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Effects of Price and Income on International Travel to the Dominican Republic: Co-integration and Causality Results

Santiago Grullón[1]

Abstract

This article examines the impacts of relative-prices and income on visiting friends and relatives (VFR) travel to the Dominican Republic during the period 1990-2012. Using the 'bounds' testing approach to co-integration, the results show the existence of a co-integrated relationship between relative-prices, US per capita income, and VFR travel. The long-run estimated relative-price demand elasticity is below unity and thus indicates that variations in relative-prices have no impact on VFR travel. However, the estimated income demand elasticity shows that VFR travel to the Dominican Republic is a luxury item. Moreover, Granger causality results show that relative-prices do not cause VFR travel from the US. There is also evidence of the existence of a causal linkage running from US per capita income to VFR travelers, and from US per capita income to relative- prices.

Key words: price/income tourism demand elasticities, autoregressive distributed lag (ARDL), unrestricted error correction model, 'bounds' test for co-integration, Granger causality

JEL classification: C32, C51, F14, F20

1. Introduction

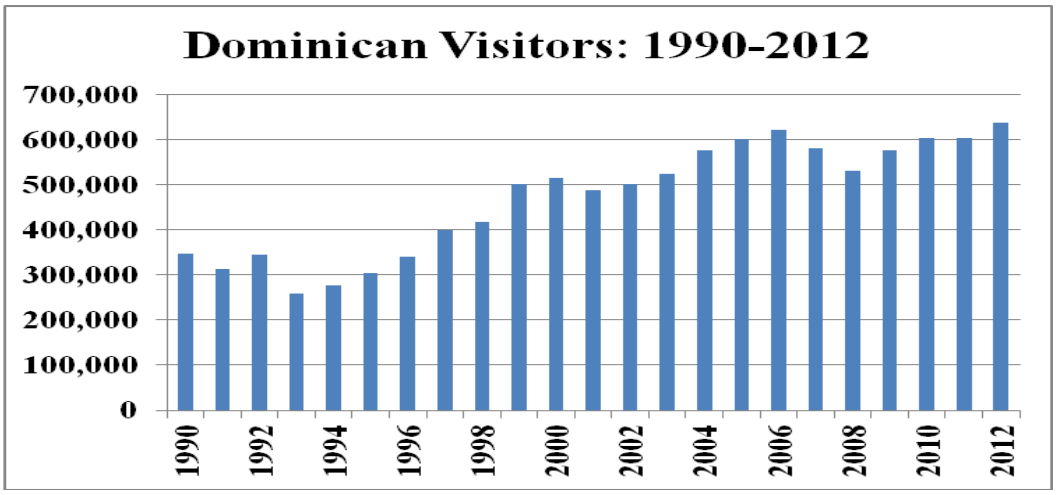
The analysis of the determinants of the demand for international tourism has recently been the focus of empirical tests. Asemota and Bala (2012) use co-integration and an error correction model to investigate the long-run and short-run relationship between visitors to Japan from five major Western countries. Their results show that while tourism in Japan is price inelastic for all five countries studied, it is a luxury item for visitors from four of the five countries. Onafowora and Owoye (2012) employ the bounds testing approach to co-integration to construct a tourism demand function for travel from Canada, Germany, the United Kingdom, and the United States to the Bahamas, Barbados, Jamaica, and St, Lucia. The empirical results indicate the existence of a unique long-run relationship between tourist arrivals, per capita real income, tourism prices and transport costs. The findings also show that travel to these destinations is a luxury item, but is price inelastic. Salleh *et al*. (2008) employ the bounds testing approach to co-integration to investigate the long-run and short-run relationships among tourist arrivals from seven Asian countries to Malaysia and tourism price, substitute price, travelling cost, income and exchange rate. The empirical results show that in the long-run and short-run these five variables are the major determinants of Malaysia's tourism demand. They also show that tourism in Malaysia is a luxury item for visitors from three of the seven countries studied and has an above-unity price demand elasticity. Brida *et al*. (2008) apply the Johansen co-integration analysis to investigate the long-run effects of US visitors to Mexico. The empirical results show the existence of a long-run relationship between US per capita income, relative-prices, public investment, and US travel to Mexico. The income elasticity of demand demonstrates that tourism is a luxury good for US visitors. Results from Granger causality tests confirm the presence of causal linkages running from US per capita income to US travel to Mexico, and from US per capita income to US visitors to Mexico, and from US visitors to

[1] Senior Director of Research and Analysis, NYC & Company
Adjunct Professor, Mercy College

Mexico to relative- prices. Their interpretation of the reverse causality of the latter result is that US travelers do not visit Mexico because of lower relative-prices, but rather that relative-prices rise because of increased tourism.

Ouerfelli (2008) applies the Johansen and Juselius co-integraton method to quarterly data from 1981 to 2008 to estimate the long-run tourism demand elasticities of visitors from Germany, France, the United Kingdom, and Italy to Tunisia. The long-run co-integration results of the effects of income show that tourism in Tunisia is a luxury item for tourists from France and Italy, but a necessity for visitors from Germany and from the United Kingdom. All the long-run relative-price coefficients are above-unity and thus confirm that variations in prices can impact travel from these countries. Garín-Muñoz (2007) applies a dynamic model to a panel data set consisting of inbound German tourism in 17 Spanish destinations to examine German demand for tourism in Spain. The empirical results suggest that tourism demand in the previous period has an important effect on current tourism demand. The findings also indicate that the demand for tourism in Spain is a luxury good for German visitors and has an above-unity responsiveness to changes in relative-prices and in the cost of travel between Germany and the destinations.

Figure 1 shows the total number of Dominican nationals that arrived in the country during the period 1990-2012 to visit friends and relatives (VFR). Over the course of this 23-year period, the number of VFR arrivals nearly doubled, despite registering declines in 1991, 1993, 2001, 2007 and 2008 and showing no change in 2011. The strong performance of this segment of the international tourism sector of the Dominican economy makes this an ideal case to quantify the impact of relative-prices and income on VFR travel to the Dominican Republic.



The approach is as follows. First, we use the 'bounds' testing approach to the analysis of level relationship of Pesaran *et al*. (2001) to investigate the existence of a co-integration relationship between relative-prices, US real per capita income and VFR arrivals. Second, we estimate the long-run coefficient of the responsiveness of tourist arrivals to relative-prices and US per capita income using a method developed by Bårdsen (1989) for error correction models. Thirdly, we use Granger Pairwise causality tests to determine the direction of causality among the variables of interest. The rest of this study is organized as follows. The method, variables, and data employed to conduct the empirical analysis are presented in the section titled "Estimation Technique, Variables, and Data Sources" section. Empirical results are discussed in the section titled "Determinants of VFR Travel to the Dominican Republic – Empirical Results." The "Conclusion" section summarizes the key findings of the study.

2. Estimation Technique, Variables, and Data Sources

The econometric methodological framework for conducting the empirical analysis uses the 'bounds' testing approach to the analysis of level relationships of Pesaran *et al*. (2001). Using an autoregressive

distributed lag (ARDL) model to estimate an unrestricted error correction model (UECM), these researchers have developed a method that takes into consideration whether the variables under consideration are stationary or non-stationary. The former are characterized by fixed deterministic trends over time, whereas the latter are distinguished by random stochastic trends with respect to time. Failure to take into account the time series properties of the underlying variables can lead to spurious results and invalid inferences. This can happen, for instance, when an explanatory variable, which is stationary at level [known as an $I(0)$ variable] is regressed with another variable, which is non-stationary at level but is first-differenced stationary (known as an $I(1)$ variable]; then this would indicate a statistical relationship between the variables when in fact none exists, and thus leading to unreliable statistical inferences. One way to avoid the problems of 'spurious results' is to estimate a dynamic function which includes lagged dependent and independent variables, i.e., an error correction model (ECM). An error correction model is dynamic model "in which the change of one of the series is explained in terms of the lag of the difference between the series and lags of the differences of each series" …"[d]ata generated by such a model are sure to be co-integrated" (Granger 2004:422). This follows directly from Granger's Representation Theorem which states that if the dependent variable and the independent variable(s) are co-integrated, then an ECM representation generates co-integrated series (Engle and Granger, ibidem). According to Harris (1995:25), "the practical implications of Granger's theorem for dynamic modelling is that it provides the ECM with immunity from the spurious regression problem, provided that the terms in levels co-integrate." The 'bounds' testing approach has been chosen to conduct the econometric analysis of this research project because it offers the following advantages over alternative procedures. It can be reliably used to estimate and test hypotheses on the long-run coefficients irrespective of whether the underlying regressors are purely $I(0)$, purely $I((1)$, or mutually co-integrated. Therefore, unlike other applications of co-integration analysis, which require that the order of integration of the underlying regressors be ascertained prior to testing the existence of a long-run relationship between the dependent variable and the independent variables, this method does not necessitate a precise identification of the order of integration of the underlying data. It thus eliminates the uncertainty associated with pre-testing the order of integration; this can be particularly troublesome in studies that have a small sample size as is the case in the present study.

Thus, the relationship between relative-prices, income and Dominican VFR travelers can be represented by the following ARDL/UECM equation:

$$\Delta \log VFR = \alpha_0 + \alpha_1 \log P_{t-i} + \alpha_2 \log Y_{t-i} + \alpha_3 \log VFR_{t-i}$$

$$+ \sum_{i=0}^{l_3} \alpha_4 \Delta \log P_{t-i} + \sum_{i=0}^{l_3} \alpha_5 \Delta \log Y_{t-i} + \sum_{i=1}^{l_3} \alpha_6 \Delta \log VFR_{t-i} + \mathrm{Dum}VFR + u_t \qquad (1)$$

where Δ is the first difference operator, VFR is the number of Dominican visiting friends and relatives annually. We are assuming that the majority of VFR travelers to the Dominican Republic come from the United States, as the US has the highest concentration of Dominicans. This notion is based on Brown and Patten (2013), who used data from the US Census Bureau's American Community Survey to show that an estimated 1.5 million Hispanics of Dominican origin resided in the United States in 2011. P is a measure of relative-prices expressed by the consumer price index (CPI) of the Dominican Republic divided by the consumer price index (CPI) of the United States. Y is a measure of foreign income represented by the US real per capita income. DumVFR is a dummy variable with value 0 for 1991, 1993 2001, 2007, 2008, and 2011 to capture declines in VFR arrivals during the first five years and zero growth during 2011 and 1 for the other years. The variable u is the error term. The tourism demand function is hypothesized to follow the law of demand. Thus, it is expected that α_1 will be negative and α_2 positive.

In performing the ARDL/UECM estimation, the maximum number of lags of the terms in levels is set equal to one, and on the first-differenced variables the process starts off from a maximum of three lags, then the optimum number is chosen based on the Akaike's Information Criterion (AIC), the Ramsey RESET test, and the R^2. Thus, the formulation with the lowest AIC, the Ramsey RESET test results for the best-fit specification, and the highest R^2 is selected. We then use the approach developed by Pesaran *et al*. (2001:8) to test for the absence of any level relationship between the dependent variable and the set of regressors via the exclusion of the lagged level explanatory variables by imposing the following restrictions on the estimated long-run coefficients of the tourism demand equation:

$$H_o : \alpha_1 = \alpha_2 = \alpha_3 = 0 \text{ (no co-integration exists)}$$

$$H_A : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq 0 \text{ (co-integration exists)}$$

Pesaran *et al*. (ibidem) provide two sets of critical value bounds covering the two polar cases of the included lagged level explanatory variables (Table 1 below). The first is the lower bound set of critical values which assumes that all the explanatory variables are integrated of order zero [*I*(0)], while the upper bound critical values assume that all the explanatory variables are integrated of order one [*I*(1)]. For a given significance level of the lagged level explanatory variables, if the calculated *F*-statistic lies outside the respective bounds of the critical values, then conclusive inference can be made about the characteristic of the underlying regressors without having to know their order of integration/co-integration status. If the computed *F*-statistic falls below the lower bound, for example, then this would lead us to conclude that there is no co-integration relationship between the dependent variable and its determinants. If, on the other hand, the computed *F*-statistic exceeds the upper bound of the critical value, then the alternative hypothesis of co-integration relationship between the dependent variable and the independent variable(s) will be accepted. However, if the computed *F*-statistic falls within the respective critical bound values, then the inference of co-integration, or the lack thereof, between the dependent variable and its determinants will be inconclusive, and the order of integration of the regressors would need to be determined before any statistically valid inferences can be made.

Table 1: Critical Value Bounds for the Wald *F*-Statistic

Level of Significance	Lower Bound Value *I*(0)	Upper Bound Value *I*(1)
1%	5.15	6.36
5%	3.79	4.85
10%	3.17	4.14

Source: Pesaran *et al.* (2001), Table C1.iii:Case III: Unrestricted intercept and no trend.

After having established a long-run co-integration relationship between relative-prices, US per capita income and VFR travelers from the US to the Dominican Republic, and following Bårdsen (1989), the long-run elasticity derived for the relative-price variable (ψ) is $-(\alpha_1/\alpha_3)$ and for the income demand variable (π) is $-(\alpha_2/\alpha_3)$. We then proceed to apply Pairwise Granger causality tests to establish whether there is a causal association between relative-prices, US per capita income and VFR travelers from the US to the Dominican Republic. Data on the number of VFR visitors, the consumer price index (CPI) of the Dominican Republic Dominican were downloaded from the Dominican Central Bank's web site. Data on the US consumer price index (CPI) were downloaded from the US Bureau of Labor Statistics's web site. Following Serrano *et al*. (1999) the data used in the econometric analysis were converted into index numbers with 1991 = 100.

3. Determinants of VFR Travel to the Dominican Republic – Empirical Results

Table 2 contains the estimates of the tourism demand function for VFR visitors. The Wald *F*-statistic is 7.82 and exceeds the upper bounds value at all three levels of significance (see Table 1 above). This result shows that there exists a co-integrated relationship between VFR visitors, relative-prices, and US per capita income. The variable for the estimated long-run relative price elasticity of VFR visitors volume has the correct sign (-0.12), but its low value indicates that the volume of VFR visitors is price inelastic. However, the estimated long-run foreign income demand elasticity has a value of +3.22 and thus shows that VFR travel volume is strongly responsive to variations in US real per capita income and is a luxury item. The estimated equation passes a battery of diagnostic tests. The Breusch-Godfrey's LM test for serial correlation rejects the presence of serial correlation. The Breusch-Pagan-Godfrey test rejects the existence of first and second order heteroskedasticity in the disturbance term. The Ramsey RESET specification test shows no general equation specification error. The plots of the CUSUM test (Chart 1) and the CUSUM test (Chart 2) reveal that the estimated parameters are stable over the sample period.

Table 2: Estimated ARDL/UECM for VFR Visitors, 1990-2012

Variable	Coefficient	*t*-Statistic	Probability
Constant	-9.99	-3.69	0.004
Log*P* (-1)	-0.12	-1.34	0.211
Log*Y* (-1)	3.22	3.85	0.003
Log*VFR* (-1)	-1.00	-4.75	0.001
Dlog*P*	-0.10	-0.58	0.574
Dlog*Y*	1.68	1.66	0.128
Dlog*Y* (-2)	-1.79	-1.78	0.105
Dlog*VFR* (-1)	0.29	2.12	0.060
Dlog*VFR* (-2)	0.34	2.55	0.029
Dum*VFR*	0.12	3.96	0.003
Elasticity			
Price (ψ)	-0.12		
Income (π)	3.22		
Model Criteria			
R^2	0.90		
Adjusted R^2	0.81		
DW	2.80		
SER	0.05		
F-statistic	9.94		
Wald *F*-Test	7.82		0.006
Diagnostic Tests			
Breusch-Godfrey LM	1.52		0.277
Breusch-Pagan-Godfrey	0.46		0.871
Ramsey RESET	0.14		0.719

Dependent Variable: VFR Visitors
Included observations: 19 after adjusting endpoints

Chart 1: CUSUM Test for ARDL/UECM for VFR Visitors, 1990-2012

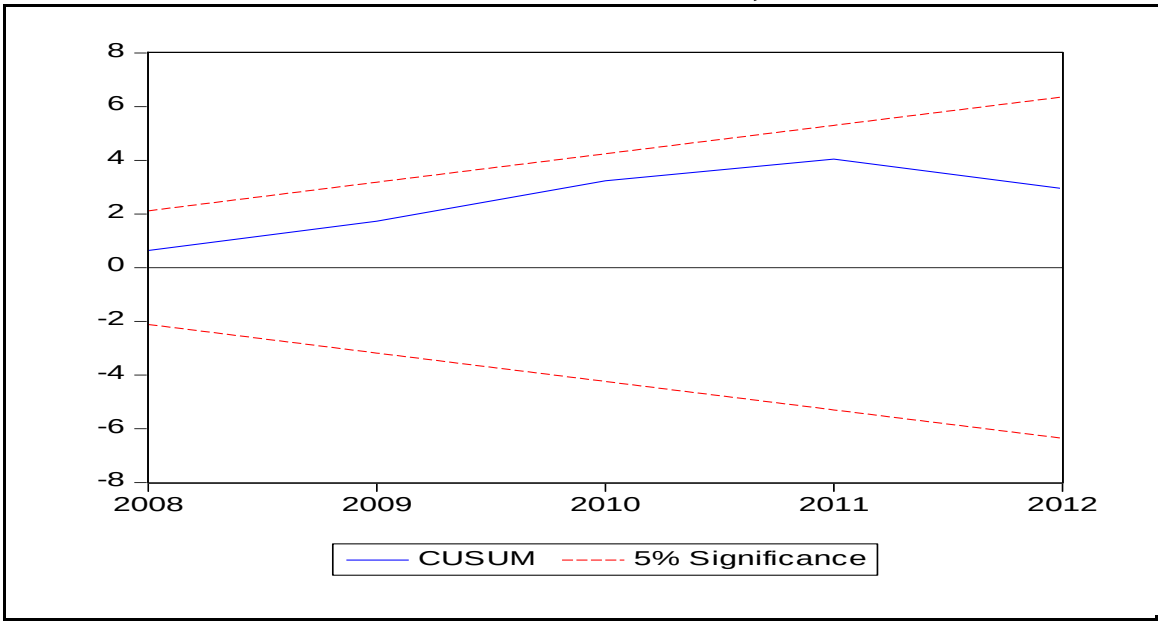


Chart 2: CUSUM of Squares Test for ARDL/UECM for VFR Visitors, 1990-2012

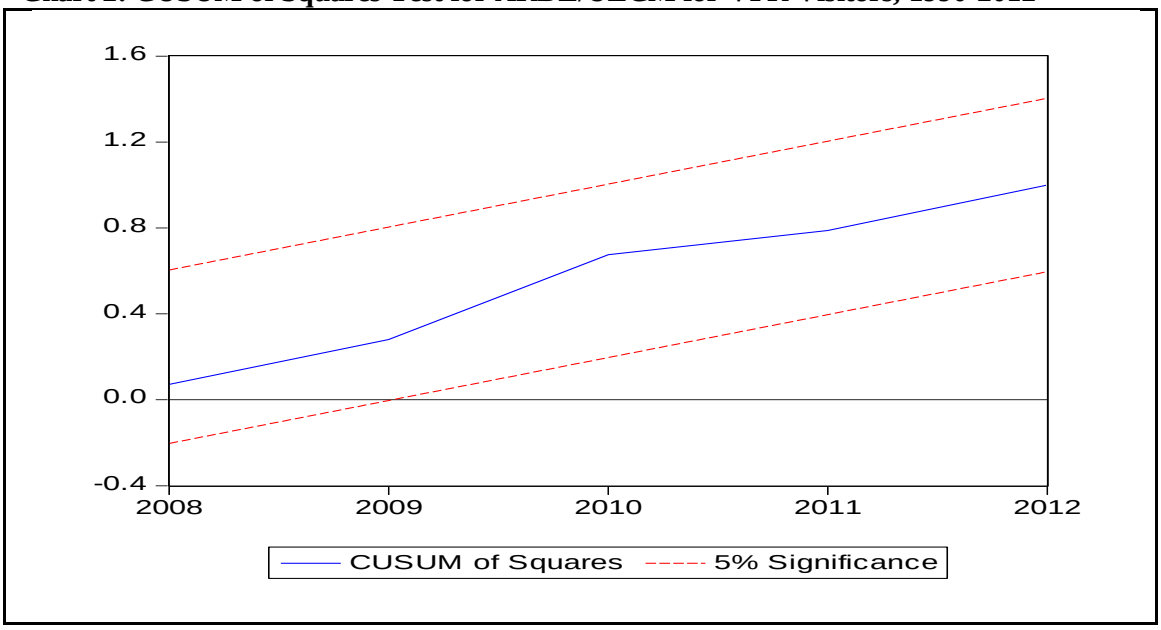


Table 3 presents the results of applying Pairwise Granger causality tests to establish whether there is a causal association between relative-prices, US per capita income and VFR travelers from the US to the Dominican Republic. These show that relative-prices do not cause VFR travel from the US. In fact, what we have is that VFR travel causes relative-prices. We also have the existence of a causal linkage running from US per capita income to VFR travelers from the US, and from US per capita income to relative-prices.

Table 3: Pairwise Granger Causality Tests, 1990-2012

Null Hypothesis:	F-Statistic	Probability	Conclusion
Log(*FVR*) does not Granger Cause Log(*P*) Log(*P*) does not Granger Cause Log(*FVR*)	2.248 0.706	0.150 0.411	Reject Accept
Log(*Y)* does not Granger Cause log(VFR*)* Log(*VFR)* does not Granger Cause Log(*Y)*	4.562 0.659	0.046 0.427	Reject Accept
Log(*Y*) does not Granger Cause Log(*P)* Log(*P)* does not Granger Cause Log(*Y)*	2.437 0.226	0.135 0.640	Reject Accept

4. Conclusion

This article examined the impacts of relative-prices and US per capita income on visiting friends and relatives (VFR) travel to the Dominican Republic during the period 1990-2012. Using the 'bounds' testing approach to the analysis of level relationships developed by Pesaran *et al*. (2001), the results indicate that there exists a long-run equilibrium relationship between relative-prices, US per capita income, and VFR travel to the Dominican Republic. Moreover, these findings show that the demand function for VFR travel to the Dominican Republic is consistent with economic theory. The estimated price demand elasticity of tourism has the expected sign, but its below unity value indicates that relative-prices exerts no effect on VFR travel. On the other hand, the value of the estimated income demand elasticity shows that VFR travel to the Dominican Republic is a luxury item and thus strongly responsive to the growth of US per capita income. The latter finding is consistent with recent studies that have found that international tourism is a luxury item. Moreover, Granger causality tests results are consistent with what Brida *et al*. (2008) found in their analysis of the determinants of travel from the US to Mexico. First, instead of relative-prices causing VFR travel to the Dominican Republic, we have the reverse. Second, there is evidence of the existence of a causal linkage running from US per capita income to VFR travel. Thirdly, there is substantiation of a causal association between US per capita income and relative-prices.

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