



TOURISM AND UNEXPECTED SHOCKS

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ABSTRACT

This study investigates the process of recovery of Caribbean tourism after being subjected to a major shock. Regime-switching models are employed to decompose tourist arrivals to the region into permanent and transitory components. The paper then provides an assessment of the extent to which shocks cause permanent losses in the levels of tourist arrivals.

JEL Classification: E32; C32; O54

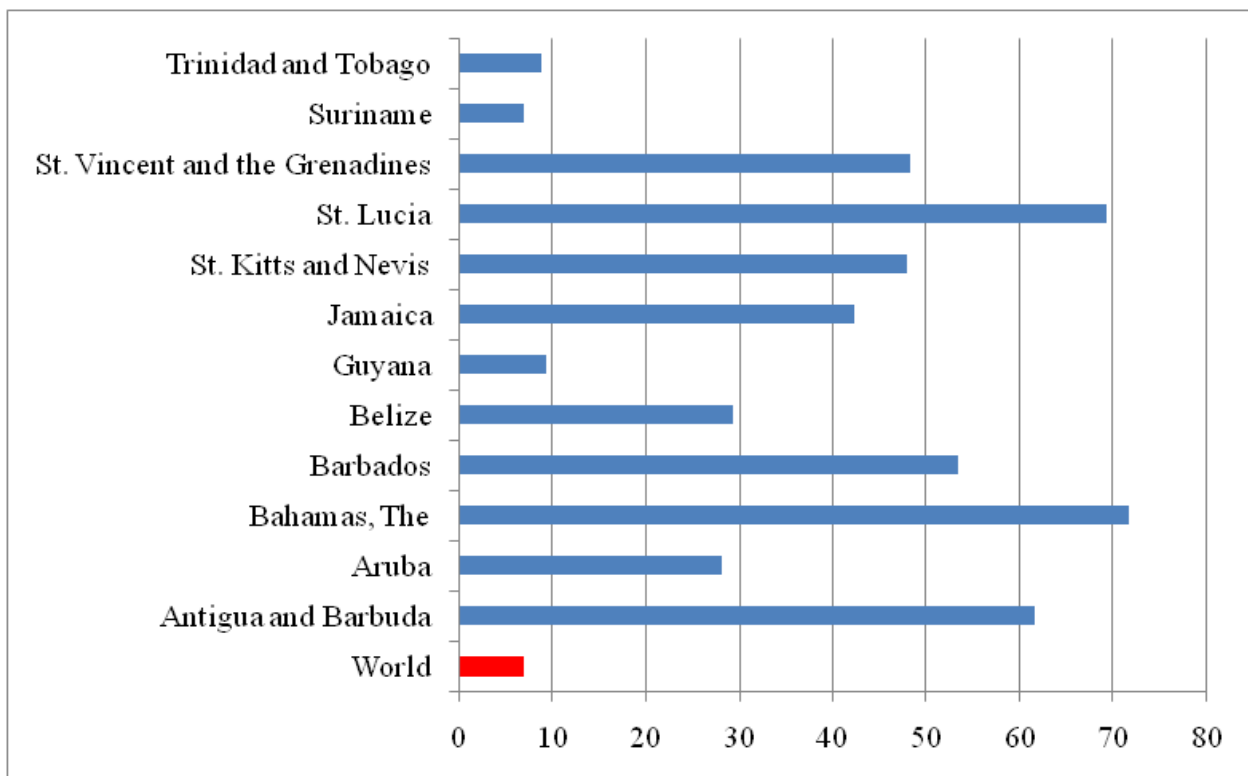
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1. Introduction

The Caribbean tourist industry has consistently been one of the most buoyant areas of regional economic activity. Between 1990 and 2005, international tourism receipts to the Caribbean more than doubled, rising from US\$8.7 billion in 1990 to US\$20.4 billion in 2005, representing an annual change of about 16 percent per year over the 15-year period (World Tourism Organisation, *Tourism Market Trends*). Figure 1 plots the average ratio of international tourism receipts as a

Figure 1: International Tourism Receipts (% of Total Exports)



Source: World Development Indicators Online

percentage of exports for 12 Caribbean countries as well as the aggregate for the world. Between 1995 and 2007, average international tourism receipts was around 40 percent for the 12 Caribbean countries, about 33 percent higher than the average for the rest of the world.

Like most other destinations, however, the industry is buffeted by shocks from time-to-time. Much of this literature has attempted to investigate whether these shocks have permanent or

temporary effects by applying non-linear unit root tests (see for example Smyth et al., 2009; Cunado et al., 2008; Narayan, 2005). If tourist arrivals have a unit root this would imply that random shocks have permanent effects on the system and therefore policymakers would need to expend significant effort in order for any recovery to take place. On the other hand, if tourist arrivals were either stationary around identified or unidentified break points, this would suggest that random shocks only have transitory effects on tourist arrivals.

While the non-linear unit root approach can answer the question of whether or not the effects of these shocks are temporary or short-lived, it implicitly assumes that all shocks are of the 'pluck' variety, i.e. large temporary shocks that dissipate over time. It is, however, possible that these shocks could lead to regime shift if, for example, the destination takes on a negative stigma. This study uses unit root tests that explicitly allows for endogenously determined mean as well as trend shifts in tourist arrivals for the 13 Caribbean countries.

The remainder of the paper is structured as follows. Following the introduction, section 2 provides a brief review of the literature assessing the effects on tourism destinations. Section 3 outlines the methodological approach employed in the study, while Section 4 provides an assessment of the transitory or permanent effects of shocks that have buffeted the Caribbean. Section 5 concludes with a summary of the results and key policy implications.

2. Literature Review

The volatility of the tourism industry has been an interest of researchers over the years. However, not much emphasis is placed on whether exogenous shocks have permanent or transitory consequences for the tourist industry. A review of the literature indicates that not until recently have researchers attempted to shed light on this matter, for example (Narayan, 2005a; Narayan, 2005b; Cunado et. al, 2008 and Au et. al, 2005). Many of these studies utilise unit root tests to identify the order of integration of tourist arrivals. The idea is if tourist arrivals are integrated of order one, then shocks to the industry would have permanent or long lasting effects. However, if arrivals were integrated of order zero, then a shock would have only temporary effects after which arrivals to the destination returns to its mean.

Narayan (2005a) formally introduced the unit root hypothesis in this area of tourism literature. The central aim of this study was to determine whether or not the 1987 military coup of Fiji had a permanent effect on tourist expenditure in that country. To examine this question, the conventional augmented Dickey-Fuller test (ADF 1979, 1981) along with the Vogelsang's structural break test is utilized. The author argued that the use of the Vogelsang's test provides the advantage of endogenously determined structural breaks, is valid for data integrated of order one or zero and can detect unknown breaks. Using annual data based on tourist expenditure from 1970-2002; this study found no unit root indicating that the 1987 coup only had a transitory impact on the tourism industry.

Despite the advantage of the endogenous one break test, these tests may lead to spurious results in the event there is more than one break in the series. Given this, Narayan (2005b) attempted to address this issue by employing the Zivot and Andrews (ZA, 1992) and Lumsdaine and Papell (LP, 1997) unit root test. First, the ZA test is specified in two models that allow a change in the intercept of the estimated equation, and the other which allows a change in the intercept and slope. The LP test is an extension of the ZA test to incorporate testing for two unknown structural breaks. These models were applied to Fiji's tourist expenditure with two breaks during 1987 and 2000 over the same period as the previous study. The ZA test indicates that tourist expenditure is stationary around the 1987 break point, leading to the conclusion that the coup at that time had a transitory impact.

In addition, the LP two break tests also found significant evidence of the break occurring at 1987. The first model where only the intercept was allowed to change identified 1985 and 1987 as the break point. However, the data was mean stationary around the 1987 break point. The model with changing intercept and slope indicated the data to have a unit root, hence, permanent impact of exogenous shocks. Overall the results show 1987 to be the break in both models, with the coup at that time having only a transitory impact.

Similar to Fiji, the unit root methodology was applied to the India tourist industry (Bhattacharya and Narayan, 2005). Use is made of the Im, Pesaran and Shin (IPS) test and the Maddala and Wu (1999) test. The major advantage of the IPS test, unlike the ADF test, is that it allows for

heterogeneous parameters across all variables, particularly the unit root autoregressive coefficient. This test was compared to the MW test, which is a non-parametric test with the main feature of testing whether the null hypothesis is one of a unit root or stationary. The results of the two tests were compared to the conventional ADF test, both the IPS and WU showed visitor arrivals to be stationary about the mean. On the other hand, the ADF test that shows the series to contain a unit root, hence, shocks would have a permanent impact. The results suggest that exogenous shocks will only have a transitory impact on the tourism industry.

The unit root test above utilizes an order of integration of $I(0)$ for a stationary process and $I(1)$ for a unit root. Unlike these studies, Cunado et al (2008) takes a different approach by using a fractional integration model with seasonal AR disturbances and an endogenously determined structural break. Rather than having a strict order of integration, 0 or 1, the authors argued that allowing the integrating factor to vary between 0 and 1 would provide an improve classification of a series. Using data on US monthly arrivals for the period 1996m1-2006m4 found that when no break is taken into account the order of integration is slightly above 0.5. However, the break is found at September 2001 when the structural break is included. The authors report that the order of integration is slightly higher than 0.5 before the attack, and slightly below 0.5 below the break. This conclusion can be interpreted as a measure of integration, where below 0.5 represents closer to transitory and above 0.5 being closer to permanent.

Unlike the studies mentioned above, papers adopting the unit root methodology have also found shocks to have permanent effects on tourism. For example, AU et al (2005) investigated the long-run impact of SARS on the Hong Kong tourism industry. This study adopts test statistics recommended by Dickey and Fuller (1979; 1981), based on the methodology of Enders (1995) with a modification introduced by Hoffman et al. (2003). This methodology allowed the authors to classify the data based on five categories: whether the series is stationary, trend stationary, random walk, random walk with drift or random walk with drift and trend. The analysis of the study indicates that 24 of the 36 countries exhibit random walk properties, implying that shocks to the system have permanent effects. Of the 12 countries which shown stationary properties, 5 were major sources of migration and labour hence. The authors argue that arrivals to and from

these countries are more business and family oriented; hence, this could be a reason why these countries display stationary properties.

The studies mentioned above highlighted the various methods of the unit root approach applied to this area of tourism literature. This study employs a similar approach by employing the Vogelsang test. As mentioned before this test has the advantage of endogenously determining structural breaks and is valid for test integrated of order one or zero. However, one way this study makes its contribution by adding a two-break specification to the Vogelsang test in the event more than one structural break exist. Another contribution is that this type of study has never been done in Caribbean tourism literature; hence, this paper is the first of its kind in the Caribbean.

Unexpected shocks, whether natural, market or governmental shocks have always been a topic of interest for researchers due to the extensive after effect associated with these phenomena. Past literature shows there have been several authors who have investigated how unexpected shocks have influenced an economy's tourism sector. Terrorism and its impact of tourism is an area frequently examined by researchers since its rapid increase from 206 acts in 1972 to 3010 acts in 1995 (Pizam and Fleischer, 2002). The consensus of these studies shows that these acts of terrorism have significant long-lasting negative effects on the tourism industry. These effects have been estimated to last up to three months after the act has occurred and can persist for up to nine months after the event has occurred (Sommez, 1994, pp43-44; Enders et al; 1992). Some researchers have studied the impact of terrorism indirectly, through the subsequent change in travel policies.

Neiman and Swagel (2009) examined the impact of changes in visa policy on short-term visitor arrivals to the United States. The authors suggest that the increased stringency in visa policies is an important factor contributing to the decline in travel to the United States. Neiman and Swagel carried out an econometric analysis on non-immigrant entries from 23 countries that were participants in the visa waiver programme to the United States. Findings from the study indicate that the decline in visits to the United States from countries requiring a visa was not larger than the decline from the countries which did not have visa requirements. This implies that the stricter

visa policy was not the cause of the sharp decline in travel to the United States, following the events of September 11th

Pizan and Fleisher (2002) also studied terrorism and its impact on the tourism sector. They hypothesized that the frequency of acts would cause a larger decline in international tourist arrivals in Israel than the severity of these acts. Two linear least squares regression models were estimated using monthly data from May 1991 through May 2001. The results showed that of the two variables, severity and the frequency, only the latter was significant and had a negative impact on tourism. These results confirm their hypothesis that the frequency of tourist attacks on Israel is more important than the severity.

Bonham *et. al* (2006) investigated the impact of 9/11 on United States and Hawaii. They reviewed recent trends in travel and tourism within these countries. In particular, reference to Hawaii, a vector error correction model was derived and dynamic forecasts were generated using quarterly data from January 1980 through to February of 2002 of tourist arrivals from the USA and Japan to Hawaii. They found that actual United States visitor arrivals exceeded the dynamic forecasts while tourist arrivals from Japan are yet to reach the levels predicted by the model. This implies that United States visitor arrivals to Hawaii had fully recovered from the 9/11 shocks.

Drakes and Kutan(2003) focused on regional effects of terrorism on tourism in Greece, Turkey and Israel. Using monthly data from January 1991 to December 2000 of tourist arrivals to these three countries, they employed a consumer-choice theoretical model which showed significant own and spillover effects on market shares. They proceeded to decompose terrorist incidents to better identify the impact and found that significant contagion effects of terrorism on market shares were present.

Instead of focusing on one type of crime, terrorist attacks, Valcarcel() generalized crime and set out to determine if there was a structural relationship between increase in tourism expenditures and the crime level in Spain. Using 162 observations of the growth of tourism-related income and crime levels spanning from January 1991 to June 2004, he carried out a VAR Approach,

structural break analysis and a critique of the Granger-cause test on the data. Findings from the study showed that there is a drastic change of structure of the Spanish growth of tourism-related income in the third quarter of 2001. He also found strong evidence that crime Granger-causes tourism but there was no drastic structural change in the crime series which should have resulted in the change in tourism-related income. He indicates this as another chink in the armor of the Granger Causality test.

In relation to disease, Min (2005) evaluated the impact of SARS on the Taiwanese inbound tourism. Monthly aggregate visitor arrivals in Taiwan from the period January 1979 to November 2003 was obtained and the SARIMA forecasting model was applied. The results indicated that following the SARS outbreak, the volume of visitors reduced significantly.

3. Empirical Approach

3.1. *Econometric*

Unexpected shocks, for example a terrorist attack or the outbreak of a disease can impact on arrivals to a particular region. It is possible that these shocks can lead to either a mean shift or a one-off dip in arrivals. To evaluate whether or not shocks to the Caribbean tend to have temporary or permanent effects, the paper employs unit root tests that explicitly allow for a break in the mean or trend arrivals.

Rather than exogenously selecting the break points, one can endogenise the selection of the break by choosing the date that gives the least favourable view of the unit root hypothesis (e.g. Zivot and Andrews, 1992; Perron and Vogelsang, 1992). Following Zivot and Andrews note that the form of the break may take one of three forms: (1) a one-time change in the level; (2) a one-time change in the trend, or; (3) one-time changes in both the level as well as the trend. Sen (2003), however, notes that while the loss in power is relatively small from using model 3 when in fact models 1 or 2 are correct are relatively small compared to choosing model 1 or 2 when in fact the correct model is model 3. Therefore the unit root test equation used is of the following form:

$$\Delta y_t = c + \alpha y_{t-1} + \sum_{j=1}^k d_j \Delta y_{t-j} + \phi DU_t + \lambda DT_t + \varepsilon_t \quad (1)$$

where y_t is the log of tourist arrivals, Δ is the differenced operator, DU is a mean shift dummy variable at a given break date, DT is a trend shift variable while ε is the error term which is assumed to have normal properties.

The breakpoints and the trend shifts are chosen to minimise the one-sided t-statistic for $\alpha = 0$. To avoid any distortion caused by the presence of end points the trimming region is set to 0.15T and 0.85T as recommended by Zivot and Andrews. The null-hypothesis that the series has a unit root, i.e. $\alpha = 0$, is evaluated by comparing the t-statistics obtained from Equation (1) to the critical values suggested by Zivot and Andrews.

The Zivot and Andrews (1992) test is, however, quite restrictive since it only allows for one level and trend shift over the entire sample period. To address this shortcoming, Lee and Strazicich (2003) extends the model above to allow for two levels and trend shifts. The model considered is therefore of the following form:

$$\Delta y_t = c + \alpha y_{t-1} + \sum_{j=1}^k d_j \Delta y_{t-j} + \phi_1 DU_t^1 + \phi_2 DU_t^2 + \lambda_1 DT_t^1 + \lambda_2 DT_t^2 + \varepsilon_t \quad (2)$$

Similar to the Zivot and Andrews test, the LM test is carried out by comparing the t-statistic for α to the critical values calculated by Lee and Strazicich. The maximum lag length for all tests is set to 12.

3.2 Data

The study uses monthly data on nineteen Caribbean countries: Antigua and Barbada, Aruba, Bahamas, Barbados, Bermuda, British Virgin Islands, Cayman Islands, Curacao, Dominica, Dominican Republic, Jamaica, Grenada, Martinique, St. Kitts & Nevis, St. Lucia, St. Maarten, St. Vincent and the Grenadines, Trinidad and Tobago and the US Virgin Islands. The data were obtained from the Caribbean Tourism Organisation Statistical Database (online edition). Table 1 provides summary statistics for monthly long-stay arrivals between 1997 and 2007, while Figure 1 plots monthly arrivals for the Caribbean countries under investigation.

The highest mean arrivals were in the Dominican Republic and the Bahamas at over 100,000 tourists per month. The Dominican Republic also had the highest number of arrivals in any given month: in July of 2006, the country reported that over 420,000 individuals visited the island. Despite the greater number of visitors to the Dominican Republic, volatility was also significantly higher relative to other Caribbean islands. While the average volatility (measured by the coefficient of variation of monthly arrivals) was 0.437, measured volatility in the Dominican Republic was 0.693. The British Virgin Islands, Dominica, Grenada, Martinique and St. Kitts & Nevis also had above average volatility. Of the Caribbean countries investigated, Curacao was the least volatile. Corroborating evidence regarding the volatility of our target group of exchanges can also be obtained by examining Figure 1.

With the exception five Caribbean countries, the distribution of arrivals to most Caribbean countries tends to be skewed to the right, i.e. long right tails. The measure of excess kurtosis for most of the countries also suggests that the distribution is relatively flat. The non-normality of monthly arrivals to the region is also confirmed by the significance of the Jarque-Bera statistic.

4. Results

The unit root tests with one and two breaks are applied to the monthly arrivals series for each of the 19 Caribbean countries. Table 2 shows the results for the unit root test with one break. The unit root null is rejected for every country at a 1% level except for Trinidad and Tobago, due to insufficient observations. With the exception of Bermuda, BVI and St. Vincent and the Grenadines the mean shift dummy variable was statistically significant at 5% level or better. In relation to the trend variable, Bahamas, Bermuda, Cayman Islands St. Marteen, St. Vincent & Grenadines were the only countries not significant at 10% or better.

With the exception of the US Virgin Islands, all the other countries reported break dates in the 1980s. Seven countries (Antigua, Barbados, Dominican Republic, Grenada, St. Kitts-Nevis, St. Lucia and St. Maarten) had break dates in either 1983 or 1984. Around this time, the Iran/Iraq war caused oil prices to rise again just when countries were recovering from the oil crisis of the

1970s. As a result, many of the major source markets for Caribbean countries entered into recessions. In particular, between July 1981 and November 1982, the US economy shrank by 2.6 percent. For some countries (Aruba, the Bahamas, Bermuda, Cayman Islands, Dominica and Martinique), the effects of this recession lasted into the late 1980s.

Table 3 provides the results for the unit root test with two breaks. Data for some countries were not enough to support to breaks in the data, as a result some countries are excluded from the table. In the case of Antigua, Grenada and Jamaica, the unit root hypothesis was rejected at a 1% level, while for Aruba and Barbados it was rejected at 5% level. Only in the case of Curacao was the unit root hypothesis, rejected at a 10% level and Bahamas and Cayman Islands were not significant at 10% or better. In relation to the mean shift and trend dummy variables, only two countries were these variables not significant at 10% or better: the Cayman Islands and Jamaica. In both of these countries, the first trend dummy variables were insignificant up to 10%.

5. Conclusions

The results provided in the paper suggest that the unit root hypothesis could not be accepted at normal levels of testing for most Caribbean countries. These results therefore suggest that shocks to the Caribbean tourist industry tend to only have temporary rather than permanent effects. Nevertheless, there were significant break points that impacted on mean arrivals over the period, but arrivals rebounded after these significant breaks. We see that most of the breaks occur in the 1980s and a few in the 1990s. One explanation for this is the occurrence of different financial crises in the USA that would affect the incomes of many and change their spending habits. Another observation noted is that only one country had a break after the terrorist attacks in 2001 but their unit root was not significant at any level.

References

- Bonham, C., Edmonds C. and Mark, J. (2006) “ The Impact of 9/11 and Other Global Events on Tourism in the United States and Hawaii,” *Journal of Travel Research*, Vol. 45(): 99.
- Cunado, J., Gil-Alana, L. and Gracia, F. (2008) “Fractional Integration and Structural Breaks: Evidence from International Monthly Arrivals in the USA,” *Tourism Economics*, Vol. 14(1): 13-
- Drakos, K. and Kutan A. M. (2003) “Regional Effects of Terrorism on Tourism in Three Mediterranean Countries,” *The Journal of Conflict Resolution*, Vol. 47(5): 621-641.
- Lee, J. and Strazicich, M.C. (2003) “Minimum Lagrange Multiplier Unit Root Test with Two Structural Breaks,” *Review of Economics and Statistics*, Vol. 85(): 1082-1089.
- Moore, W. and Whitehall, P. (2005) “The Tourism Area Lifecycle and Regime Switching Models,” *Annals of Tourism Research*, Vol. 32(1): 112-126.
- Min, J. C. H. (2005) “The Effect of the SARS Illness on Tourism in Taiwan: An Empirical Study,” *International Journal of Management*, Vol. 22(3): 497-508.
- Narayan, P.K. (2005) “Did Rabuka’s Military Coups have a Permanent Effect or a Transitory Effect on Tourist Expenditure in Fiji: Evidence from Vogelsang’s Structural Break Test,” *Tourism Management*, Vol. 26(): 509-515.
- Neiman, B. and Swagel, P. (2009) “The Impact of post-9/11 visa policies on the travel to the United States,” *Journal of International Economics*, Vol. 78(): 86-89
- Pizam, A. and Fleisher, A. (2002) “Severity versus Frquenc of Acts of Terrorism: Which Has a Larger Impact on Tourism Demand?,” *Journal of Travel Research*, Vol 40: 337
- Sen, A. (2003) “On Unit Root Tests when the Alternative is a Trend Break Stationary Process,” *Journal of Business and Economic Statistics*, Vol. 21(): 174-184.
- Smyth, R., Nielsen, I. and Mishra, V. (2009) “I’ve been to Bali too’ (and I will be going back): Are Terrorist Shocks to Bali’s Tourist Arrivals Permanent or Transitory?” *Applied Economic*, Vol. 41(11): 1-xx
- Valcareel, V. () “The Impact of Crime on Tourism Revenues in Spain: VAR Approach, a Structural Break Analysis and A Critique of Granger-Cause Test”
- Zivot, E. and D.W.K. Andrews (1992) Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis, *Journal of Business and Economic Statistics*, 10, pp. 251-270.

Table 1: Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Observations
Antigua	14504.710	29441.000	3272.000	0.388	-0.076	2.253	8.999 (0.011)	372
Aruba	38329.660	77723.000	10010.000	0.495	-0.037	1.485	35.668 (0.000)	372
Bahamas	119472.600	192455.000	28933.000	0.256	0.029	2.564	2.907 (0.234)	360
Barbados	36236.460	63841.000	13260.000	0.251	0.046	2.706	1.473 (0.479)	372
Bermuda	31981.810	58087.000	7312.000	0.425	-0.216	1.786	25.761 (0.000)	372
British Virgin Islands	17710.980	48315.000	3357.000	0.528	0.617	2.566	23.926 (0.000)	336
Cayman Islands	19762.770	44540.000	1968.000	0.482	0.276	2.090	17.569 (0.000)	372
Curacao	15978.190	37103.000	5946.000	0.246	0.288	5.280	85.686 (0.000)	372
Dominica	4073.739	9935.000	183.000	0.545	0.350	2.164	17.245 (0.000)	348
Dominican Republic	150480.100	420265.000	12638.000	0.693	0.469	2.233	19.835 (0.000)	324
Jamaica	77592.660	195409.000	14782.000	0.478	0.424	2.616	13.444 (0.001)	372
Grenada	6913.462	17381.000	0.000	0.536	0.303	2.267	14.000 (0.001)	372
Martinique	28821.830	65353.000	4110.000	0.546	0.430	2.035	24.246 (0.000)	348
St. Kitts & Nevis	6054.131	14710.000	756.000	0.499	0.477	2.850	13.968 (0.001)	360
St. Lucia	15869.160	38901.000	3416.000	0.463	0.186	2.016	15.503 (0.000)	336
St. Maarten	35142.320	64690.000	8739.000	0.348	-0.086	2.218	9.298 (0.010)	348
St. Vincent and the Grenadines	4837.931	11862.000	875.000	0.445	0.920	3.853	61.709 (0.000)	360
Trinidad and Tobago	24692.640	54255.000	9478.000	0.407	0.624	2.517	20.586 (0.000)	276
US Virgin Islands	51316.470	83932.000	12866.000	0.263	-0.292	2.761	5.571 (0.062)	336

Table 2: Unit Root Test with One Break

	Date of Break	Lag Length	β	DU	DT
Antigua	82/370; 1983 M10	1	-0.540 (-11.784)	0.314 (7.267)***	0.001 (5.865)***
Aruba	142/370; 1988 M10	0	-0.350 (-9.110)	0.290 (7.840)***	0.001 (5.329)***
Bahamas	123/354; 1987 M8	5	-1.28 (-17.471)	0.316 (9.685)***	0.000 (0.729)
Barbados	84/370; 1983 M12	1	-0.808 (-14.419)	0.093 (3.213)**	0.001 (8.476)***
Bermuda	122/364; 1987 M3	7	-1.377 (-15.923)	0.124 (3.315)	-0.003 (-11.135)
British Virgin Islands	60/331; 1981 M12	4	-0.729 (-11.453)	0.080 (1.022)	0.003 (9.215)**
Cayman Islands	118/371; 1986 M10	0	-0.322 (-8.537)	0.275 (5.075)***	0.000 (0.267)
Curacao	72/371; 198 M12	0	-0.434 (-10.136)	-0.118 (-4.137)***	0.001 (7.208)***
Dominica	142/347; 1988 M10	0	-0.902 (-17.020)	0.709 (10.845)***	0.003 (7.965)***
Dominican Republic	77/320; 1983 M5	1	-0.641 (-12.590)	0.478 (9.481)***	0.004 (11.475)***
Grenada	95/371; 1984 M11	0	-0.829 (-16.182)	0.672 (7.612)***	0.003 (6.825)***
Jamaica	58/370; 1981 M10	1	-0.569 (-12.218)	0.216 (5.576)***	0.002 (10.057)***
Martinique	121/342; 1987 M1	1	-0.581 (-12.647)	0.434 (8.048)***	0.002 (6.317)***
St. Kitts-Nevis	96/358; 1984 M12	0	-0.456 (-10.352)	0.352 (5.88)***	0.001 (4.085)***
St. Lucia	95/335; 1984 M11	0	-0.459 (-10.083)	0.197 (5.354)***	0.002 (8.141)***
St. Maarten	94/346; 1984 M10	1	-0.423 (-9.657)	0.317 (6.45)***	-0.000 (-0.732)
St. Vincent-Grenadines	58/356; 1981 M10	1	-0.832 (-14.150)	0.0097 (1.676)	0.003 (9.843)
Trinidad and Tobago	-	-	-	-	-
US Virgin Islands	25/334; 1995 M9	1	-0.443 (-9.883)	-0.151 (-3.561)***	0.002 (3.266)***

Table 3: Unit Root Test with Two Breaks

	Date of Break	Lag Length	β	DU1	DU2	DT1	DT2
Antigua	82/359; 1983 M10	12	-0.563	0.210	-0.198	0.003	-0.001
	225/359; 1995 M9		(-5.896)***	(5.192)***	(4.767)***	(4.672)***	(2.239)**
Aruba	111/359; 1988 M3	12	-0.278	-0.057	0.0382	0.006	-0.006
	160/359; 1990 M1		(-5.336)**	(-2.038)***	(1.159)	(5.010)***	(-4.926)***
Bahamas	51/347; 1981 M3	12	-0.719	-0.077	-0.070	0.003	-0.003
	127/347; 1987 M7		(-4.756)	(-1.882)*	(1.875)*	(3.243)***	(-3.294)***
Barbados	63/359; 1982 M3	12	-0.354	-0.074	-0.092	-0.002	-0.001
	161/359; 1990 M6		(-5.324)**	(-3.522)***	(-4.220)***	(4.798)***	(-3.637)***
Bermuda	114/359; 1986 M6	12	-0.347	0.024	-0.129	-0.001	0.002
	288/359; 2000 M12		(-3.644)	(1.178)	(-3.409)***	(-3.091)***	(3.774)***
British Virgin Islands							
Cayman Islands	108/359; 1985 M12	12	-0.256	0.167	-0.515	0.000	0.018
	332/359; 2004 M8		(-4.177)	(3.301)***	(-5.010)***	(1.020)	(5.462)***
Curacao	75/359; 1983 M3	12	-0.460	-0.264	0.121	0.003	0.003
	138/359; 1988 M7		(-5.248)*	(-5.484)***	(2.571)**	(3.264)***	(-2.796)***
Dominica							
Dominican Republic							
Grenada	81/359; 1983 M9	12	-0.377	7.478	8.055	-7.603	7.604
	83/359; 1983 M11		(-7.574)***	(14.511)***	(34.677)***	(-23.371)***	(23.374)***
Jamaica	73/359; 1983 M1	12	-0.393	0.159	0.126	0.000	0.001
	153/359; 1989 M9		(-5.895)***	(4.694)***	(4.322)***	(0.267)	(1.949)*

Note: Two break unit root tests for Martinique, St. Kitts-Nevis, St. Lucia, St. Maarten, St. Vincent and the Grenadines, Trinidad and Tobago and the US Virgin Islands are not applicable.

Critical Values for One break Unit Root Test

Level	1%	5%	10%
LM	-4.239	-3.566	-3.211

Critical Values for 2 break Unit Root Test

Level	1%	5%	10%
LM	-5.823	-5.286	-4.989

Figure 1: Long-Stay Arrivals

