does not take into account the tourism system in its entirety, "with the result that it overlooked exogenous forces such as variations in the economic cycle of source regions and countries" (2005: 159). As both authors say: this limitation was highlighted by Leiper's 2004 critique "arguably the most scathing appraisal of the model to date", which he asserts "should now be assigned to the archives of history – as a former theory, now discredited, shown to be false" (2004:135).

On the other hand, we can try to resolve this problem from an economic perspective. It could be assumed that Butler's curve pictures the economic growth path and the structural changes that usually experiences one specific geographic area when it gets specialized in tourist activities and becomes a consolidated tourist destination. In such a case, the resulting growth path of the destination during a period of economic stability (when markets grow steadily without any major economic turbulence) can be easily observed, giving as a result the well know S shaped logistic curve that Butler pictured in his article. But, as it can be observed in the case of Majorca, under non-stable economic conditions the interpretation of the evolutionary path of the destination can become more complex. In this scenario, it could be assumed that under economic shocks the evolutionary path of the destination can temporary differ from its structural path due to the temporary effects caused by the existence of economic instability, but in the long term the S shaped curve would be the usual path followed by classical destinations.

This work pretends to go forward in the interpretation of the TALC from a more estructurated perspective. In order to reach this objective the work has been divided in three parts. In first place, we study the functional form of the model. The traditionally logistic curve of the model can be attributed to two origins. On one hand, it can come from supply side limitations (maximum carrying capacity) due to the limited reproducibility of the original natural attraction and congestion effects, and on the other hand, it can be caused by demand side limitations (lifecycle product theory-word of mouth mechanism). This second point of view is represented by Lundtorp and Wanhill (2001) model. [1]

The second part of this work deepens in the analysis of the nature of the logistic curve (as a model to represent the evolution of tourist area) using the discrepancies between the observed data and the estimated logistic growth path. That is to say, the study of the random shocks that affect to the variable that measures the evolution of the tourism in the selected destination. In this way, it can shown that the persistence proprieties of the random shocks determine if, on one hand, the path described by the logistic curve can be interpreted as a long term evolutionary trajectory or, on the other hand, it doesn't determine the long run and thus the validity of the TALC (and its associated logistic curve) to describe long term behavior of a tourist destination. The statistical test of this idea can be done through a slow transition unit root test suggested by Leybourne et alt. (1998). As it is well know, the presence of unit roots can drive to a non cautious researcher to obtain spurious results if he doesn't take in a count its presence. In the

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[1] This curve could be also the result of a growth model with constant factors (Lozano, 2002)

present case, the Leybourne et alt. (1998) test, more than a slow transition unitary root test with structural change, can be interpreted as test over the suitability of the logistic curve, and thus the TALC, to describe the evolution of a tourist destination. In this sense, if the deviations from the logistic curve present a unit root, it will mean that they are permanent and not transitory and as a result of it the TALC is not consistent with the observed data.

Finally, we apply this new technique to Majorca using the data of arrivals, tourists and days expended by tourist in the island commenting the results and their implications.

2. The functional form in Butler's model.

In this section we present a formal model for the S-shaped curve of the transit activity from two different points of view. First, we reinterpret the demand oriented model of Lundtorp and Wanhill, (2001) and in second place, we complement it with a supply oriented model based on the carrying capacity concept that also results in a similar S shaped path of expansion.

2.1. Demand side limitations: the product lifecycle and the potential market.

The Butler's (1980) TALC model has been traditionally associated with the product life cycle and to the logistic curve. The product lifecycle assumes that products go through several stages in the market (introduction, growth, stagnation and decline) like any living organism. The initially growing sales stage is usually identified with the increasing knowledge of the product and with buyer's curiosity for new goods. In contrast, maturity and stagnation stages are associated with market saturation (the potential market already knows or has tried the product) and increasing dependence on loyalty and repeated consumption. Finally, it's assumed that the product will decline if a better or cheaper substitute appears.[2]

From this point of view, the TALC could be taken as a variety of the product lifecycle model where the product is a destination. The number of clients or visitors of a tourist area will grow as its knowledge spreads into the market reaching its peak (stagnation stage) when all the potential clients know about its existence. The functional specification of this phenomenon must be coherent with the visitor's curve usually observed in these areas, using as principal explanatory arguments a representative variable of the number of the destination clients (visitors, tourists or tourist per day) and the knowledge speed expansion of the destination in the market.

This interpretation of the lifecycle was used by Lundtorp and Wanhill (2001) to create a model that intended to represent the evolution of tourist destinations. In their case the logistic form of the curve derives from a word of mouth mechanism. They suppose a potential market of M potential clients, where M_t represents the people that already know the destination at time t. If the awareness of the destination expands in the market at the speed of $\gamma>0$, during the lag of time dt, M_t will grow $dM_t/dt = \gamma(M-M_t)/M$, where $(M-M_t)/M$ represents the proportion of people that haven't heard yet from the destination. Integrating dM_t/dt we may write:

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[2] Even if TALC has been usually associated with Vernon (1966), authors like Sinclair and Stabler (1997) remark the differences between the product lifecycle studied in economics (Vernon, 1966) and the product lifecycle theory studied from the industrial economics perspective. For them, Vernon's vision could be used to explain the expansion of the international tourism meanwhile TALC could be closer to the product lifecycle concept developed by the Industrial Organization Theory (even if both of them have in common Postner -1961- and Vernon -1966- works). This same differentiation can be found in the first evolutionary authors who distinguished between the evolution of a particular destination and the international tourist evolution. From their point of view, it was clear that any particular destination in the more advanced stages of its evolution (stagnation or decline) could still maintain a relevant (but significant lower) level of tourist activity focusing in the upper social levels or in specialized segments of the market, living the most standardized activities to new destinations that still enjoy all their original attractions and cost advantages.

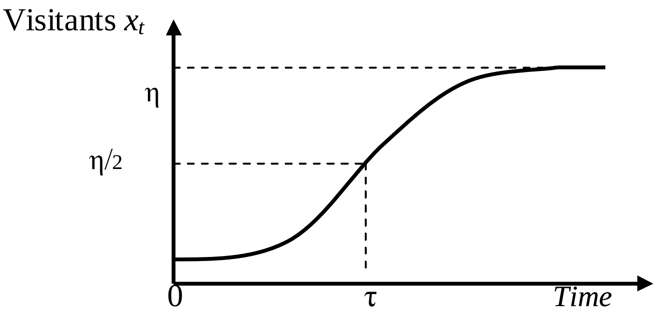
$$M_t = \frac{M}{1+e^{-\gamma(t-\tau)}} \tag{2.1}$$

where τ is the time where $M_t = M/2$ and where $M_t \to M$ when→∞. Associated to M_t (people that knows the existence of the tourist area at time t) there is a probability p of visiting the destination. Substituting in (2.1) then:

$$x_t = \frac{pM}{1+e^{-\gamma(t-\tau)}} = \eta S_t \tag{2.2}$$

Where x_t *is* the number of visitants to the destination in the period *t,* $\eta = pM$, and $S_t = \left(1+e^{-\gamma(t-\tau)}\right)^{-1}$. Consequently, when $t\to\infty$, $x_t \to \eta$. In other words, in the long term the destination will reach a maximum number of visitor η and it will stabilize around it (maximum potential market of the destination), see figure 2.

Figure 2. Logistic curve representation.



2.2. The supply side limitation. The carrying capacity

In spite of the interest of this demand side interpretation of the S shaped curve of the TALC (word-of-mouth mechanism and reputation effects), Papatheodorou remarks that: “although plausible and appealing, this explanation treats the supply-side of tourism as a black box. This is fundamentally at odds with the tradition in evolutionary economic geography, whereby explanation of endogenous changes stems from the underlying market and spatial structures” (2004; 221). For Papatheodorou, although some researchers have tried to deep in the mechanism of the supply in order to explain the

TALC (Tremblay, 1998; Britton, 1991; Debbage, 1990) "these research efforts remain without substantial continuation" (2004: 220).[3]

But, as Butler (1980) remarks, the carrying capacity concept plays a central role in the TALC acting as a supply limitation. Originally, each destination, depending on their initial stock of resources and the tourist modality developed, will have a maximum amount η of visitors that could be attended in the best suitable conditions (Oreja et al. 2007). In fact, probably the S shaped curve of the TALC, so many times observed in different tourist destinations, could owe more to the carrying capacity than to the behavior of the consumers into the tourist markets.

Although TALC related literature has given great importance to the carrying capacity concept (Butler, 20005b; Oreja et al. 2007), the complexity of the tourist product has generated some controversy over the elements that must be present in its definition and the interpretation that must be given to them. Nowadays, one of the definitions that seems to be more accepted in tourist literature (Oreja et al. 2007) stands that: carrying capacity of a tourist area is: the maximum number of tourist that can be tolerated without an unacceptable or irreversible deterioration of the physic environment and without a sensible decrease on user's satisfaction (Mathieson y Wall, 1982: 21, Tisdell 1988: 244, Davis y Tisdell, 1996: 232).

In this last definition there are two main elements: deterioration of the environment and the satisfaction obtained by the user (tourist). Destinations will keep attracting visitors as far as they satisfy their expectations and they will loose clients if they deceive them. The tourist area demand (or the demand of its tourist services) depends, as the vast majority of economic goods, on its utility or capability to satisfy needs. The problem of

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[3] Papatheodourou (2004:220-21) referring to TALC: "evolutionary theory can have truly useful policy implications only if it can explain the casual mechanisms of development … To do so, such a framework should primarily focus on inherent system dynamics or the endogenous changes in tourism destinations".

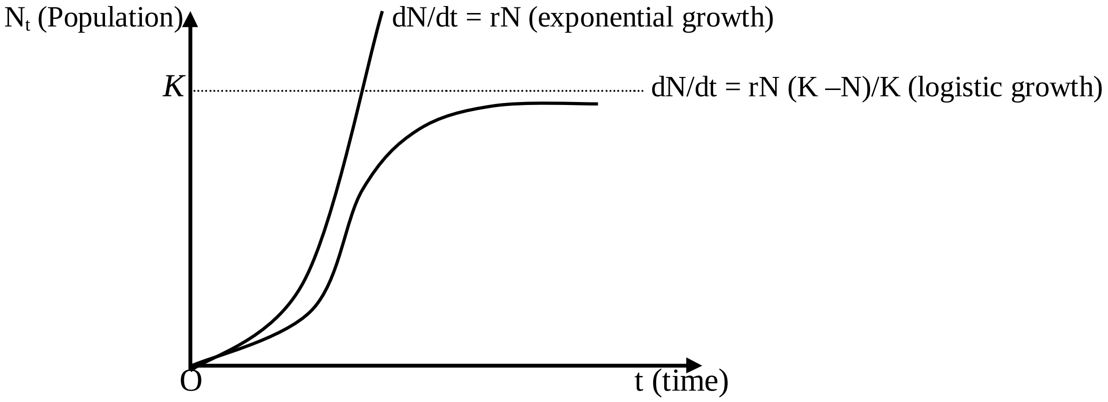
tourist areas is that many of their attractions (beaches, forests, traditions, etc.) are public goods with limited reproducibility and subject to congestion problems. If we accept the former carrying capacity definition, its existence implies a maximum ceiling of visitor η. But, even if a majority of tourist experts accept today that most of the tourist areas have a certain upper limit in their development, many of them reject the idea that the usual trajectory to reach it must be the logistic curve pictured by the TALC (Aguiló et al. 2005). And as will see this is at odds with the origin of the concept.

The origin of the carrying capacity concept is attributed to Robert Malthus. In his book *An Essay on the Principle of Population* (1986, first Ed. 1798) he introduced his population theory where food resources acted as a growth limiting factor. In a world where population grew at a geometric rhythm meanwhile food resources increased arithmetically, the population was condemned to misery and starvation. Thanks to its simplicity, Malthus population theory was broadly accepted without been empirically tested and exerted an important influence on science during the XIX century, especially on Darwin writings and in his natural selection theory that afterwards became the foundations of the actual biology, evolutionary ecology and human demography (Seidl y Tisdell, 1999). As these two last authors remark, the mathematical expression of the Malthusian idea of an explosive growth of population only limited by natural resources, was first established and empirically tested by Pierre Verhulst in 1938 using population data ranging from the beginning of the XIX century of some countries (Belgium, France, Russia, England). The equation used by Verhulst adopted the logistic form:

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right) \qquad (2.3)$$

where N was population, r the growth rate and K the carrying capacity. Verhulst r term (relative constant rate of growth), latter known as “*malthusian parameter*” (r = [birth rate *b*–death rate *d*]) introduces the Malthusian assumption of the exponential growth (mathematically $dN/dt = rN$), whereas the parameter K (carrying capacity) introduces the population limitation associated to the limited provision of food.

Figure 3 Graphic expression of Verhulst formula.



When population level reaches K (figure 3), birth rate equals to death rate and the growth is cero (stationary estate).[4]

As Seidl and Tisdell (1999) remark, carrying capacity concept (and its dynamic application in the logistic growth of populations) has become a basic supposition for particular ecosystems in biology (is more difficult to accept in complex populations). In ecology this term is especially important in the study of particular habitats or ecosystems (like cattle prairies, wild ecosystems or tourism) or to illustrate the ecologic impacts and limits of human growth and the consumption of resources (Club of Rome). But the application carrying capacity to human beings requires the acceptance that, in contrast to biology, social carrying capacity is essentially determined by social aspects (consumption patterns, institutional framework, technology, environmental impacts, cultural level, etc.) that may play a more important role than the biological.

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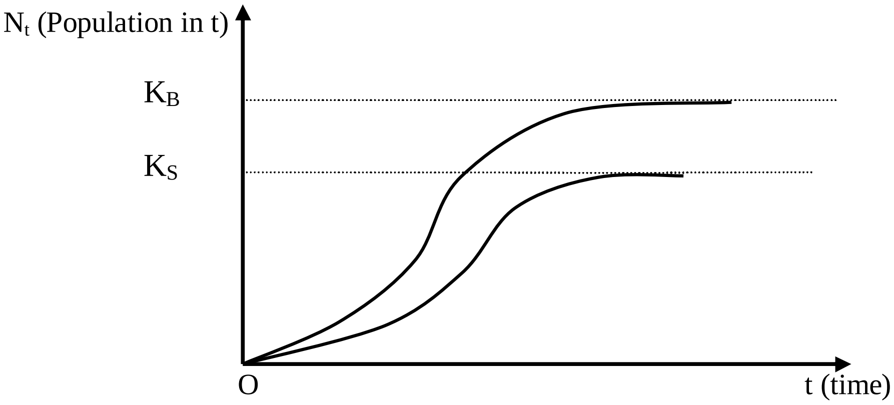
[4] Latter on in 1920, Pearl and Reed, unknowing the works of Verhulst, formulated a logistic curve adapted to the evolution of the United States census (Pearl and Read, 1920). Their success is reflected in the fact that today we refer to the Verhulst-Pearl logistic equation (Seidl y Tisdell, 1999).

Figure 4 Social and biophysics' carrying capacity limits.



In consequence, for human beings there will be a biophysical (K_B) and social carrying capacity (K_S) with the former always higher than the second ($K_B > K_S$) (Harding, 1986). Biophysical carrying capacity (K_B) determines the maximum level of human population that can be maintained with a given technology and natural resources, meanwhile, social carrying capacity (K_S), determines the maximum population that can be maintained under different social systems (Daily y Ehrlich, 1992).

This last aspect could raise some doubts over the stability the carrying capacity in a tourist destination. As we know today, Malthus' pessimistic perspectives never became reality thanks to the technologic advances in food production, but at the same time the increase of the minimal subsistence salary (or minimal level of social subsistence) avoided the explosive increase of the population in high developed countries.

As it happened with Malthus' prophecies, the introduction of technical advances and new management techniques in the tourist industry and destinations seems to potentially increase destination's carrying capacity level. But these improvements can even be outset by the increasing quality standard required by tourist (Morgan, 1990), or by the supply limitation strategies adopted in mature destinations (Oreja et al. 2007). In our case we can assume the hypothesis that tourist quality standards evolve at least at the same rhythm than the resources saved with the use of new technical advances and destination management improvements. In this case, destination’s carrying capacity will stable and the natural way to reach it will be the logistic curve pictured in figure 4.

3. The estimation of the logistic curve and its validation as a long term path.

3.1 Estimation of the logistic

Either if Butler´s curve is interpreted from the supply side (carrying capacity limitation) or from the demand side (market exhaustion), the logistic function is the most logical functional form to represent the evolution of a tourist area. It is coherent with both interpretations and apparently fits with the evolution observed in many destinations.

Assuming the possibility of fluctuations in its evolution due to exogenous factors, we can return to 2.1 expression and introduce an error term $u = x_t - \eta S_t$, in order to collect the discrepancies between the observed values x_t and the path forecasted by ηS_t model so:

$$x_t = \eta S_t + u_t = \eta (1 + e^{-\gamma(t-\tau)})^{-1} + u_t \qquad (3.1)$$

The logistic curve is non-linear in its parameters, so it requires to be estimated by non lineal least squares (NLLS). The proprieties of these estimators will depend on the stochastic characteristics of the error term u_t and, specially, of its persistency degree as will be see ahead.

On the other hand, the model (3.1) could be generalized to allow more general forms in the systemic part of the model. In this way, we can consider the specifications:

$$x_t = \alpha + \eta S_t + u_t \qquad (3.2)$$

$$x_t = \alpha + \beta t + \eta S_t + u_t \qquad (3.3)$$

$$x_t = \alpha + \beta t + \eta S_t + \delta S_t t + u_t \qquad (3.4)$$

3.2. The logistic curve as a long term relation.

Unit roots. The test of Leybourne et alt. (1996) and its application to TALC.

Let consider again the model given by the expression (3.1). Both, the validity of the NLLS estimators and the interpretation of the model depend on the same (stochastic) properties of error term u_t. As it has been previously indicated, this term is the discrepancy between the observed values and the forecasted evolution of the logistic curve. On one hand, this term collects the effects that have on tourist destinations exogenous random shocks such as increases in oil prices, changes in the economic conjuncture of tourist sending markets, natural or terrorist disasters, etc. In consequence, it collects all the short-run factors that can not be considered in long term stylized evolutionary model given by a logistic curve. And on the other hand, u_t could also collect all the effects on tourist demand of commercial policies applied by public administrations and/or tourist companies provided that they do not represent a structural change in the parameters of the logistic curve.

In any case, if the term u_t tends to be very high and to move permanently away from the growth path ηS_t, we can not assume that this trajectory constitutes an equilibrium path. If we want to achieve this last goal, we need that the fluctuations collected by u_t will be transitory.

Therefore, it is required that random shocks u_t have finite memory and in consequence they have transitory effects. That does not mean that they do not show signs of autocorrelation but these shouldn’t be very intensive. To illustrate the idea more formally, we may assume that u_t behaves as an AR(1) process,

$$u_t = \rho u_{t-1} + \varepsilon_t \qquad (3.6)$$

where ε_t is white noise, that is, it has null mean, constant variance and it is not autocorrelated. Although this set of assumptions is very restrictive (so it will be relaxed ahead), it helps us to center our attention in a simplified model and in the role played by ρ parameter. When $-1< \rho <1$, the expression (3.6) is a first order autoregressive process AR(1), that includes, as a particular case, the situation in which u_t is uncorrelated ($\rho = 0$). The AR(1) process is stationary and ε_t have a transitory effect on the values taken by u_t. That is to say, the shock effects of ε_t over u_{t+h} tend to cero as h horizon gets higher. In consequence, the sequence of values that adopts ε_t does not have influence on the values that will have u_t in the future. In fact, as it is well known, the best forecast that it can be make for u_t at long term is its unconditional expectation, which in our case is cero. Thus, if the error term u_t is a stationary AR(1), then the best long-run forecast of x_t will be given by the logistic curve:

$$E\left(x_{t+h} \middle| x_t, x_{t-1}, \ldots\right) = \eta S_{t+h} + E\left(u_{t+h} \middle| x_t, x_{t-1}, \ldots\right) = \eta S_{t+h} \qquad (3.7)$$

when $h \to \infty$, given that, in this case $E\left(u_{t+h} \middle| x_t, x_{t-1}, \ldots\right) \to E\left(u_{t+h}\right) = 0$. In this situation, we can interpret the logistic curve as the long-run trajectory and the fact that x_t does not continually adopt the values forecasted by this curve is due to transitory disturbances that temporally move it away from this evolutionary path. In the case that nothing disturbs the system, its followed evolution will match with the logistic curve.

Lets consider now the case where $\rho=1$, in such a way the model given by (3.6), is known as random walk. In this case, if we replace recursively in (3.6), we can write:

$$u_{t+h} = u_t + \sum_{j=1}^{h} \varepsilon_{t+j} \qquad (3.8)$$

that replaced in (2.2), actualized to $t+h$ and taking conditioned expectances results in:

$$\begin{aligned} &E\left(x_{t+h} \middle| x_t, x_{t-1}, \ldots\right) = \eta S_{t+h} + E\left(u_{t+h} \middle| x_t, x_{t-1}, \ldots\right) \\ &= \eta S_{t+h} + u_t \end{aligned} \qquad (3.9)$$

for any $h \geq 0$, so all the forecasts on the future evolution of x_t depend on the present value of u_t, unlike AR(1) case shown in (3.7). On the other hand, as u_t is a random walk and (even if it has a cero mean) its variance increases lineally with the time, the probability that u_t takes very high values (in absolute terms) in relation to ηS_t gets each time bigger. That is to say, the provability that x_t moves away from the deterministic path ηS_t will keep growing. Moreover, a random walk is characterized by: its high persistence (where each value is its preceding value plus a little change); the lack of any tendency to repeat past values; the presence of long series of positive values (u_t<0) that can be followed by other negative (u_t>0), or vice versa; and finally, there is not limit to the variation. All these facts imply that at long term, the evolution of x_t will basically depend on u_t so Butler's model doesn't apply for that destination.

From this point of view, a easy and simply way to empirically test if one specific destination fulfil with Butler's model will consist in contrasting if u_t is a random walk or AR(1) process, or even in a more general way, if u_t has a unit root (and thus it looks like an random walk) or it is stationary in variance in such way that its better long term forecast is cero. To do so, we can use the unit roots test developed by Leybourne et al. (1996). Although this test was developed for a context of unit roots with gradual structural change, it looks appropriated to resolve the proposed problem because it's equally based on (3.2) to (3.4) expressions.

We must also remark that expression (3.8) shows that the value u_t (and the value of x_t in the long-run) is in fact the accumulation all part random shocks. In consequence, if all the policies applied by the enterprises and administrations had obtained positive (or negative) effects, they will accumulate so there is place for the political action in order to find positive results.

3.3. Unit roots test of Leybourne, Newbold y Vougas (1998).

Leybourne et al. (1998) consider three (auxiliary) regressions to contrast the null hypothesis of one unit root against the alternative of stationarity around a determinist path that experiments a soft (logistic) transition between two states.

They consider three auxiliary regressions given by the expressions (3.2) to (3.4) where u_t is a stationary process of zero mean. If we assume that v_t is a zero order integrated process I(0), then model (3.2) implies that x_t is stationary around a value (a mean) that gradually changes from an initial value of α to a final value of $\alpha + \eta$. Model (3.3) is quite similar but allows the presence of a term that represents the existence of a constant slope (β). And finally, model (3.4) allows not only the variation of the intercept from α to $\alpha + \eta$, but also the variation of the slope parameter (with the same transition speed) from β to $\beta + \delta$. If $\gamma < 0$, the initial and final states switch, but the parameter's interpretation remains the same. Consequently, if we wish to test the TALC, the appropriate auxiliary regression to be used is model (3.2.). The other two models allow an indefinitely growth of x_t being, for this reason, incompatible with Butler's model.

The null hypothesis of Leybourne et al. (1998) test is that x_t is a random walk

$$X_t = \mu + X_{t-1} + \varepsilon_t \qquad (3.10)$$

while the alternative to the null hypothesis is one of the three models given by (3.2) to (3.4) expressions, where ε_t and u_t are assumed to be stationary process of null mean.

The test of the hypothesis are made in a two step process:

- First: Using a non-linear lest square algorithm (NLLS), we estimate the deterministic component of the model and we compute the residuals ($\hat{u}_t$) for A, B or C models.

- Second step: We compute the ADF statistics, the t-statistic ratio associated with $\hat{\rho}$ in the ordinary least square regression (OLS).

$$\Delta \hat{u}_t = \rho \hat{u}_{t-1} + \sum_{i=1}^{p} b_i \Delta \hat{u}_{t-1} + e_t \qquad (3.14)$$

where the lagged differenced residuals have been introduced, as usual for the unit roots tests of Dicckey-Fuller kind, in order to avoid that the e_t term in (3.14) is autocorrelated. The null hypothesis of the test is equivalent to H_0: $\rho = 0$, which can be tested with the t-ratio associated to $\hat{\rho}$. If this t-ratio is lower than a given critical value, the null hypothesis of the test will be rejected. Otherwise, the null hypothesis of the unit root will not be rejected and the data is not consistent with the logistic model.

As first step uses an algorithm of numeric approximation, the asymptotic distribution of the test can not be annalistically calculated (Leyburne et al. 1998). On the other hand, the critical values for the test carried out in this work had been computed using Monte Carlo simulations adapting it to the used sample size and to the lag selection procedure of p in (3.14) expression. In our case, the lag selection procedure has been based in the Akaike Information Criterion (AIC) beginning with a maximum lag of 5. The resulting critical values are shown in the following table.

Table 1 Critical values for the Leybourne, Newbold and Vougas unit root test.

	Signification level			
	1%	2.5%	5%	10%
Model A	-5.24	-4.81	-4.48	-4.1
Model B	-5.90	-5.46	-5.11	-4.72
Model C	-6.36	-5.93	-5.58	-5.18

Note: Critical values resulting from 50.000 gaussian random walks generated from 3.10 with $\mu=0$. Lags selected according with AIC for T=55 and beginning with p =5.

4. Results obtained in the empirical application to Majorca

In this section we apply the Leybourne, Newbold and Vougas (LNV) test to the evolution of Majorca. As we have already explained, the results obtained with this test will be very important to know if a tourist area like the island of Majorca has followed a coherent path with the TALC.

Majorca is one of the most popular tourist destinations of Spain. In the year 2005 the island received more than 9 millions tourists representing around 17% of Spanish international tourist arrivals (INE, 2006). Majorca by itself receives more international tourist arrivals than countries like Belgium, Switzerland, Australia, Ireland or Japan (UNWTO, 2007). The important role play by Majorca in the in the international tourist industry added to the fact that Majorca is an island and has old records of tourist arrivals makes this destination a very interesting case to study its evolution.

We have considered three variables representing the tourist activities of Majorca: number of arrivals, tourist and tourist per day. The election of these variables is founded in the belief that even if *tourist* or *tourist per day* data seem to be more representative of the degree of use of tourist assets in a particular destination and the congestion problems related to them, the data problems that seem to affect the homogeneity of these series recommend the use of more reliable variable like the destination arrivals. Even with some reserves over accuracy of the tourist data available, we present the results obtained with the LNV test to all three series (arrivals, tourist and tourist per day) and to the auxiliary regressions given by expressions (3.2) to (3.4) in order to test the robustness of the obtained results. The span of the series is from 1950 to 2004.

The data comes from different sources. Initial figures of passenger arrivals come from the annual reports of local Trade, Industry and Navigation Chamber, latter completed in the fifties with data published by the *Diputacion de Mallorca*[5] and from the eighties with data coming from the *Conselleria de Turisme de les Illes Balears* in its annual publication *"El Turisme a les Illes Balears. Dades Informatives"*. These publications have been also used to obtain the data referred to tourist and average tourist length in the destination.

The following Charts (1 and 2) show the adjustment of the model (3.2) in tourist and tourist per day data series of Majorca, estimated by NLLS. Apparently, there seems to be a good adjustment although its proprieties will depend on the existence of unit roots in the error term u_t.

Chart 1. Adjust of the logistic model (1.2) to the tourist per day series.

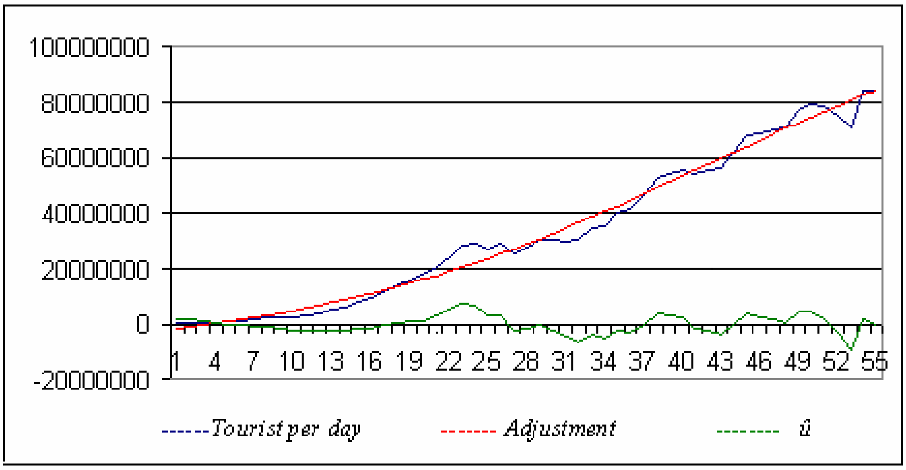
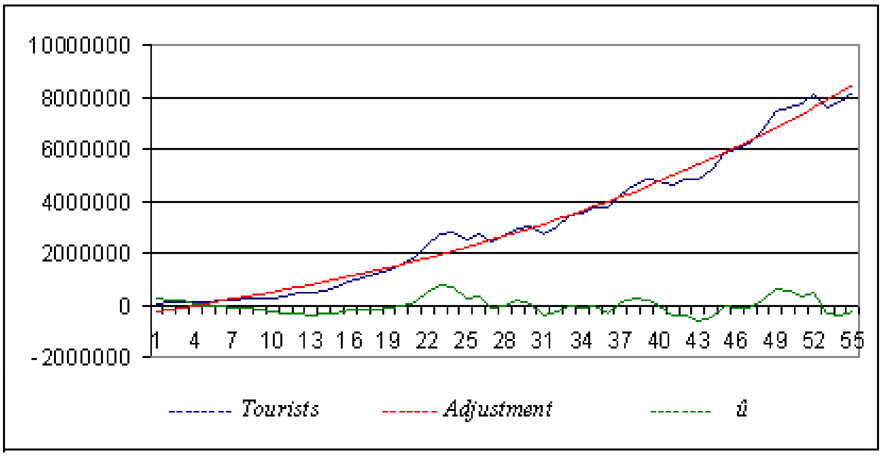


Chart 2. Adjust of the logistic model (1.2) to the tourist series.



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[5] *"Diputación de Mallorca"* also published data referred to the number of tourist arrivals and the average length spent in the island that have been also used to elaborate this study.

As we can observe in the evolution of u_t in Charts 1 and 2 there are some signals that point to a random walk of these variables. Contents of table 2 confirm this first opinion.

Table 2 LNV tests of passenger arrivals, tourist and tourist per day units (1950–2004)

		ADF (LNV)	
Variable		Y_t	Ln Y_t
Passengers arrivals	Model 3.2	0.3924	-1.5093
	Model 3.3	-2.0267	-1.9341
	Model 3.4	-3.0459	-3.6351
Tourists	Model 3.2	2.8070	-2.1349
	Model 3.3	-1.9296	-3.9067
	Model 3.4	-2.9356	-5.7509**
Tourist per day	Model 3.2	-3.3775	-2.5586
	Model 3.3	-3.3175	-3.4259
	Model 3.4	-2.5954	-4.6909

Note: ***, ** y * respectively indicate signification levels of 0.01, 0.05 y 0.10

Table 2 shows the results obtained by the application of the unit roots test to all three series. These results do not allows us (in all three cases) to reject the null hypothesis that the series x_t have an unit root (the results of the LNV tests are beyond the critical values tabulated in table 1). Even more, the generalization of the test to the tourist and tourist per day series between the years 1950 and 2004 obtain similar results. In all three cases the alternative hypothesis represented by (3.2) to (3.4) models are rejected. In order to test the robustness of these results we have made the same operations in logarithmic terms (as it can bee observed in the second column of table 2). The results obtained in this case are similar to those obtained in the former case with exception of the model (3.4) using tourists (as it had been explained before, model (3.4) is the less representative of the TALC). But in any case, even if this last model would be adequate, the results obtained by the unit roots tests applied to the evolution of Majorca conclude that there is strong evidence that this particular destination does not follow the patterns predicted by the TALC.

5. Conclusions

These results allow us to assert at least three relevant conclusions. In first place, we can not assert that Majorca’s tourism evolutionary behavior is coherent with the TALC. The logistic evolutionary path sustained by this model do not fulfill in the case of Majorca. In contrast, the island presents an apparently random evolutionary path. In second place, the non stationary nature of the data implies that the apparently maturity state of Majorca do not imply the stationary state of its activity. The number of visitors, tourist or tourist per day in the destination probably could register up and down random variations in the future. And in third place, the random nature of this series implies that all the shocks that affect this tourist area will have not only temporary but permanent effects. These shocks include policy measures adopted by local or state authorities (public investments in tourist infrastructure, subsidies to develop new tourist products, etc). In consequence, in this case if the destination begins to show the signal of stagnation, the local or state authorities must act fast and strongly if they want to maintain the growth of their destination. There is not such thing as a deterministic law that hampers the growth of the destiny and makes useless the attempts to overpass it.

In conclusion, even if nowadays Majorca presents all the typical characteristics of the stagnation stage of the TALC model, the statistical validation of the Butler Model for this island rejects its validity. Even more, the results obtained seem to reveal some clues about its future. The black prophecies for old mass tourist destinations like Majorca pointed out by many of the early evolutionist authors (Cristaller, 1963; Thurot, 1973; Plog, 1976), or the more directly and recently exposed by authors like Knowles y Curtis (1999) are confronted with the results obtained. The deterministic assumptions of these authors do not have to disappoint or prevent the application of tourist policies by local or central authorities. Policy makers, specifically in this case, must be aware that the application of *pull-out* policies backed by some authors or the wait and see policies could be costly if they do not strongly back pro-active action. The hesitation face to this situation can drive in these situations to adopt auto self-fulfilled measures.

On the other hand, in the same way that positive shock cumulates and can give result to a high level of tourist activity, the accumulation of negative shocks could give place to a prolonged decadence of the destination. Both possibilities are compatible with the existence of unit roots.

Of course, this work is focus in the case of Majorca. Future research must apply the same method to other tourist destinations to see if they follow the logistic path described by the TALC. If the results are similar to Majorca, the TALC could be definitely challenged as one of the most important paradigms in tourism.

References

Agarwal, S. (1994). The resort cycle revisited: implications for resorts. In Cooper, C.P. & Lockwood, A. (Eds.), *Progress in Tourism, Recreation and Hospitality Management.* Vol. 5 (194-208). Chichester: Wiley.

Agarwal, S. (1997). The resort cycle and seaside tourism: an assessment of its applicability and validity. *Tourism Management*, 18(2), 65-73.

Agarwal, S. (2002). Restructuring seaside tourism. The resort lifecycle. *Annals of Tourism Research,* 29(1), 25-55.

Aguiló, E. Alegre, J. and Sard, M. (2005). The persistence of the *sun and sand* tourism model**.** *Tourism Management,* 26 (2), 219-231

Akama, J.S. (1999). The evolution of tourism in Kenya. *Journal of Sustainable Tourism*, Vol. 7 (1), 6-25

Britton, S.G. (1991). Towards a critical Geography of Tourism. *Environment and planning D. Society and Space,* 9, 451-478.

Buhalis, D. (2000). Marketing the competitive destination of the future. *Tourism Managemen*t, 21(1), 97-116

Butler R.W. (1980). The concept of a tourist area cycle of evolution: implications for management of resources. *Canadian Geographer*, 24, 5-12.

Butler R.W. (2005a). *The TALC Volume I: Applications and Limitations,* Clevedon Chanel View Publications, Clevendon, England.

Butler R.W. (2005b). *The TALC Volume II: Conceptual and Theoretical issues*, Clevedon Chanel View Publications, Clevendon, England.

Choy D.J.L. (1992). Life cycle models for pacific islands. *Journal of Travel Research*, 30 (3), 26-31.

Christaller, W. (1963). Some considerations of tourism location in Europe: The Peripheral Regions -Underdeveloped Countries- Recreation Areas. *Regional Science Association Papers*, 12, 95-105.

Cohen, E. (1973). Towards a sociology of international tourism. *Social Research*, 39, 164-182.

Cooper C. and Jackson, S. (1989). Destination life cycle: the Isle of Man case. *Annals of Tourism Research*, 16, 377-398.

Daily, G.C. & Ehrlich P.R. (1997). Population, sustainability, and earth's carrying capacity. In Elgar Reference Collection, *The development of ecological economics* (465-75), International library of critical writings in economics, vol. 75. United Kingdom. Cheltenham.

Davis, D and C. Tisdell (1996) "Economic management of recreational scuba diving and the environment. *Journal of Environmental Management*, 48, 229-248.

Debbage K.G. (1990). Oligopoly and the Resort Cycle in the Bahamas, *Annals of Tourism Research*, 17, 513-527.

Formica, S. & Uysal, M. (1996). The revitalization of Italy as a tourist destination. *Tourism Management*, 17 (5), 323-331.

Getz, D. (1992). Tourism planning and destination life cycle. *Annals of Tourism Research*, 19, 752-770.

Goncalves, V. F. da C. and Aguas, P. M. R. (1997). “The concept of life cycle: an application to the tourist product”, *Journal of Travel Research*, 36(2), pp.12-22.

Harding, G. (1986). Cultural carrying capacity: a biological approach to human problems”, *BioScience*, Vol. 36 (9), pp: 559-604.

Haywood, K.M., (1986). Can the tourist-area life cycle be made operational? *Tourism Management*, 7, 154-167.

Hovinen, G.R. (1981): "A Tourist Cycle in Lancaster County Pennsylvania", *Canadian Geographer*, Vol. 25, pp 283-286.

Hovinen, G.R. (2002). Revisiting the destination lifecycle model. *Annals of Tourism Research*, 29(1), 209-230.

INE (Instituto Nacional de Estadística) (yearly). *Hostelería y Turismo (in Cifras INE y Últimas cifras; INE Base Servicios)*. www.ine.es (date of access: 05/03/2006)

Ioannides, D. (1992). Tourism development agents: the Cypriot resort cycle. *Annals of Tourism Research*, 19, 711-731.

Karplus, Y. and S. Kracover (2005). Stochastic multivariable approach to modeling tourism area life cycles. Tourism and Hospitability Research, 5 (3), 235-253.

Knowles, T. & Curtis, S. (1999). The market viability of european mass tourist destinations. A post-stagnation life-cycle analysis. *Journal of Tourism Research*. 1(2), 87-96.

Leybourne, S. Newbold, P. & Vougas, D. (1998). Unit roots and smooth transitions. *Journal of Time Series Analysis,* 19 (1), 83-97

Leiper, N. (2004). *Tourism Management*, French Forests: Pearson Education, Australia

Lozano, J. (2002). *Crecimiento Económico con Restricciones Medioambientales en Economías Turísticas*. PHD Thesis. Palma de Majorca, Universitat de les Illes Balears.

Lundtorp, S and Wanhill, S (2001). The resort lifecycle theory: generating processes and estimation. *Annals of Tourism Research*, 28 (4), 947-964.

Mathieson, A. and Wall, G. (1982). *Tourism: Economic, Physical and Social Impacts,* New York: Longman House.

Meyer-Arendt, K. (1985). The Grand Isle, Louisiana resort cycle. *Annals of Tourism Research,*12, 449-465.

Miossec, J.M. (1977). Un modèle de l'espace touristique. *L'Espace Géographique,* 6, 41-48.

Morgan, M. (1991). Dressing up to survive. Marketing Majorca anew. *Tourism Management*, 12 (1), 15-20.

Oreja Rodríguez, J. R. Parra-López, E. Yanes-Estévez, V. (2008). The sustainability of island destinations: Tourism area life cycle and teleological perspectives. The case of Tenerife. *Tourism Management* 29(1), 53-65

Oglethorpe, M. (1984). Tourism in Malta. A crisis of dependence. *Leisure Studies,* 3, 147-162.

Papatheodorou, A. (2004). Exploring the evolution of tourism resorts. *Annals of Tourism Research*, 31 (1), 219-237.

Pearce, D.G. (1995). *Tourism Today. A Geographical Analysis*, Longman Group Limited, Essex (England).

Piconell, C. and Picornell, M. (2002). L'espai turístic de les Illes Balears. Un cicle de vida d'una àrea turistica? Evolució i planificació a la darrera década. In *L'Espai Turístic* (Ed. Picornell y Picornell), Palma de Mallorca, INESE (Institut d'Estudis Ecològics).

Prideaux, B. (2000). The resort development spectrum (a new approach to modeling Resort development). *Tourism Management*, 21, 225-240.

Priestley, G. and Mundet L. (1998). The post-stagnation phase of the resort cycle. *Annals of Tourism Research*, 25 (1), 85-111.

Plog, S. C. (1973). Why destination areas rise and fall in popularity? *The Cornell Hotel and Restaurant Administration Quarterly*, 14, 55-58.

Smith, R.A. (1992). Beach resort evolution: implications for planning. *Annals of tourism Research*, 19, 304-322.

Seidl, I. & C. Tisdell (1999). Carrying capacity reconsidered: from Malthus' population theory to cultural carrying capacity. *Ecological Economics*, 31, 395-408.

Sinclair, M. T. & Stabler, M. (1998). *The Economics of Tourism*. London. Routledge,

Stansfield, C.A. (1978). Atlantic City and the resort cycle: background to the legislation of gambling. *Annals of Tourism Research*, 5, 238-251

Tisdell, C. (1988). Sustaining and maximizing economic gains from tourism based on natural sites: Analysis with reference to the Galapagos. in Tisdell, C.A, Aislabie, C. J, Stanton J. C. (Eds.), *Economics of Tourism: Case Studies and Analysis*. (229-251). Newcastle: Institute of Industrial Economics, University of Newcastle.

Thurot, J.M. (1973). *Le Tourisme tropical Balnéaire: le modele caraibe et ses extensions*, CHET. Aix en provence.

Tremblay, P. (1998). The economic organization of tourism. *Annals of Tourism Researc1h* 25, 837–859.

UNWTO (2007). *Tourism Highlights, Edition 2006*. web document obtained in http://unwto.org/facts/eng/pdf/highlights/highlights06_sp_hr.pdf (date of access: 05/04/2007).

Vernon, R., (1966). International investments and international trade in the product Cycle, *Quarterly Journal of Economics*, 80(2), 190-207.

Weaver, D.B. (1990). Grand Cayman Islands and the resort cycle concept. *Journal of Travel Research*, 29(2), 9-15.

Weaver, D.B. (1998). Peripheries of the peripheries: Tourism in Tobago and Bermuda", *Annals of Tourism Research*, 25(2)

Weaver, D.B. (2000). A broad Context Model of Development Scenarios, *Tourist Management*, 21(3), 217-224

Willians, M.T. (1993). An expansion of the tourist site cycle model: The case of Minorca (Spain). *The Journal of Tourism Studies*, 4(2), 24-32.

Wilkinson, P.F. (1987). Tourism in small islands nations: A fragile dependence. *Leisure Studies*, 6, 127-146.