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Beyond the Resort Life Cycle: The Micro-Dynamics of Destination Tourism

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Abstract. The model described in this paper combines a set of discrete investment and policy choices to explain a continuing process of resort-level change in response to competition through globalization. It shows how the stages of growth, as defined by Butler's resort life-cycle model, are the result of a combination of elements, the public policy and investor mindset, the scale of investment and transnational involvement. Four elements come together in the formal model; lumpiness of investment, delays in marketing and construction, distribution of expenditures between the local and overseas components of tourism, and scale-related economies and constraints. Despite the relative simplicity of the model equations the range of results is wide, varying from slow to very rapid take-off, to continuing long-run growth to early overshoot and decline. The model exhibits a variety of growth characteristics that reflect the growth stages of the life cycle model, as well as other phenomena, such as stepped growth and cycles. The paper uses the historic growth paths of Aruba and Barbados, both small open island tourism-based economies in the Caribbean – but exhibiting contrasting tourist accommodation and tourism policy – as stylized examples. The paper explains how other exogenous and endogenous variables, such as global competition and carrying capacity, enter into the basic equations and concludes with a summary of the determinants of characteristic pathologies of tourist destinations.

1. Introduction

The "resort life cycle" due to Butler (1980) is the most-widely cited conceptual framework for comprehending the dynamics of tourist destinations.¹ Sometimes called the Butler model or TALC (Tourism Area Life Cycle) model, it proposes that destinations follow an S-shaped growth path from exploration, involvement, development, consolidation, stagnation, and then rejuvenation or decline as shown by the smooth curve in Figure 1. Many empirical studies have demonstrated that resorts do indeed exhibit this phenomenon (see e.g. Pearce 1989; Cooper 1993; Wilkinson

1997). The many variants of this model place different emphasis on physical, market, institutional, and developmental variables (see e.g. Thurot 1973, Miossec 1976, van Doorn 1979, Lundberg 1980, De Albuquerque and McElroy 1992). Formal explanations of the model typically fit a logistic curve or equivalent time-continuous explanatory variables – a characteristic exponential growth phase, slowing asymptotically to a hypothesized limit (e.g. Lundtorp and Wanhill, 2001; Berry, 2001). These formal models do not answer important questions about the life cycle of specific resorts, for example, why some resorts "take off", while others with comparable amenities, markets, and policies do not, what is the importance of the scale of tourist operations for a destination, or why resorts are so vulnerable to relatively small disruptions (Poon, 1989).

The smooth evolution in Figure 1 averages away the shorter-run irregular development of a "typical" resort, better characterized by the jagged trajectory shown. The model in this paper demonstrates how

¹ In keeping with the spirit of this section, the model described in this paper arose from an effort to understand the evolution of tourism in Aruba from a systems perspective, as precursor to the Framework for Sustainable Tourism for the National Tourism Council and the Minister of Tourism of Aruba (Cole, 2002; Cole and Razak, 2003, 2007). This paper links the model developed to the life cycle literature cited.

key features of the long-term evolution of a resort arise from transient events and choices, also indicated in Figure 1. It explicates how the stages of growth, as defined by the life-cycle model can arise from a combination of elements, the public policy and investor mindset, the scale of investment and transnational involvement and demand. Four elements come together in the formal model; lumpiness of investment, delays in marketing and construction, distribution of expend-

itures between the local and overseas components of tourism, and scale-related economies and constraints. The model reproduces the characteristic variations in the timing of events and turning points across resorts, including the gap between the initial tourism ventures and the take-off to self-sustaining growth, and the combinations of factors that may promote rejuvenation or decline.

Processes Involved in the Resort Life Cycle Model

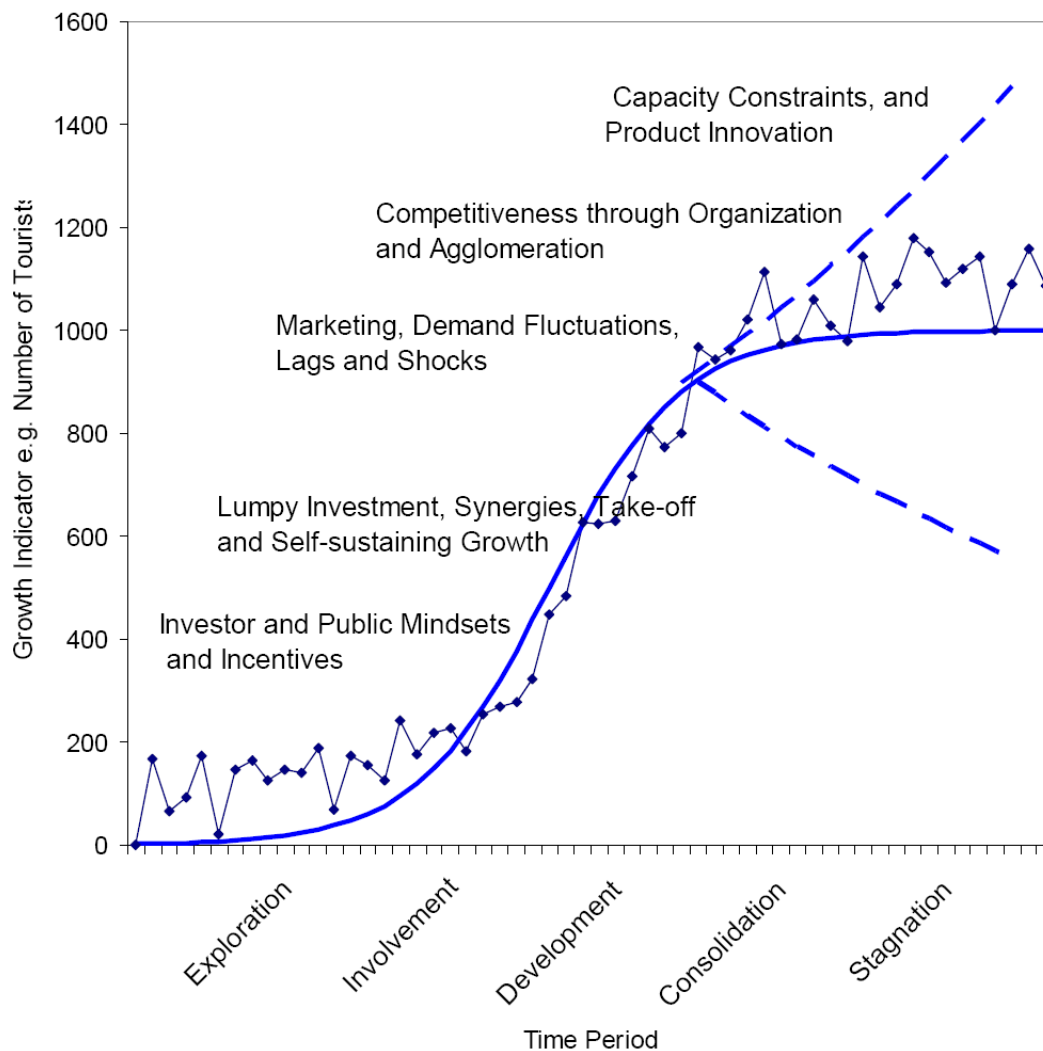


Figure 1. Factors Determining Tourism Life Cycle

The model's pathologies – its behavior in each stage of the life cycle in a variety of configurations and circumstances is shown to depend on the interplay between combinations of processes. Short-run fluctuations and singular events may be the determinants of

life cycle timing and evolution. For example, whether specific incentives will be successful depends on the coincidence of events, ambient occupancy levels, and hotel size, and marketing, operation and construction costs. In some situations, these relations can be critical

in that small changes may dramatically affect long-run outcomes. While the separate elements of the model are relatively simple, their collective behavior -like the systems it describes - is complex.² The difference from the life cycle model is that no *a priori* trajectory is assumed - growth may be continuing, terminal, or cyclical - and may exhibit critically unstable behavior to small changes in parameters. Although a specific process or event may be most closely associated with a particular stage of the life-cycle, any event may become the critical determinant at any time. The difference from time series statistical extrapolations is that the trajectories come only from the initial parameter set specifying the interaction of discrete events and policies against a background of collective choices and with aggregate continuous processes. While trajectories are simulated, the conditions determining critical situations are specified formally.

The principal goal for this paper is to set out the essential assumptions behind the model and demonstrate how rather straightforward equations, together with parameters directly related to the micro-economic attributes of tourist destinations, can explain a variety of resort styles and life-cycle trajectories, such as resorts with contrasting "styles" of tourism. The paper then indicates how other processes, such as global competition, infrastructure, and capacity constraints, enter into these basic equations. The paper concludes with a summary of the pathologies exhibited. Two contrasting case studies of small Caribbean islands, Aruba and Barbados, provide stylized points of reference for the exposition here. In Aruba, it has been a matter of explicit public policy since the 1950s to favor large hotels and solicit international investors and major chains. Initially, this was driven by the need to reduce high unemployment caused by regular layoffs from the Island's oil refinery, plus availability of development assistance. In Barbados, with no tourism policy, following the introduction of low-cost air travel, tourism development was undertaken by local investors, and has characteristically smaller enterprises, incorporating larger scale properties after 1990.

² Indeed, some authors suggest that complexity-theory is required to comprehend tourism dynamics (Faulkner and Valero, 2000, p50; Butler 2008). The present model can exhibit tourism "butterfly effect" noted by these authors. The literature on complexity offers a variety of definitions and pathologies (see e.g. Segal, 1995). For the most part, however, present analytic, econometric, and statistical models deal with singular aspects of tourism, predominantly the demand for tourism, occupancy, pricing policy, or determinants of new investment (e.g. Song and Witt, 2000).

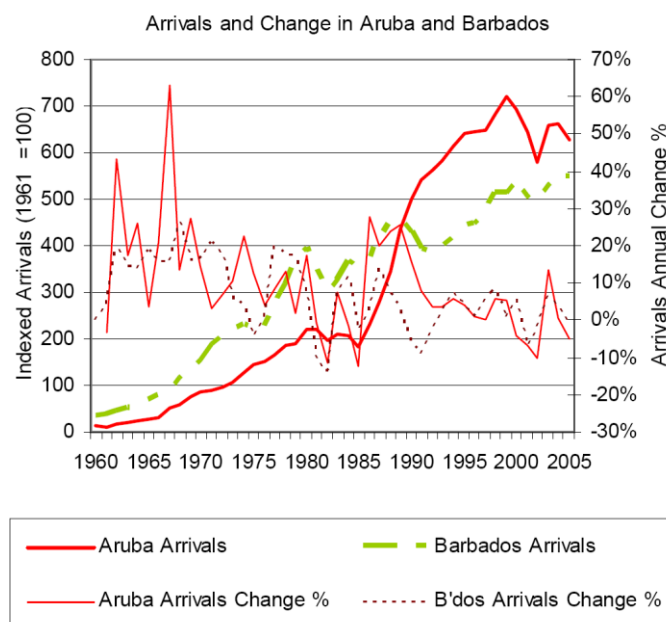
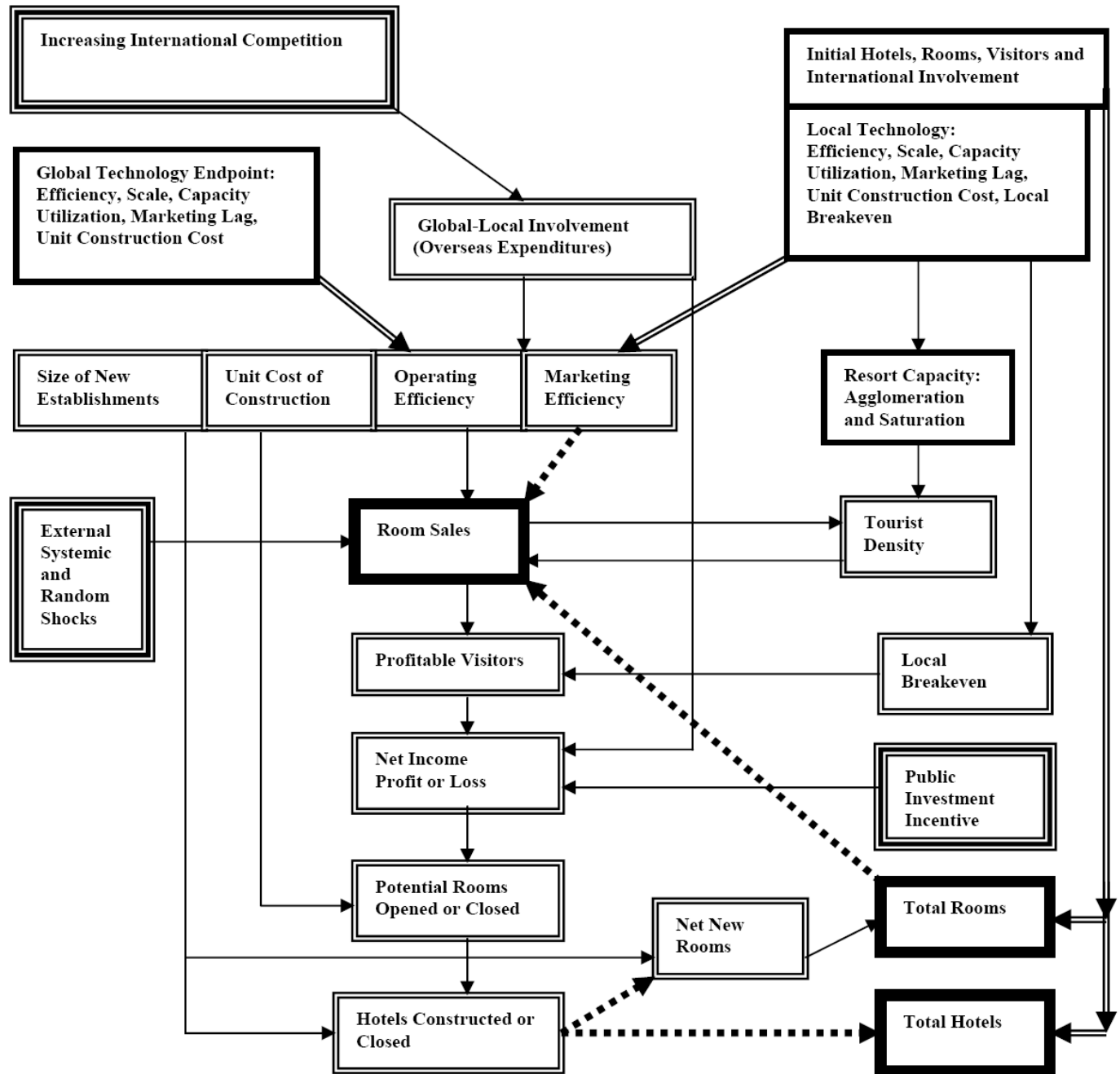


Figure 2. Contrasting Growth Trajectories in Aruba and Barbados

2. Model Implementation

The model combines micro-economic processes of supply and demand using a simple set of decision rules in order to reproduce phenomena at the macro scale, including the broad trends implied by resort life cycle theory. Trajectories are initiated using data on the number of hotels, rooms, and arrivals from an early year in a resort's tourism development. There are exogenous policy and demand conditions representing unique events not directly due to the tourism industry and an endogenous representation of scale economies.³ This involves establishing rules for the aggregate decision that tourists make, for the decision of individual developers to invest, and also for the public policy decisions about the style of tourism and incentives. The "style" of tourism in a resort (especially the size and operation of establishments) is critical to the behavior and projections of the model. The driving force determining change in the model is the steadily increasing global competitiveness of the tourism industry. The overall structure of the model and the links between variables are shown in Figure 3. Table 1 summarizes the degree of aggregation and endogeneity adopted for these variables.

³ These exogenous inputs are equivalent to dummy variables in a multivariate statistical analysis. We use the most simple formulation here to be elaborated through statistical analysis (e.g. Song and Witt, 2000; Jeffrey and Barden, 2001; Frechtling, 2001).



Key

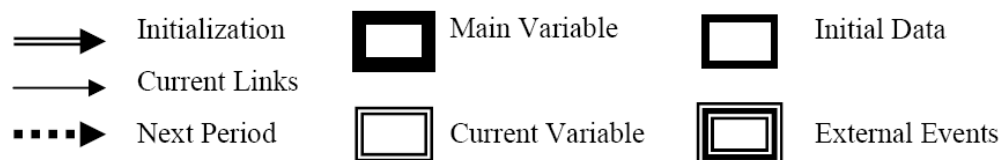


Figure 3. Model Implementation

Formally, the model is a set of equations linking variables in the model such as supply and demand in a time-stepped sequence. The main equations of the model relate to the relationship between local demand for accommodation and construction of hotels. Conceptually, this model is quite straightforward – supply generates demand, and increased demand stimulates increases in supply, and so on. With respect to demand, the main assumption is that sales of rooms depends directly on the number of rooms, but may be affected by several other variables. This includes attractiveness of the resort – its intrinsic appeal as modified by improvements (such as better access and amenities) or detractions (such as overcrowding), the level and efficiency of marketing, or exogenous determinants of demand (such as non-tourist sector related shocks or increased competition from other destinations).

In terms of supply, the principal assumption is that development of new hotels is driven by the prospect of net profitability being sufficient to cover construction of a particular type of hotel within an acceptable time-period. In some cases, development needs public incentives. In setting up the model for a given resort, at the outset of its tourist development is assumed to have certain characteristic appeal, style of

tourism (hotel size), marketing and operational efficiency, breakeven costs, construction costs, capacity, and so on. This local resort model in turn will have a characteristic set of behaviors that will be determined in part by exogenous stimuli such as public incentives, or temporary shifts in demand. The characteristics of the resort may hold steady or change in response to a steadily intensifying competitive environment.

The model includes elements of incremental growth theory and discrete choice theory. For explanatory purposes, it is useful to describe first the discrete choice aspects of model and then the continuous choice aspects. This is because the discrete choice appears to be most important during the early stages of tourism – in what Butler (1980) termed the development stage – when developers and/or government are making the first significant investments in tourism. These choices are critical to the initiation or takeoff of tourism and the turning point at which it might accelerate to become self-sustaining. Nonetheless, depending on the situation, discrete choices can impact a system dramatically throughout its progress, for example, determining the point when tourism collapses or the system becomes critical (i.e. very sensitive to small changes and hence unpredictable, and unmanageable).

Table 1 Variable Aggregation, Inclusiveness, and Dependence

Variable	Process	Model Treatment	Depends on:
Visitor Decision	Aggregate Choice	Endogenous	Rooms Available, Marketing, Attractions and Aversions
Investment Decision	Discrete Choice	Endogenous	Local Costs, Potential Profits, Construction Costs, Hotel Size
Policy Decisions and Incentives	Proactive or Reactive	Exogenous (Known)	Island Economy, Tourism Style and Products, Major Infrastructure
Global Competition	Cumulative Trend	Exogenous (Assumed)	Collective Behavior of Many Resorts and Corporations
Agglomeration and Saturation	Reactive Behavior	Endogenous	Hotel Clusters and Amenities, Resort Capacity, and Evolving Technology
Past Events	Ad hoc and Unexpected	Exogenous (Known)	Local and Global Events (Unemployment, Recession)
Future Events, Trends, and Policies	Uncertainties and Policies	Exogenous (Exploratory)	Possible Changes, Shocks, and Strategy

The path calculated for the main variables such as the number of hotel rooms or visitors variables depends on the parameters in the model (representing hotel size, marketing efficiency, capital intensity, natural endowment, and so on) or, more especially, on the relative magnitude of these parameters. In some of the initial calculations presented below, parameters remain constant in order to demonstrate particular phenomena, and then allowed to vary in order to demonstrate other phenomena. In some cases alternative formulations that may be more appropriate for specific destinations are considered.

3. Tourism Styles, Incentives, Take-off

The core dynamic of the model is the supply-demand relationship between supply of rooms and demand for rooms described above. The key assumptions of this component of the model are simplified here in order to illustrate the essential behavior of a tourism system in which there is a specified style of tourism. For the moment this "style" is specified by a fixed size of hotel. The key question is whether the system generates sufficient surplus (if necessary, with government support) for construction of one or more new hotels. The equations lead to a "time-step" model whereby in each time period expected profits based on sales, costs, and incentives dictates the decision whether or not to build (or close) hotels, and so leads to changed demand and supply in subsequent periods. For explanatory purposes, this simplified model as

$$S(t) = N(t)m(t)a(t) \quad (1)$$

where $S(t)$ is the annual sales in period t , $N(t)$ is the number of rooms marketed, $m(t)$ is the marketing efficiency, and $a(t)$ is the relative attractiveness of resort, so that $m(t)a(t)$ becomes the resort-wide average annual occupancy rate. Both sales and costs are measured as "room-years" in order to simplify presentation. Thus, occupancy is measured as annual sales divided by total number of rooms, with marketing efficiency and attractiveness as percentages.⁴ This equation represents the aggregate choice of visitors to a resort and how this is affected by private and public marketing efforts as well as the intrinsic and manufac-

tured attractions of the resort.⁵ It is also implied that the local market is not segmented, for example, between luxury and mass tourism, or between large and small hotels.⁶

The surplus per room (profit) generated by hotels is calculated from the annual budget equation as

$$p(t) = m(t)a(t) - f(t) - e(t) \quad (2)$$

Here $f(t)$ is the foreign share of costs and $e(t)$ the local breakeven share. Operating costs depend on wage rates, labor productivity, tax regimes, and materials costs (including imports), and may be subdivided to cover components of fixed and variable costs. The foreign share of costs covers expenditures overseas to improve efficiency, primarily the efficiency of marketing (as in Equation 1). For the moment, differences in marketing and operational efficiency etc. between different kinds of hotels are not accounted for.

The immediate concern is whether the surplus is sufficient to promote new investment in a particular hotel system. The total cost of building a new hotel depends on the construction cost per room plus interest and other charges and the number of rooms and a developer or investor would expect to cover this outlay within a given number of years. Since we have taken the accommodation to be homogeneous, the expected profitability per room up to the discount horizon, y , is $p(t)y$.

Several simplifying assumptions are made initially to highlight the discrete nature of tourism development. In each period, all available rooms are marketed and marketing efficiency, attractiveness, capitalization criteria, and other intrinsic variables remain constant through all stages of development. As explained earlier-

⁵ Cline (2002) notes the centrality of marketing for the hospitality industry and considers that the economies of scale that can be achieved by global organization have less to do with operations (the running of a hotel) than with marketing. Unfortunately, as Song and Witt (2000) observe, marketing has not often featured in tourism demand models. Marketing efficiency is defined here as the increase in the number of visitors per available room at a specified resort to the marketing-related share of total revenue income spent overseas. This simplified definition implies that the efforts of multinationals and government to bring tourists to the resort are proportional to their investment in tourism.

⁶ This assumption is sufficient for the present, but noting that in many resorts tourism incorporate a succession of adaptations of a "large international hotel" tourism product, or as vintages of parallel products (low rise, high rise, timeshare, even cruise), as in Aruba. In Barbados, there are few large hotels, and the principal product has been the "small locally-operated" hotel. The relative attractiveness of the resort related to the intrinsic attractions of a destination (nature, culture, accessibility, etc.) as modified by public and private action (see e.g. PKF, 1994; Wilkinson, 1997).

⁴ Each variable here deserves explanation. For example, using "number of rooms" as the measure of the drawing power of a resort is a grand assumption. Whether this should be the "core" measure of a resort is considered later, together with issues such as agglomeration and saturation effects (such as augmenting and facilitating activities and over-crowding).

er, “lumpiness” of hotel investment is a key aspect of the model and represents the discrete choices made by investors and policy makers. For example, since Aruba and Barbados were initially rather successful, this cemented their respective contrasting styles of tourism, and a mindset that stipulated the room-size of new establishments at these resorts. Moreover, this mindset sees the resort as a whole, in order to determine that there is a sufficient expected net return to cover construction of at least one additional hotel of the stipulated size.⁷ Thus,

$$N(t)p(t)y \geq nkh(t) \quad (3)$$

Here $h(t)$ is the possible (integer) number of new hotels of size n at time t , and k is the construction cost per room (measured against the annual sales per room). Again, to focus the comparison, construction and related costs per room are taken to be the same, recognizing that in reality materials costs, access to finance, etc. vary with the type of establishment and developer.

If the condition of Equation 3 is satisfied, one or more new hotels can be constructed. Conversely, if the expected surplus in any period is below the level needed for hotel construction then no new hotel will be constructed. Moreover, if there is a continuing loss, then hotels may be closed. In the latter cases some incentive or subsidy is required to bring the level of surplus up to a minimum required level for new hotel construction (or to forestall closure). The source of the incentive $I(t)$ may be local government, development assistance from the former colonial power, or international agencies.⁸ With incentives included the last equation becomes

$$N(t)p(t)y(t) + I(t) \geq nkh(t) \quad (4)$$

⁷ The model might equally be specified in terms of occupancy criteria, rather than profitability criteria. For example, consultants in Aruba have recommended that governments use target occupancy as the signal for soliciting new major hotel construction (Spinrad, 1981; Cole, 1997). In Barbados the investment decision small hotels was rather of the “sticking a finger in the air” variety (Marshall, 1978; Wilkinson, 1997). Nonetheless, banks and investors base lending on similar criteria. Of course, mega-chains and international investors may conduct a rational analysis based on a discounted cash flow forecast versus total investment costs, including cost of borrowing, depreciation, etc. with comparison against competing development options (e.g. Basinelli and Olsen, 1990; O’Neill and Rushmore, 2000).

⁸ In both Barbados and Aruba, for example, such assistance is granted for specific projects with specific timing designed to offset unemployment due to failures in non-tourism sectors.

The number of new rooms is added to the existing number of rooms to give the new total for hotel rooms $N(t+1)$ over the next time period.

$$N(t+1) = N(t) + nh(t) \quad (5)$$

Should a new hotel be constructed or closed, this will affect the number of visitors in the next time period (as in Equation 1) resulting in a period-to-period growth process. Together the above equations constitute a dynamic model of the mutual growth of hotels, hotel rooms, and visitors.

4. Implications for Resorts

The implications of the above equations for different styles of tourism of hotels are now illustrated. With the exception of the stipulated hotel size, the initial conditions - number of rooms, operating and marketing efficiency, cost of construction per room, incentives, and so on - are taken to be identical.⁹ Again, for purposes of illustration here, investment (or disinvestments) in one time period are taken to lead to new usable rooms in the next period. In practice, the time taken to construct hotels and to bring them to “full” occupancy also will affect the rate growth. The implications of such lags in marketing and construction will be considered later.

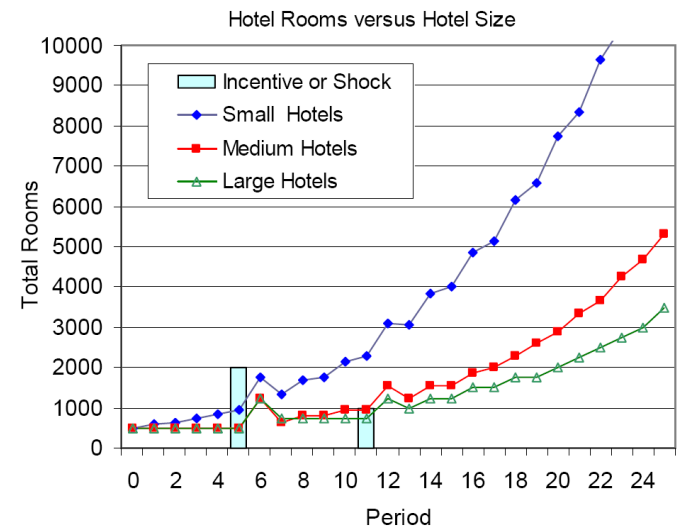


Figure 4. Take-off Trajectories for Small, Medium, and Large Hotels with Incentives.

⁹ For this calculation, small, medium, and large hotels are taken to have 50, 150, and 250 rooms respectively. In addition, the occupancy $m(t)a(t) = 85\%$, local breakeven $e(t) = 50\%$, foreign share of income $f(t) = 50\%$, capital/room $k(t) = 3$, the discount horizon $y(t) = 3$ years, and incentives $I(t)$ are measured as room years. The figures are based on Cole (1997).

Trajectories for three styles of tourism based on small, medium, and large hotels are shown in Figure 4. With small hotels growth is spontaneous and self-sustaining with this level of initial activity. The incentives promote construction of additional hotels but are not required since the total surplus is sufficient to stimulate new investment. With medium-sized hotels the perceived surplus is insufficient to promote new investment. Only after a sizable incentive does take-off to self-sustaining growth occur. With the largest hotels, the first incentive is sufficient to initiate construction of several hotels. Nonetheless, the total surplus is not raised to the level required for developers to invest without incentives. This occurs only after two rounds of incentives. These simulations suggest that several conditions have to be fulfilled for self-sustaining growth to proceed. One or more incentives may promote construction of hotels but there is no guarantee that it will lead to self-sustaining growth. The formal conditions obtain by rearranging the above equations.¹⁰

The first condition on the size of single incentive to promote construction of one or more new hotels is

$$(Np + I) > nkh \text{ or } I > nkh - Np \quad (6)$$

The second is the condition is that this construction is followed by a single similar hotel without another incentive

$$(N+n)p/nk > 1 \text{ or } N/n > k/p - 1 \quad (7)$$

This is also the condition for continuing endogenous growth. The conditions are not remarkable: the first simply says that the incentive must be sufficient to cover the gap between cost of construction and expected profit; the second says that there must be sufficient total rooms for the total expected profit to cover the cost of construction of the chosen size of hotel. Note here, however, that, from period to period any of the variables that make up profitability p or total investment per room k may change. In particular, as considered below, a resort-wide dip in occupancy following construction of new hotels may be sufficient to curtail spontaneous growth. When the total number of rooms at a resort becomes very large compared to a single new hotel the second condition becomes $N/n > k/p$ when $N \gg n$. Whether this situation can emerge in a

particular resort depends on the prevailing constraints such as the available beachfront, whether the resort sub-divides, and so on.

5. Timing of Discrete Events

The above example contrasts the situations of small-hotel resorts with laissez faire public policy with a large-hotel resort with incentives. It shows the possibility of rapid spontaneous growth in a resort such as Barbados versus the need for successive large incentives to initiate tourism in large-hotel resorts such as Aruba. It also suggests why construction of a single signature hotel in Barbados did not lead to growth of a chain hotel sector. However, there are some detailed points to be made that illustrate why the behavior of tourism observed any given island at different points in time or in similar islands at a given point in time could be so different. This has been a repeated observation in the literature (see e.g. Pearce, 1987; De Albuquerque and McElroy 1992; Wilkinson, 1997).

First, although the overall trend is roughly exponential once spontaneous growth has begun, the trajectory actually comprises a series of regimes when the resort switches from construction of one new hotel per year to two hotels, and so on. An increasing total number of rooms at the resort increases total annual surplus, and hence the number of new hotels of a given size that can be built. This is most clearly seen from the trajectory of the largest hotels. Once tourism has taken off, growth proceeds strongly (and eventually at the same pace for any size hotel, all else equal), is deemed successful, and becomes embedded. This possibly answers the "intriguing question" of the observed divide across the Caribbean between small and large-establishment resorts (Poon, 1989; Ioannides, 1994).

Second, the timing and size of incentives is critical, in that reducing a particular incentive by a small amount will mean that no new hotel is constructed, or that the number constructed is not sufficient to bring total surplus to the level required by potential investors. This is the case for the first incentive and the large hotels in the above example. In this sense there are clear "tipping points" where quite small changes at a particular moment in time can dramatically affect the long-term outcome. This critical behavior applies both to positive changes (such as incentives) and negative changes (increases in taxes). Equally, increasing an incentive may not affect the outcome greatly provided it is above the level required for growth. In the above example this is the case for the impact of the first incentive on the growth of large hotels. Thus, a

¹⁰ Note that without the condition that hotels must have a significant number of rooms, and without lags, the equations define an incremental investment model with exponential growth. This is because the number of sales is proportional to the number of rooms and hence the rate of growth of rooms becomes proportional to the number of rooms.

larger incentive would be inefficient in relation to a particular objective and circumstances.

Third, critical behavior is not confined to public support. If the system is near a critical point, any small change in any variable in the model, resort attractiveness, marketing efficiency or expenditure, breakeven cost or construction cost, can lead to similarly dramatic shifts through relatively modest shifts in any model parameter. In reality compensating private and public sector responses such as price adjustments or temporary public support may mute these effects, but the underlying system is nonetheless likely to pass through regimes when it is very sensitive to changes. Small island resorts are especially vulnerable to demand shocks arising from any number of short-run external and domestic events such as recessions, oil spills, corporate bankruptcy, terrorist attacks, crime waves, or price hikes (see e.g. Briguglio, 1993).¹¹ If these shocks are sufficiently large, the consequences may be terminal. Again, this depends on the size of the shock relative to the main parameters of the model (such as characteristic hotel size), and the current state of the system (e.g. whether it is close to criticality).

Equation 1 is modified to account for the exogenous fall $d(t)$ in demand in specified years. If the decline is expected to continue for several years - beyond the discount horizon - the condition for previous spontaneous growth to continue becomes

$$N/n > (py + ma(1-d)y)/k - 1 \quad (8)$$

As a result, profitability is lowered during these years. The situation is the obverse of the condition for single new hotel given earlier. Now, if $Npy < nk$ there are likely to be closings - in reality of older less profitable properties. Again, the former appears to have been the case in Barbados (which has seen constant churning of small properties), and the latter in Aruba when over-capacity contributed to the bankruptcy for two half-built hotels and demolition of another. This is illustrated by Figure 5. In this case it is seen that the shock (simulated here as a sudden fall in profitability) has relatively small impact on the small and medium-sized hotel resorts. For the large hotel resort demand falls below level required for self-sustained growth, and so new incentives would be required to revitalize the industry. Together, the above results show how a combination of adverse circumstances or events can

have a catastrophic effect on a resort. The results again demonstrate the possible consequences of the "style of tourism" on the growth of a resort.

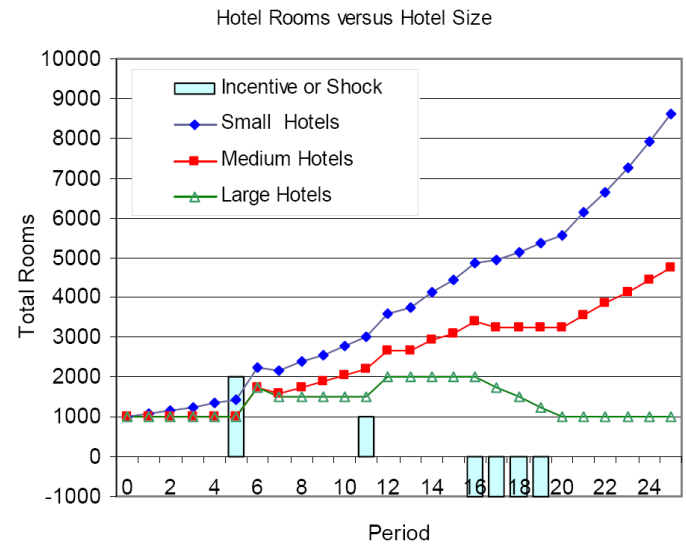


Figure 5. The Impact of a Large Demand Shock on the Resort Growth

6. Construction and Occupation Lags

In general, demand will lag supply, and vice versa. From the time that the investment decision is made, several years may elapse before construction is completed and several more years before a property reaches its potential occupancy.¹² The period of construction - design, permits, materials, and fabrication - concatenates with those for marketing - raising awareness in the potential market about a new hotel or resort. Inevitably these delays lead to systematic over and under-estimation of future trends leading to a mismatch between available rooms and visitors that may lead to periodic cyclical behavior (similar to business cycles), or even unstable growth fluctuations. To investigate this, the earlier Equation 1 is modified with a lag g .

¹¹ The demand loss will vary according to the type of shock, accommodation, and destination. For example, the wide variations in the decline of occupancy and recovery period of Caribbean destinations after 911, and also different types of accommodation, and may be estimated as demand elasticity against price variations or magnitude of events.

¹² In the early days of tourism, the Island Government undertook a prolonged marketing effort to get "Aruba" on the tourist map. In general, hotel chains have greater opportunities and are better able to reduce these marketing delays. Modern mega-chains can bring a new destination to their own customers' attention relatively quickly. Several types of sales, such as those based on word of mouth recommendation, repeat visitors, timeshare sales depend on visits over several earlier periods leading similar effects. In some cases, sales are based on not-yet-completed hotels as has occasionally happened in Aruba (i.e. a negative lag). Since low occupancy represents inefficiency and lower profitability, there is an incentive for operators to raise the potential occupancy and shorten the lead-time for construction and occupation.

$$S(t) = N(t-g)m(t)a(t) \quad (9)$$

As an illustration of the importance of lags, a one period delay between hotel construction and its target occupancy rate, typically well-above break-even. This represents a two-year lag between initiation and full occupation since the model already includes a one period delay between the decision to construct a hotel and its opening. Figure 6, shows the resulting trajectory for the number of room sales and occupancy levels,

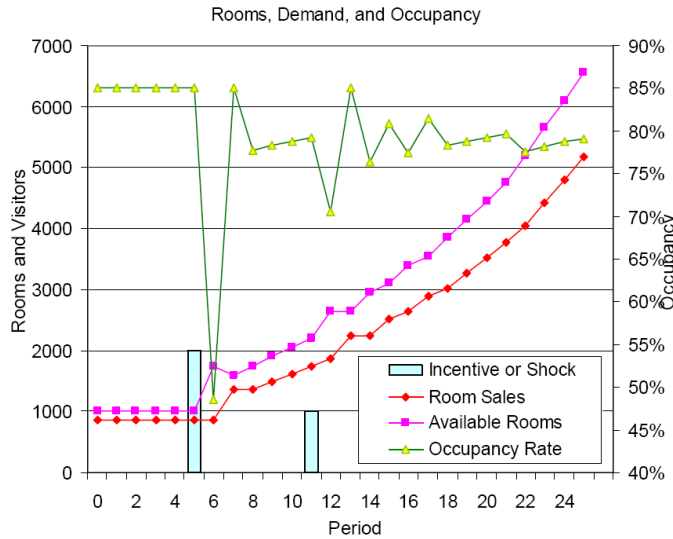


Figure 6. Trajectories for Medium-sized Hotels with Planning Lags

as well as the number of rooms for medium-sized hotels with a one-year delay.¹³ The growth of rooms is broadly similar to the earlier chart with an increase in the number of rooms after each round of incentives, followed by hotel closings or a period of no-growth. Here, marketing delays lead to a temporary depression in average occupancy rates that may cause overall operating surplus to become negative. Because the incentives are not well timed to the potential demand, there is an “overshoot” in the number of rooms.¹⁴ Once demand catches up with supply, investment continues in a self-sustaining manner, as before. Non-

¹³ The earlier results show that all else equal with respect to the intensive aspects of hotel (costs per room, breakeven, etc) take-off depends on number of new rooms relative to the current stock. Thus, the characteristic behaviors can be explained using a single size of hotel. Note, however, that identical lags applied to larger hotels may block the transition to self-sustaining growth entirely unless the level of incentives is increased considerably.

¹⁴ Earlier, it was assumed that the number of visitors depended on the current number of rooms. With lags, actual occupancy will typically be below the potential occupancy, although it may overshoot provided occupancy remains below target occupancy.

etheless, there is a tremendous overall slow down in growth and, in this simulation; the final number of rooms is halved. Thus, marketing delays have effects well beyond creating fluctuations in occupancy.

7. Carrying Capacity

In the above example, the spontaneous growth of the small-hotel resort arises because the conditions for hotel construction are already met by the initial situation (i.e. there are already sufficient rooms). Nonetheless, at some time in the past there must have been too little room-capacity for spontaneous growth. Thus, a resort was attractive enough for existing establishments to survive, but not to “take off”.¹⁵ Public and private sector initiatives such as opening a new airport, marketing campaigns, new festivals or discovery of historic sites might raise attractiveness to the required level.¹⁶ Unlike one-off or discrete incentives, these enhancements may have a continuing or cumulative impact. Thus, there is a step-increase in attractiveness of a destination, leading to increased sales per room (as in Equation 1) and also in profitability. In this case, equation 1 is modified to account for the exogenous increase in demand for all years following the improvement, *i*. As a result, profitability rises during these years. This will now promote continued growth provided the modified Condition (2) is satisfied.

$$N/n > (p + ma(1+i)y)/k - 1 \quad (10)$$

Once take-off has begun, spontaneous growth may continue even if the new amenity begins to deteriorate.¹⁷ This deterioration or similar processes such as steadily rising global and regional competition, due to the collective effect of many different local operators and multi-national corporations operating in many destinations, is treated as a continuous process.

¹⁵In most resorts, tourism evolves from some previous type of establishment satisfying local needs or those of occasional visitors. In Barbados, this hotel system was small apartments and guesthouses. In Aruba, there were far fewer hotels but regular guests of the many expatriates working at the oil refinery (Cole, 1997). Hotel tourism in both islands was also seeded by early stopover cruise visitors.

¹⁶ It should be noted here that in a tourist-dependent economy development of most infrastructure (harbors, access roads) and utilities (water, electricity, waste disposal, etc) comes directly or indirectly from the growth of visitors. This investment too, mainly from the public sector, is “lumpy” and triggered when existing capacity is squeezed, and the underlying process is similar to that for hotels.

¹⁷ For example, an airport may become overcrowded. If the amenity deteriorates too far however, the result is similar to the prolonged demand shock shown earlier, and the number of visitors, rooms, and arrivals could decline terminally. Whether transportation systems, notably airports, are a trigger or simply a facilitating agent is left open here, with the implied assumption that delivery systems keep up with demand.

Thus far, the geographic scale of a resort has not entered analysis explicitly.¹⁸ In Butler's (1981) original version of life cycle theory limitations of resort capacity are primary causes of stagnation of a mature resort through the increasing demands of mass-tourism. Although this is one of the more contentious aspects of the model, it is nonetheless an ongoing concern for many resorts (Pearce, 1989; Ioannides, 1995). Physical limits might arise in terms of beachfront or land for hotel development, or from the downstream requirements such as residential land and support for workers. Other constraints arise from limitations in the size of the local labor force, or available infrastructure. Yet other "constraints" arise from socio-psychological factors such as visitors' sense of overcrowding, or residents feeling overwhelmed and displaced by visitors or immigrant workers.¹⁹

Since these constraints often arise from the actual or perceived geographic size of a resort any increase in operating and other costs, or costs of offsetting the process may be related to a "saturation-related" measure or attribute, such as density of tourism. Formally, the process is similar to that described for the increasing international competition, and successive opening of new resorts, but now driven by the increased intensity of resource use at existing resorts. This reflects the spatio-temporal life cycle model suggested by Miosec (1976, Gormsen (1981) and described in Pearce (1987). Saturation, alone, leads to stagnation, not decline unless other factors such as increasing competition are included, or marketing and construction lags coupled with irreversible damage to cultural and environmental amenity, leaving a spiraling wake of abandoned properties. Conversely, a "new" technology such as timeshare in Aruba in the late 1980s, or chain hotels in Barbados in the 1990s, can stimulate a new product

cycle, and extend the resort's life cycle. The sensitivity to scale of accommodation, marketing, incentives, and other factors discussed above, mean that the resort system may become as vulnerable to a mistimed concatenation of events as during the initial take-off. This is especially so if structural problems from declining arrivals leads policy makers to panic and over-react rather than carefully reappraise their policy for rejuvenation (as wishfully suggested in Lundberg's version of the life cycle model).

9. Pathologies and Model Testing

The above results illustrate the type of trajectories generated by the model. Despite the relative simplicity of the basic equations the range of results is wide, varying from slow to rapid take-off, to continuing long-run growth to early overshoot and decline. The model exhibits a variety of growth characteristics that reflect the growth stages of the life cycle model, as well as other phenomena, such as stepped growth and cycles as well as the characteristics of complex systems such as a critical sensitivity to small changes in parameters in some regimes. Although, typically several processes may contribute to a given outcome, it is evident that some are primary causes of a particular phenomenon while others enhance or diminish it. Each of the phenomena revealed during take-off may arise at the onset of decline and rejuvenation as overbuilding, increasingly large expansion of properties, especially when coupled to an associated decline in the comparative attractiveness of a destination, or downturns in the global market. It is noted that the trajectories are influenced by sub-systems with their own cyclical and other reactive behavior. For example, the overbuilding of hotels induces migration, and settlement, family-building, new jobs seekers, unemployment and a new round of hotel construction. (Cole, 2002, Cole and Razak, 2003).

From the practical stance of estimating the model against historic trends for a particular resort, availability of consistently defined measured time-series data becomes the major constraint on very detailed model specification. Assembling the more than 50-year time span data sets needed to test the model across a range of variables (arrivals, infrastructure and accommodation, occupancy, policy, migration, employment, physical capacity, market conditions, and transport) is a lengthy business, but plausible "fits" are obtained for Aruba and Barbados.

How any given process shown earlier in Table 1 is specified depends on its magnitude and relevance relative to the resort under investigation. Changes may be specified as continuous (up-scaling existing ac-

¹⁸ To address the National Tourism Council's principal question "how far and how fast" should tourism grow in Aruba, the model described in this paper was embedded within a multi-sector macro-economic and social accounts model of the island economy linked to a population age-cohort and immigration model (Cole, 1997). The combined model demonstrated a "pumping" effect such that each time a new hotel is constructed a new wave of immigration and settlement occurs increasing the rate at which the island approaches its "carrying capacity". The latter was determined by comparing revealed and surveyed aspirations of settled Arubans against remaining territory available for tourism and residential development as determined from the tourism footprint associated with different styles of visitor. (Cole and Razak, 2007).

¹⁹ Historically, such limits are addressed through changing social policy and norms, exploiting new less choosy tourist markets, or investing in new technologies. Often these factors are inter-related. For example, in Aruba lack of local suitable labor led to rapid immigration and a social reaction to tighten immigration, until budgetary issues provoked a new expansion of tourism, exacerbating social and land use concerns, eventually provoking a new round of offsetting measures.

commodation, or shift in the mix of transient and timeshare, or aging stock) or discrete (such as a new competing resort). Alternatively, a semi-discrete specification, whereby the older less efficient vintage of properties are discarded, or agglomeration depending on the cluster-size of operations (as opposed to the individual properties or carrying capacity), may be used. Figure 7 shows a selection of trajectories explored using variants of the model.

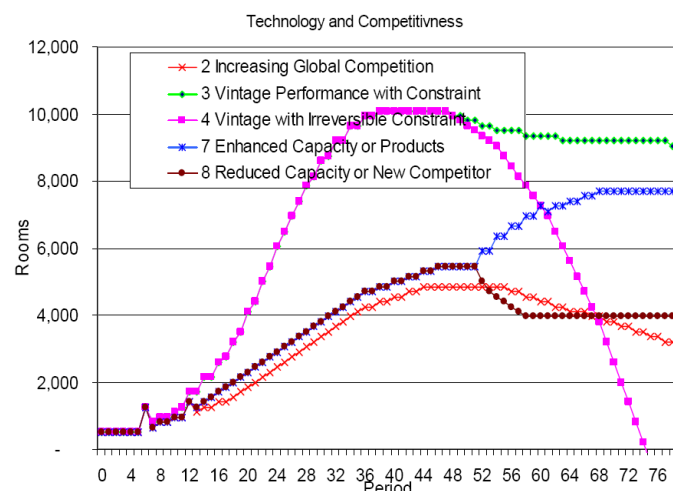


Figure 7. Contrasting Trajectories for Variants of the Model

Table 2 summarizes how specific pathologies associated with the resort life cycle - take-off, stepped growth, fluctuations in occupancy rates and arrivals, tendencies to stagnation, decline, or revitalization are determined by lumpy investment, lags and shocks, market competition and globalization, intrinsic attraction and constraints and synergies, and incentives. In conclusion, while the model cannot answer the question of how tourism “begins” (i.e. where does the first tourist come from?), it may explain the conditions for take-off, instabilities during the growth phase, changing external conditions that may trigger, that in turn may be offset by appropriate public policy and investment strategies.

Table 2 Summary of Model Pathologies – Processes and Outcomes

Processes	Lumpy Investment	Lags and Shocks	Competition and Globalization	Intrinsic Attraction and Constraints	Incentives and Synergies
Take-off	--	--		x	x
Stepped Growth	x	+	-		+
Occupancy Fluctuations	+	x			
Stagnation/Decline	+	+	x	x	--
Revitalization			+	+	+
Key: x primary cause + amplifies outcome -- diminishes outcome					

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