Towards a Sustainable Tourism Product for Jamaica: A Dynamic Simulation Modelling Approach

Working Paper

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September 2007

Abstract

This paper presents a system dynamics-based tourism model, which focuses on the dynamic interdependencies between the hospitality sector and both the labour market and the manufacturing sector. The model incorporates a generic value-chain structure (VCM) that allows modelling of customer-supplier value chain for the tourism sector. Additionally, a work-force structure is incorporated into the analysis to capture the labour dynamics surrounding the hospitality sector. As such, the model developed integrates several concepts of traditional network-based approaches to enhance the applicability of the model to the Jamaican tourism sector. The model adequately captures the dynamics of the tourism sector between 1990 and 2005. The paper also assesses the effects of large but plausible shocks to demand for the product and capacity on, among other things, capacity adjustments and the demand for labour over the medium term. The results of such experimentation are used to make policy oriented recommendations to enhance the sustainability of the sector as well its contribution to the growth and development of the wider economy.

[1] The views expressed are those of the author and not necessarily those of the Bank of Jamaica.

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INTRODUCTION

The question of how to make tourism in Jamaica more sustainable is a timely topic. The sector has provided direct employment to the accommodation sector of 31 227 at end 2005, which has grown steadily from 20,561 in 1990. Besides the direct employment, indirect jobs have been provided to farmers, construction companies as well as the manufacturing sector. Indeed, the labour force employed to the Hotel, Restaurants & Clubs was 287,852 in 2005.[1] Similarly, the industry's supporting sectors, namely transportation, agriculture, electricity and water, manufacturing, construction and the distributive trade together represent over 60.0 per cent of GDP. It is not surprising then that tourism is viewed as one of the most important engines of growth and development in the Jamaican economy. Despite this, Jamaica's tourism industry faces many significant challenges. Not least of which has been the continued low and declining impact of the industry on the overall economy (McCatty & Serju 2006). This study found that though the expected boom in the industry over the medium term should have noticeable effects, the estimates of the impact multipliers suggested that the contribution of the sector to the wider economy would be below potential**.** However, one source of this problem is a limited understanding of tourism's complex dynamics, which stems partly from the absence of comprehensive integrated quantitative frameworks to capture its pervasive social and economic impacts.

The purpose of this paper, in light of the aforementioned, is four-fold. To construct a model of tourism dynamics; apply the model to Jamaica's tourism market between 1991 and 2005; present scenario type analysis to evaluate the impact of shocks to the industry; and to highlight policy implications arising out of the framework. A review of the evolution of tourism product since the 1990's provides a background to the assessment of the industry's prospects over the medium term.

[1] The value added of the tourism industry is captured within the Hotels, Restaurants, & Clubs component of the Miscellaneous Services category in the national accounts. This sub-sector contributes approximately 6.3 per cent directly to the country's gross domestic product.

AN OVERVIEW OF JAMAICA'S TOURISM MARKET BETWEEN 1990 AND 2005

By end December 2005, 1.47-million stayover tourist visited Jamaica representing a 49.4 per cent increase since 1990. During the last 15 years the annual growth in stopover visitors has been 2.75 per cent per year. However the average growth rate in tourist arrivals masks a considerable amount of volatility with a record annual year-on-year growth rate of 6.6 per cent in 2003 and a fall-out of minus 3.4 per cent in 2001.[2] Over the period, the dominant share of visitors to the island has come from the USA, followed by the United Kingdom and Canada. Typical of mature destinations, Jamaica has been an average stay-day of 7.9.

Jamaica's tourism sector has also exhibited increasing scale and consolidation. Over half of all rooms available are in large hotels (100+ rooms) and a rising number of stayovers choose hotels rather than villas and guest houses. The 59.0 per cent average occupancy rate over the last five years, with a maximum monthly occupancy rate of 77.0 per cent, is representative of the average occupancy rate in the Caribbean (McElroy and Albuquerque, 1998). This rate has been rising due to expanded promotion of all-inclusive hotels and increased marketing presence overseas. New room construction has increased the stock of rooms by 63.0 per cent since 1990 to a total of 26,039 rooms at end 2005. This represents an annual growth rate of 3.2 per cent, with a tendency to accelerate in recent years.[3, 4]

The industry is the country's major earner of foreign exchange. Over the period between 1999 and 2005, Jamaica enjoyed an average net surplus of US$1,100 million on the travel account in the balance of payments, representing an average increase of 4.2 per cent. In 2005, gross tourism foreign exchange earnings represented 89.8 per cent of the value of merchandise imports.

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[2] Growth in tourist arrivals was impeded by the events of 11 September 2001, which led to a 3.4 per cent decline in arrivals. In an attempt to attract visitors to the Island, given the fall in world travel, hoteliers were compelled to offer discounted rates in the following year.

[3] Over the next five years, it is anticipated that over 12,000 new hotel rooms will be added along the islands north coast.

[4] Similarly, over the period the number of beds in the industry has increased by 64.0 per cent to 53,030 at end 2005.

DATA DESCRIPTION AND SOURCES

The main data source for this paper is obtained from the Jamaica Tourist Board's Annual Travel Statistics 1995 - 2005, which is replete with information on the hotel and accommodation sector. Annual tourist arrivals, bed capacity, and the number of workers in the accommodation sector were obtained from this source between 1990 and 2005. Monthly tourist arrivals between 2000 and 2005 were used to compute a seasonality index for tourist arrivals which was a critical component for computing both the occupancy rates and the monthly revenue for the sector. The seasonality index was constructed by computing the ratio of the arrivals for a given month to the 12-month moving average (MA) arrivals. Thereafter, the 5-year average of those ratios, for the particular month in question, was used to compute the index.[5]

Occupancy rates were computed as a function of bed nights sold and were given by equation (i)

$$\text{Occupancy Rates} = \frac{\text{Number of Monthly Arrivals (t)} * \text{Average Length of Stay}}{\text{Average Number of Beds} * 30} \qquad \text{(i)}$$

Cross sectional data gleaned from the Annual Travel Statistics included average length of stay per visitor, expenditure per tourist, average bed to tourist ratio and average labour to tourist ratio.

MODEL DESCRIPTION

A system dynamics simulation model highlights the structure underlying the interactions along Jamaica's hotel value chain (VCM). The model incorporates a generic supply-chain structure that allows modelling of customer-supplier value chains predominant in business systems. The supply chain sub-model and the labour supply chain structures are for the most part generic (Sterman 2000, Chapters. 17 & 19). Effective VCM models

[5] For example, the January Index = 5 year average {January Arrivals $_{\text{Year t}}$/ 12-month MA} where t = 2000…2005. See Appendix for the computed seasonality index.

must incorporate different agents and firms, including suppliers, hotels, distribution channels and customers (e.g. tourists). System dynamics is well suited for Jamaica's hotel VCM modelling and policy design because the island's hotel value chain entails multiple chains of stocks and flows, with time lags and delays, and because the decision rules governing the flows create feedback loops among value-chain participants and supply-chain partners.

Jamaica's hotel supply-chain management (SCM) sectors

Like all firms, Jamaica's hotels are sets of processes. Their order fulfillment, service delivery, advertising, hiring, firing and pricing are all processes. Each requires inputs acquired from suppliers. A customer-supplier value chain is the structure that acquires the inputs, transforms them into outputs and delivers them to customers. Customers can be external (e.g. tourists) or internal (e.g. hotels) and the inputs and outputs can be tangible (e.g., a jet ski and its parts and raw materials) or intangible (e.g., a concert performance, where the output is a soul-inspired audience).

The supply-chain management (SCM) sector of the tourism industry can be summarized in ten equations, half of which are the decision rules governing the procurement of bedroom capacity for the sector for both the hoteliers and the providers of room capacity.

The supply chain governing the provision of beds for the sector is comprised of the stock of unfulfilled orders for new hotel beds, i.e. orders that have been placed with manufactures but not yet received (Eq. 1). This stock is increased by the accumulation of yet more orders for beds (Eq. 2) and depleted inter-temporally by acquisitions by hoteliers (Eq. 3).

Supply Chain Structure Sector

Supply Chain (t) = Supply Chain (t – dt) + (orders – acquisitions)*dt (1)

where

Orders = MAX (0, adjust SC + desired acquisition) (2)

Acquisitions = MAX (0, Supply Chain/ acquisition lag) (3)

The MAX function of equations 2 and 3 ensures that bed acquisitions and orders are constrained to be nonnegative. Generally, hotel managers cannot simply add new beds to a hotel as they wish. Acquiring new beds involves time lags and delays, and requires resources. Hotel construction, for example, requires labour and equipment. If it assumed that there is ample process capacity, then the only delay in acquiring new beds entails an acquisition lag, the acquisitions rate depends on the supply chain (SC) that has been ordered but not yet received and the acquisition lag.

The stock to be controlled by hoteliers, hotel Bed Capacity (Eq. 4), is the accumulation of the acquisitions rate (Eq. 3) less the depreciation rate. For simplicity, the stock of beds is assumed to depreciate at a constant rate (Eq. 5).

Bed Capacity (t) = Bed Capacity (t – dt) + (acquisitions – depreciation)*dt (4)

where

Depreciation = Bed Capacity / average bed life (5)

Decision rules for the SCM Sector

In the decision rules structure, hoteliers and hotel managers place orders to replace depreciated hotel beds (Eq. 5) as wells as any discrepancy between desired bed capacity and actual BC (Eq. 7). Where desired bed capacity is a function of the target bed-to-tourist ratio and the annual number of stopover visitors (Eq. 9). The acquisition lag forces them to maintain an adequate supply of unfilled orders, so that bed acquisitions are close to desired acquisitions (Eq. 6). Hence, the orders rate represents an *anchoring and adjustment process* (Eq. 7). Similarly, the suppliers of beds to hoteliers must adjust their Supply Chain analogously to how hoteliers adjust their bed capacity. They must also set their desired supply chain (SC) according to the expected acquisitions lag, which could generally differ from the actual acquisition lag.

Desired Acquisitions = MAX (0, depreciation + adjust BC) (6)

Adjust BC = (desired bed capacity – Bed Capacity)/ bed capacity adjustment time (7)

Desired Bed Capacity = Bed tourist ratio*(Annual Tourism) (8)

Adjust SC = (desired SC – Supply Chain)/ Supply Chain adjustment time (9)

Desired SC = desired acquisitions*acquisition lag (10)

Hence, the decision rules structure of the SCM sector for both hoteliers and manufacturer is firmly grounded on the theory of bounded rationality developed by Cyert & March (1963) and Simon (1982).[6] Additionally, the procurement process modeled with its delays, capacity constraints, and negative feedback loops will exhibit the large oscillations and instability typical of SCM systems. Oscillation, typical of the bullwhip-effect, requires both that time delays exist in decision structures controlling a system and that SCM fails to account for them.[7]

Labour Market Sector

The labour force for the accommodation sector is aggregated into a single stock which is increased by the hiring rate and decreased by the attrition rate (see Eq. 11). The attrition rate includes voluntary quits and retirements and is modeled as a first-order process in which employees remain with the industry for the average duration of employment (see Eq. 12). Similarly, hiring is captured as the rate at which the sector converts vacancies into positions within the industry (Eq. 13).

Labour Market (t) = Labour Force (t–dt) + (Hiring Rate –Attrition Rate)*dt (11)

where

Attrition Rate = Labour/ Average Duration of Employment (12)

Hiring Rate = Vacancies/ Time to Fill Vacancies (13)

[6] The agents in this model do not have perfect foresight or perfect information i.e. they do not know how many tourists will come next year. Instead they are boundedly rational, having to make decisions under uncertainty using various heuristics.

[7] Managers often ignore the supply change of corrective actions that have been initiated but which have not yet had their effect.

Vacancies for the industry are increased by the vacancy creation rate and decreased by the vacancy closure rate, which is set equal to the hiring rate (Eq. 14).[8] The hiring rate for the industry is captured as the sector attempts to replace those employees who leave and eliminate any discrepancy between the desired and actual number of workers (Eq. 16). Hoteliers determine the desired number of workers by maintaining, over time, the ratio of expected visitors to employees. Additionally, hoteliers determine the desired level of vacancies as the number of persons that will yield the desired hiring rate given their belief about how long it takes to fill a position.

Vacancies (t) = Vacancies (t– dt) + (Vacancy Creation Rate – Vacancy Closure Rate)*dt (14)

where

Vacancy Creation Rate = MAX(0, Desired Vacancy Creation Rate) (15)

Decision rules for the Labour Market Sector

Desired Vacancy Creation Rate = Desired Hiring Rate + Adjustment for Vacancies (16)

where

Adjustment for Vacancies = (Desired Vacancies – Vacancies)/ Time to Adjust Vacancies (17)

Desired Hiring Rate = Expected Attrition Rate + Adjustment for Labour (18)

Adjustment for Labour = (Desired Labour - Labour)/ Time to Adjust Labour (19)

where Desired Labour = Labour to tourist ratio*(Annual Tourism)

Equations 20 to 24 capture the decision rules of the sector concerning their demand for labour during a downturn. The layoff rate is the magnitude of the desired hiring rate when the rate is negative (Eq. 21). The implication is that hoteliers are just as willing to hire to fill vacancies as they are to lay-off to eliminate 'excess' employees in the event of a downturn. The same formulation is used to model the vacancy cancellation rate.

Layoff Rate = MIN (Desired Layoff Rate, Maximum Layoff Rate) (20)

Desired Layoff Rate = MAX (0, - Desired Rate) (21)

Vacancy Cancel Rate = MIN (Desired Vacancy Cancel Rate, Maximum Vacancy Cancel Rate) (22)

Desired Vacancy Cancellation Rate = MAX (0, - Desired Vacancy Creation Rate) (23)

[8] Vacancies comprise the demand for new workers that have been placed but whose positions have not yet been filled.

Tourism Arrival Sectors

The logistic or Verhulst growth model Eq. 24 helps to replicate the growth pattern of Jamaica's actual annual tourism. This formulation is capable of capturing the transition from exponential growth to equilibrium.

Annual Tourism (t) = Annual Tourism(t – dt) + (come – go)* dt (24)

where

Come = growth fraction*Annual Tourism*(1 + step (step height) (25)

Go = (growth fraction/Carrying Capacity)*Annual Tourism^2 (26)

Carrying Capacity (t) = Carrying Capacity (t – dt) (27)

The dynamics of monthly tourist arrivals are modeled in a similar fashion (see Eq. 28). However, it incorporates the important dynamic of tourism seasonality on Jamaica's tourism product. Jamaica's foreign visitors and local tourists arrive (Eq 29) according to the seasonality index (Eq. 30), feeding the monthly Tourism Stock (See Eq. 28). After 7.9 days, according to the *Annual Travel Statistics*, the visitors depart (Eq. 31).

Monthly Tourism (t) = Monthly Tourism (t- dt) + (arrive – depart)*dt (28)

where

Arrive = Tourism Seasonality*(Annual Tourism)/12 [9] (29)

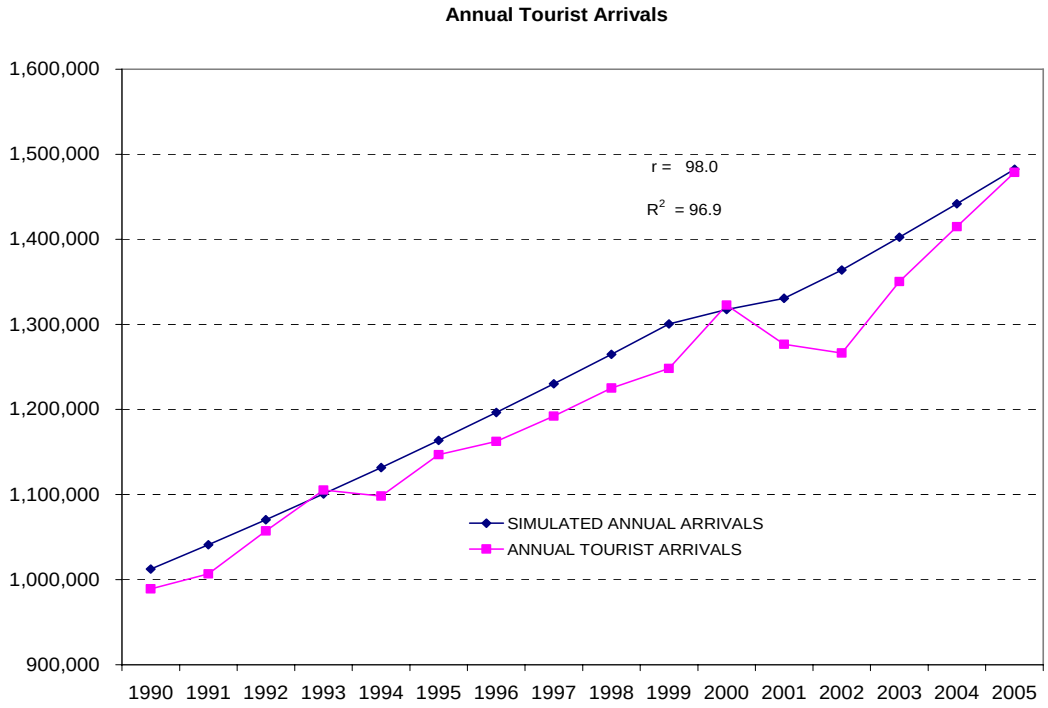
Tourism Seasonality = GRAPH(month,1,1,{0.418,0.582,0.887,1.12,1.17,1.14,1.47,1.55,1.29,1.12,0.672,0.571}) (30)

Depart = Tourism/average length of stay (31)

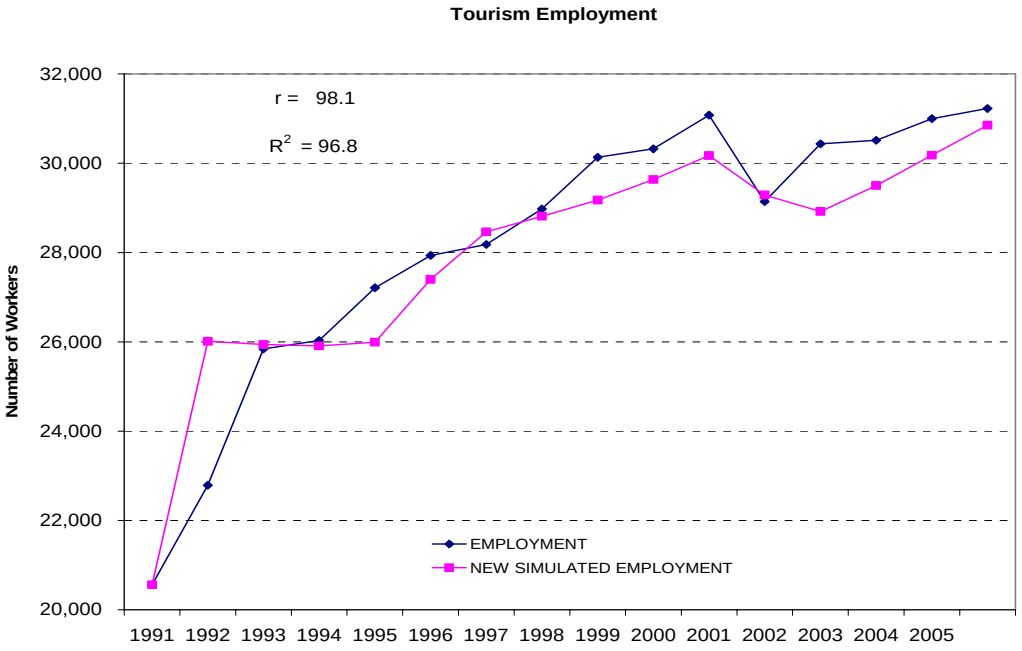
[9] This function converts the simulation time (months) to a 12-month metric of time. Thereafter, whenever the simulation indicates a corresponding month between 1(January) and 12 (December) the appropriate seasonality index is operationalized).

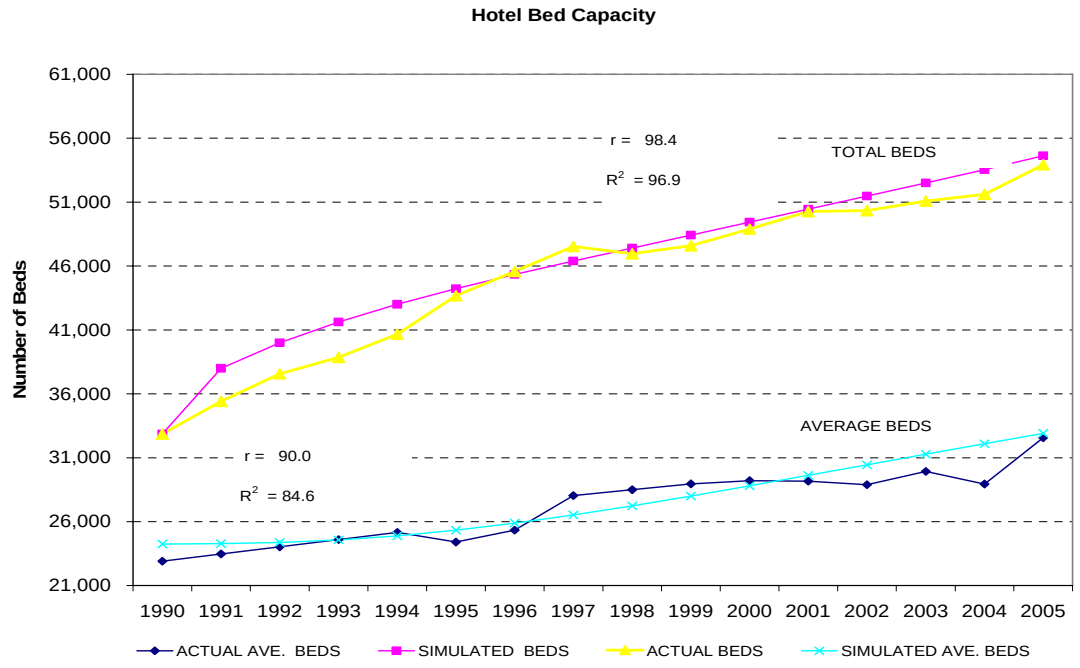
SIMULATION RESULTS

The coefficient of determination, R^2, which measures the variance in the data explained by the model, is used to assess the model's ability to reproduce the dynamics within the tourism sector between 1990 and 2005. The parameters of interest are the number of tourist arrivals, the number of beds in the hotel sector, and the number of workers in the accommodation industry. Figures 1 - 3 show the actual versus the simulated data for the aforementioned parameters. Both the r (correlation coefficient) and the R^2 are reasonably high for each of the variables, showing that the model captures the mean and the trends in the actual data quite well. It should be noted that the tourism arrivals sub-model could not/ did not 'predict' the down-turn in stayover visitors as a result of 9-11 but that an exogenous shock was added to replicate the impact the downturn had on arrivals to the island.[10] Indeed, the knock-on effect of 9-11 on the labour market, bed capacity and occupancy rates served as a benchmark to validate the internal consistency of the model.



[10] The growth in tourist expenditure was impeded by the events of 11 September 2001 in the islands main tourist market, the United States of America. In an attempt to attract visitors to the Island, given the fall in world travel, hoteliers were compelled to offer discounted rates, which further reduced tourist revenues in the following year.

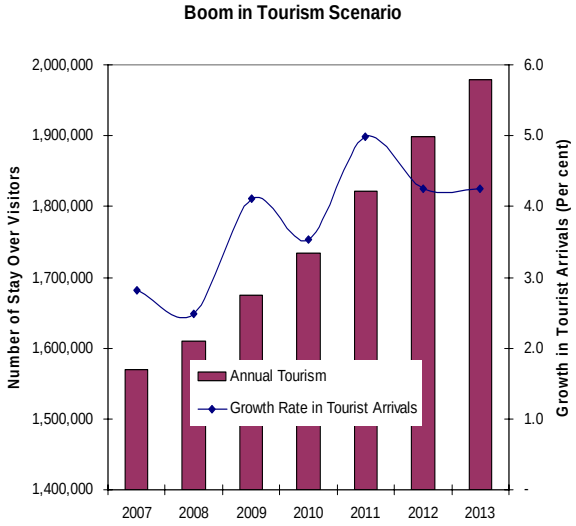

Tourism Employment
32,000
30,000
28,000
26,000
24,000
22,000
20,000
Number of Workers
r = 98.1
R2 = 96.8
EMPLOYMENT
NEW SIMULATED EMPLOYMENT
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005

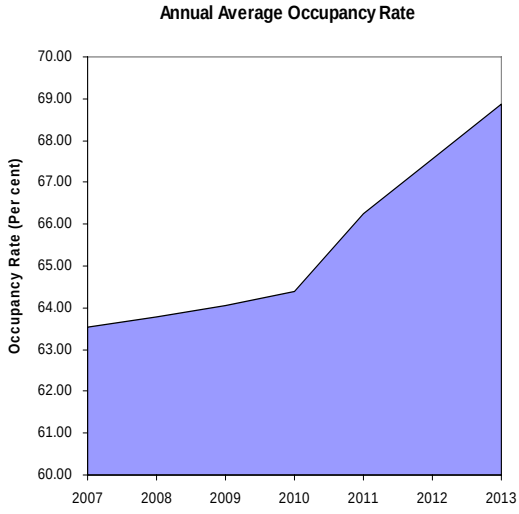

Hotel Bed Capacity
61,000
56,000
51,000
46,000
41,000
36,000
31,000
26,000
21,000
Number of Beds
r = 98.4
R2 = 96.9
TOTAL BEDS
AVERAGE BEDS
r = 90.0
R2 = 84.6
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005
ACTUAL AVE. BEDS
SIMULATED BEDS
ACTUAL BEDS
SIMULATED AVE. BEDS

SIMULATION RESULTS AND SCENARIO ANALYSIS

THE ANATOMY OF A BOOM IN TOURISM

The specific and sustained shock to annual tourism growth would result in an incremental growth rate of 2.0 percentage points to an average of 3.94 per cent over the following five years. This shock would result in tourism stopover arrivals peaking at 1,979,430 visitors by 2013 and average annual occupancy rates increasing to 68.8 per cent at the end of the period from 63.5 per cent at end 2007.





Labour Market Response

In response to the buoyed demand in Jamaica's tourism product and a desire of hoteliers to maintain their target employee-per-tourist ratio desired vacancies rises immediately by 28.0 per cent to 6,206 persons and the vacancy creation rate climbs by 51.0 per cent to 1,863 vacancies per month. After 11 months, the number of vacancies increases to accommodate the new employment opportunities in the sector. Due to frictions in the labour market, the hiring rate lags behind the vacancy creation rate. However, both the hiring and vacancy creation rate reach their new equilibria in 24.0 months. As a result of the aforementioned dynamics, the number of persons employed in the sector grows

cumulatively by 16.3 per cent to 40,507 persons by 2013.[11] Note that small changes in desired labour force induce large swings in the demand placed on the human resources function within the industry to identify a new pool of hotel workers.[12] If the required rate of activity exceeds the capacity of the industry's HR complement, the delay in filling vacancies would increase and the quality of new hires may well fall.

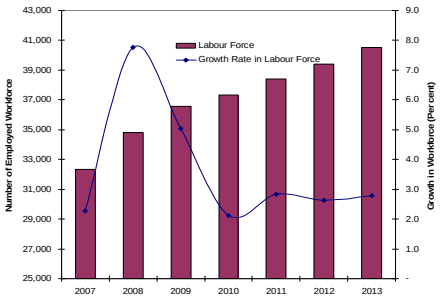
Supply Chain Response

The shock to tourism growth also spurs an increase in the desired stock of beds by 13.0 per cent. However, the impact of the relatively small increase in desired capacity has profound consequences for the capacity management structure. The procurement process creates a significant increase in the amplification ratio from 1.0 to 2.7. That is, a 1.0 per cent increase in desired capacity causes a 2.7 per cent surge in the demand for new room capacity. Thus firm's *suppliers* face much larger changes in demand than the hotel industry itself and much of the surge in demand is only temporary. Thus the order rate (for new beds) increases by 18.0 per cent while the acquisition rate increases only by 6.3 per cent. However, the acquisition of new capacity consistently exceeds the loss in capacity due to depreciation. As a result the stock of beds rises cumulatively by 15.1 per cent to 67,122 at an average growth rate of 2.7 per cent. The somewhat more anemic change in overall capacity occurs because adjusting the capital stock is difficult, expensive, and time consuming; and the long lifetime of plant and equipment means mistakes are not easily undone.

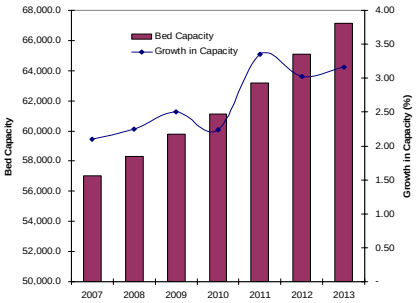
[11] The surge in the growth rate of labour occurs within the first year of the growth shock as labour increases by 7.5 per and subsequently declines to an average of 2.5 per cent per annum thereafter.

[12] That is, a 10.0 per cent increase in the amount of desired employees results in a 51.0 per cent increase in the hiring rate.

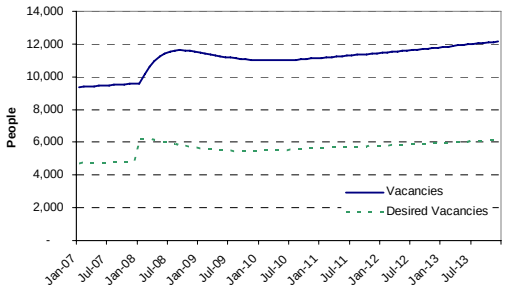
Labour Force Dynamics



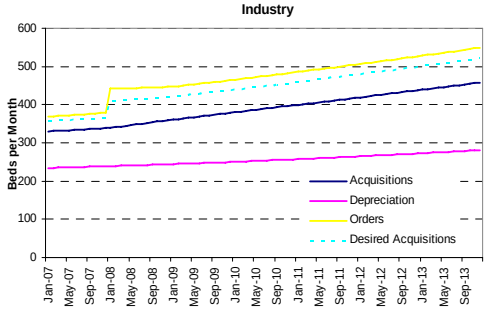
Hotel Capacity Dynamics



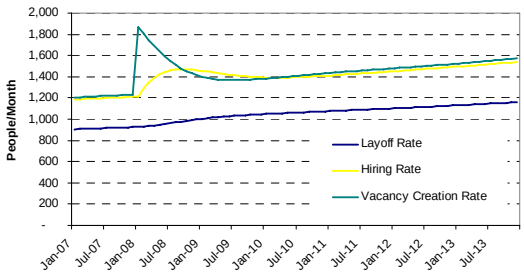
Vacancies and Desired Vacancies in Tourism Sector



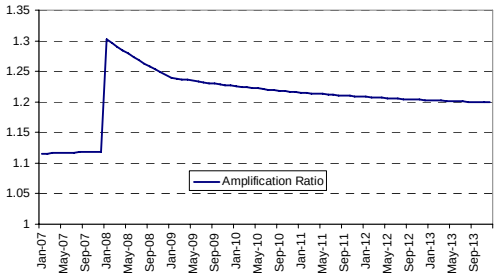
Supply Chain Dynamics in Response to a Boom in Tourism Industry



Response of Labour Market to an Unanticipated Boom in Tourism



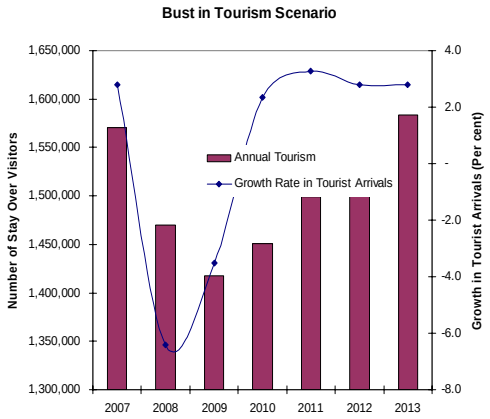
Amplification Ratio

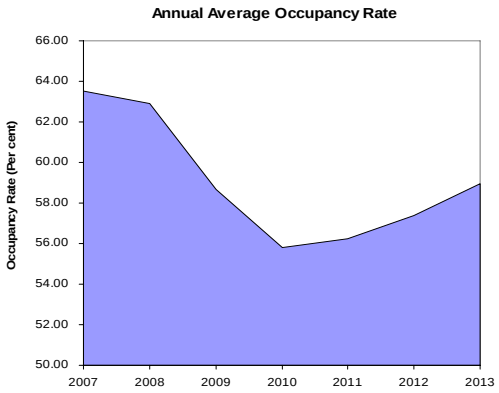


THE ANATOMY OF A FALL-OUT IN THE TOURISM SECTOR

Scenario

The negative shock to tourism capacity arises from a hypothetical hurricane which damages the infrastructure of the sector. In particular, bed capacity is assumed to decline by 20.0 per cent to 45, 519 beds at end 2008 from 57,024.0 beds at end 2007. The decline in destination attractiveness also elicits a decline in stay-over visitor of 5.0 per cent and 2.0 per cent in 2008 and 2009 respectively.[13] This shock would also result in average annual occupancy rates from decline to a low of 55.0 per cent in 2010 before recovering to 59.0 per cent in 2013, from 63.5 per cent at end 2007.



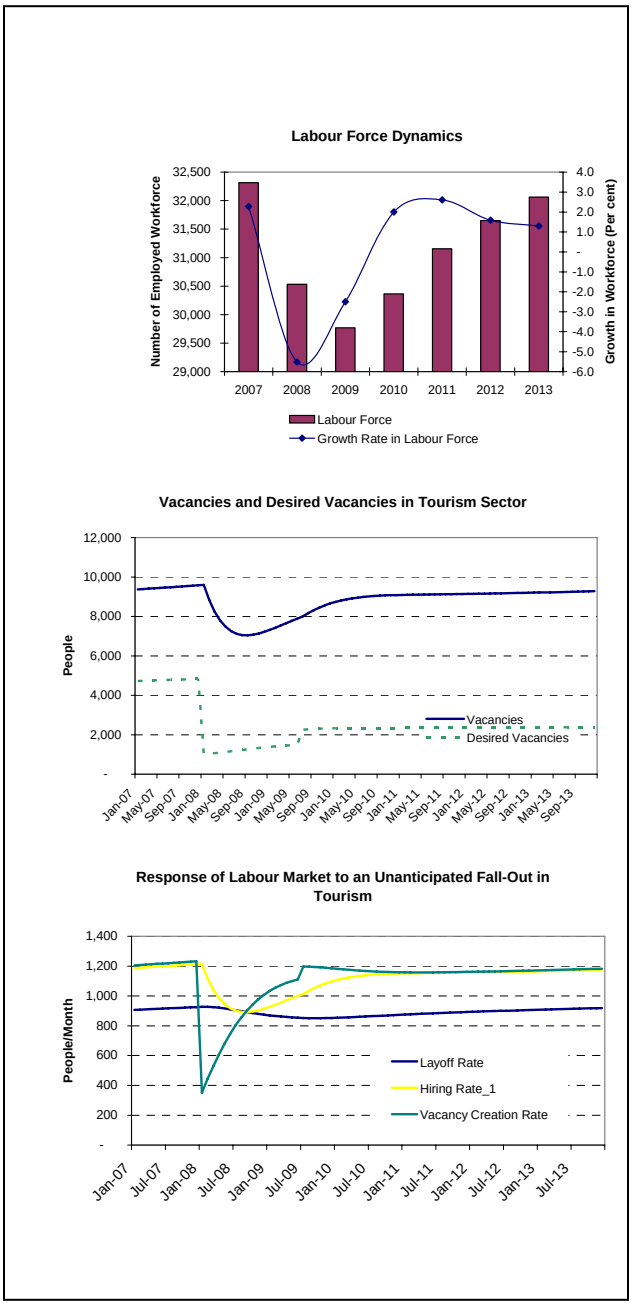


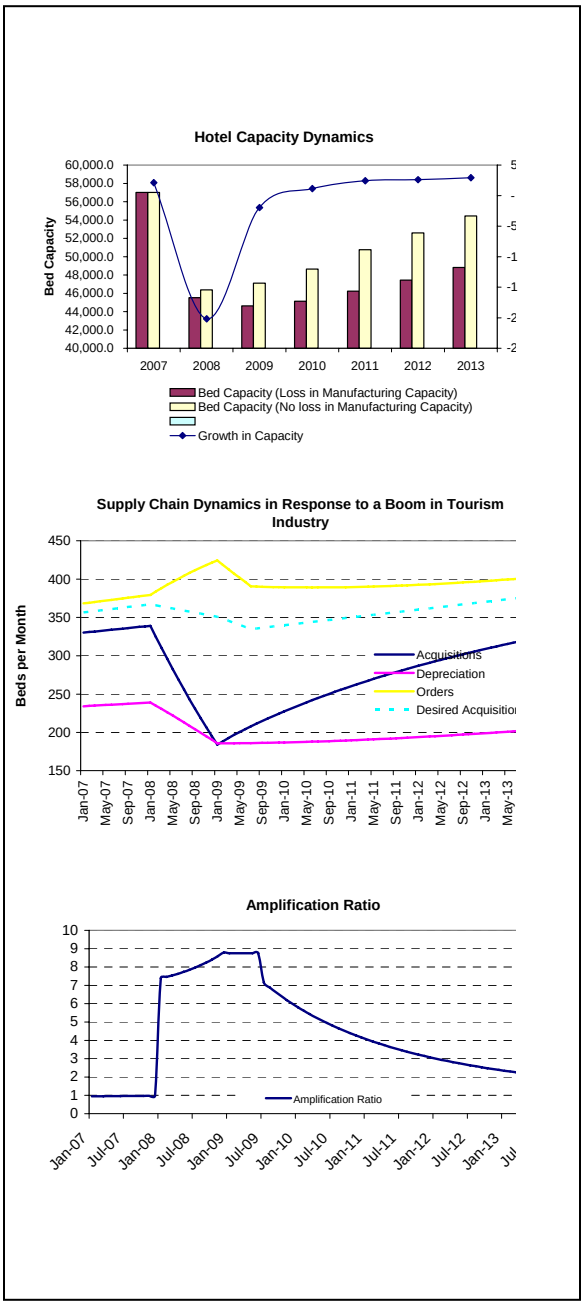
Labour Market Response

The reduction in both the capacity of the industry and the reduced demand for Jamaica's tourism product results in excess labour market conditions to prevail. In response, hoteliers reduce both their demand for desired vacancies and desired labour force decline by 64.0 per cent and 8.0 per cent, respectively. The vacancy creation rate drops precipitously by 66.0 per cent to 400.0 persons per month and the hiring rate declines to 940 per month from the third quarter of 2008 from 1 231 persons per month at end-2007. Initially, therefore hiring rate falls below both the lay-off rate and the attrition rate which induces a decline the number of workers in the industry. In particular, the labour force declines by 6.0 and 3.0 per cent in 2008 and 2009. Thereafter, the sector grows at an

[13] This shock represents a marginally larger reduction in the 99th percentile reduction in annual arrivals between 1990 and 2005.

average of 2.0 per cent as the hiring rate increases to accommodate the recovery in tourist arrivals. The labour market recovers to its pre-shock levels of 32,064 labourers at end 2013.





Supply Chain Response

The 20.0 per cent loss in bed capacity elicits a 12.0 per cent increase in the rate of orders for new beds to 424.0 beds per month as the sector seeks to build out it capacity in order to restore normalcy to the sector. However, the recovery process is exacerbated by the fact that the supply chain has also suffered loss in capacity.[14] As a result the procurement rate declined by 45.0 per cent to 185.0 beds per month. By the end of 2009, the rate of acquisition begins to rise above the rate of depreciation and rises steadily to pre-shock rates. As such the capacity of the industry rebounds gradually. This process involves long delays. By 2013 the industry is still below its pre-shock capacity of 57,024 beds by 15.0 per cent. Interestingly, if it is assumed the supply chain (manufacturers) suffered no loss in capacity then hotel industry recovery is catalyzed and reaches within 4.0 per cent of its pre-shock capacity by 2013. Again, the procurement process creates a significant increase in the amplification ratio from 1.0 to 8.9. That is, a 1.0 per cent increase in desired capacity causes an 8.9 per cent surge in the demand for new room capacity.

DISCUSSION AND POLICY RECOMMENDATIONS

Insights into Low Multipliers for the Tourism Industry

Both boom and bust scenarios yield insights into probable sources of the low multiplier effect found for Jamaica's tourism product a la Serju (2005). Experimentation with the model revealed that hotel suppliers (manufacturers) may face larger changes in demand than hotels do. Although temporary, during its disequilibrium adjustments, orders consistently overshoot their new equilibrium points. The further upstream hotel suppliers are (i.e. away from hoteliers in the supply chain), the more amplified their demand surges might be. This is a manifestation of the 'bullwhip effect.'[15] The analysis yielded amplification ratios for boom and bust scenarios as 2.8 and 8.8, respectively. These may seem benign. But as a manufacturer, the challenge of managing production costs, order cancellation costs, inventory costs and the quality of one's output in the face of such

[14] The supply chain is assumed to lose 40.0 per cent of its carrying capacity as a result of the natural disaster.

[15] Bullwhip behaviour refers to the tendency of orders to increase in variation as they are passed upstream in the supply chain (i.e., away from the final consumer).

uncertainty can make the difference between a going concern and an entity going out of business. From the perspective of the hoteliers, the need for a fast and efficient procurement process which delivers products which are on time on quality may lead them to seek alternative sources of supply, reducing demand for domestically produced manufactured goods. Imports will be the natural alternative. As such, if hotels and their suppliers resort to imports, foreign labour included, then Jamaica's economy may not gain much from the developments in the tourism industry.

Supply Chain Insights and Policy Recommendations

The logical policy recommendation seems to be that suppliers need to improve on or develop their forecasting capabilities for estimating future demand for capacity in the tourism sector. However, suppliers to the hotel industry (and policy makers) who rely on forecasting face a dilemma. In the short run, they can forecast but cannot act. In the long run, they can act but cannot forecast (Sterman JD. 2000).[16] The solution to this dilemna, which will promulgate sustainable growth of the sector, is to abandon forecasting in favour of fore-sighting. Hoteliers, policy makers and other stakeholders must opt for the flexibility and responsiveness to cover simultaneously several future states, regardless of the probabilities. These responses should cover both the best- and worse-case scenarios. Fore-sighting would help managers in the hotel and manufacturing sectors face their own internal logic and assumptions about the future and help them shape their desired outcome in constructive ways and create a culture of change in the way Jamaica approaches the prospects for sustainable growth (Geograntzas and Acar, 1995). Fore-sighting exercises have the power to break old stereotypes. Further, scenarios help rehearse the future, while enabling institutional learning in strategy-design and implementation (Sterman 2000). Assisting stakeholders to avoid surprises, and enabling them to adjust quickly to change and act effectively by facilitating proactive contingency planning. The integration of network-based tools and simulation models, such as presented in this paper, can contribute to the development of such an approach.

[16] "Those who have knowledge don't predict. Those who predict don't have knowledge" 6th-century BC poet Loa Tzu.

From an operational perspective several policy prescriptions may assist in improving the participation of domestic manufacturer's in the development of Jamaica's tourism product. Firstly, information sharing, particularly sharing information on inventory levels, has been cited as a possible countermeasure to the bullwhip effect (Croson and Donohue, 2005). Inventory information can be used to update demand estimates and lessen the impact of demand-signaling errors and delays, with suppliers enjoying most of the benefits. For example, high frequency data on the number of beds on order, number of beds that are approaching obsolescence can provide useful signals to suppliers to begin sourcing materials required to fill potential demand. These signals can thus be factored into the supplier's order (for material) decisions, resulting in lower safety stock and/ or higher service levels compared to cases where no inventory information is shared. Secondly, improving intra-sectoral communication, responsiveness and accountability through supplier integration, can be a significant source for competitive advantage. Improved partnerships with domestic suppliers, arising out of inter-sector dialogue, can help Jamaica's hoteliers focus resources on their core business.[17]

Labour Market Insights and Policy Recommendations

The insights gained from the labour market dynamics revealed that the more aggressively hotels respond to annual tourism changes, the greater the shocks they can inflict upon the economy.[18] During booms the demand for skilled and semi-skilled workers can increase considerably in a very short period of time. As noted earlier, if the demand on HR exceeds its capacity the quality of new hires may fall, diminishing the productivity of the sector. As such, having a pool of well-trained personnel who are able and ready to meet increased demand for labour is critical and underscores the importance of training and equipping personnel for increased productivity in the tourism sector. Experimentation with the model suggests that in boom the sector could require up to 9,000 new jobs to be generated over the next five years. On the other hand, because the sector tends to

[17] However, these improvements in supply-chain efficiency occur over time and primarily through the development of existing supplier capabilities rather than large-scale supplier switching.
[18] This is true especially during downturns in the sector's demand for labour.

overcompensate in regard to downturns by laying-off (or not re-hiring) large numbers of persons the type of training that these persons receive is critical.[19] Personnel need to be cross-trained in areas which have a low correlation with the accommodation and entertainment industry. In so doing, the magnitude of the structural unemployment that would emerge in a scenario of a downturn would be minimized.

[19] During the 2001 downturn, the labour force for the sector declined by approximately 2,000 laborers. This is approximately 8.0 per cent of the labour force employed directly by the accommodation sector.

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