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Modelling the international demand of US receptive tourism in Mexico

Modelando la demanda internacional del turismo receptivo estadounidense en México

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Abstract

To obtain a suitable econometric model in order to explain the international tourism demand in Mexico by the American inbound tourism in the span of time of 1980 to 2016, the general-to-specific approach was used with annual data where a general autoregressive distributed lag model was set then it was reduced to various specific models by imposing parameter restrictions and the selection of the final model was made according to the restriction tests. The results suggest that the best model to explain the demand is the model of partial adjustment from which it can be deduced that in this international tourism demand exists a positive relationship with the real economic growth of the United States by getting an income elasticity of 0.54 percent, there is also a positive relationship between this demand and the real trade volume of the two nations which elasticity accounts for 0.094 percent. As for the real price paid by the American tourists is inelastic (-0.3). Finally, there is a promotional effect made by the tourist who was in Mexico in the previous period that accounts for 0.52 percent.

Econometric model, Elasticities, Lag dependent variable

Resumen

Para definir un modelo econométrico adecuado con el objeto de explicar la demanda de turismo internacional en México por parte del turismo receptivo estadounidense en un periodo de tiempo que va del año 1980 al año 2016, se empleó la metodología de lo general a lo especifico con datos anuales, donde se plantea un modelo general autorregresivo de rezagos distribuidos, el cual se redujo a varios modelos específicos al imponer restricciones en los parámetros y la selección del modelo final se hizo en base a pruebas estadísticas. Los resultados indican que el mejor modelo para explicar la demanda es el de ajuste parcial, del cual se puede deducir que en esta demanda de turismo internacional existe una relación directa tanto con el crecimiento económico real de los Estados Unidos obteniéndose una elasticidad ingreso de 0.54 por ciento como del volumen comercial real que hay entre las dos naciones cuya elasticidad es de 0.094 por ciento, en cuanto al precio real del turismo pagado por estos turistas es inelástico (-0.3). Finalmente, existe un efecto de promoción que efectúa el turista que estuvo en México en el periodo anterior que es de 0.52 por ciento.

Modelo econométrico, Elasticidades, Variable dependiente rezagada

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Introduction

Tourism, in addition to being classified as a strategic sector by various countries or an important economic activity, is a multidisciplinary phenomenon that has undergone a remarkable shoring up and a remarkable diversification to the extent of becoming one of the most dynamic economic sectors worldwide. According to the World Tourism Organization (2019), tourism turnover equals or even exceeds that of oil exports, food products or automobiles, in addition to representing one of the primary sources of income for several developing countries.

Hard data from this organization, ensure that in 2018 the number of international arrivals worldwide amounted to 1,400 million, which reflects an increase of 6 percent over the previous year and clearly above the 3.7 percent growth of the world economy. In fact, this number of international travelers was reached two years ahead of previous forecasts, as a long-term forecast made by this agency in 2010 estimated that this number of international tourists would be reached by 2020.

The results of international arrivals reached in 2018 were mainly due to the momentum of a favorable economic environment and solid demand from the main source markets, in addition to other causes such as more accessible air travel, changes in technology, new business models and greater facilities in the issuance of visas that have also contributed to the growth of these tourists traveling around the world (World Tourism Organization, 2019).

The World Tourism Organization divides the planet into five regions to carry out statistical control over tourism activity, these regions are: Europe, Asia and the Pacific, America, Africa and finally the Middle East. Regarding one of the most important variables to be measured by this organization which are the international tourist arrivals it has that in 2017 the participation of each of these regions worldwide was 51, 24, 16, 5, 5 and 4 percent respectively, so it can be noted that the region of the countries of Europe has a huge participation (World Tourism Organization, 2018).

Another variable that is relevant when measuring tourism activity is the income obtained from international arrivals which in 2017 amounted to 1.34 billion dollars which is 5 percent more than the previous year, in this field the participation of the regions mentioned above are: 39, 29, 24, 3 and 5 percent respectively, also the region of Europe is much higher in this field before the other regions, while the region of America and Asia and the Pacific are somewhat similar.(World Tourism Organization, 2018).

The countries with the most international tourist arrivals in 2017 according to World Tourism Organization (2018) are: France, Spain, United States, China, Italy and Mexico with 86.9, 81.8, 76.9, 60.7, 58.3 and 39.3 million tourists respectively. In terms of international tourism income, the five countries that attracted the most foreign exchange were: The United States, Spain, France, Thailand and the United Kingdom with 210.7, 68, 60.7, 57.5 and 51.2 billion dollars respectively. It is worth mentioning that Mexico is not among the first ten nations in the analysis of this variable.

The World Tourism Organization also makes a ranking of the countries whose international tourists spend the most on tourism and according to its 2017 statistics China by far takes the first place with 257.7 billion dollars, followed on the list by the United States, Germany, United Kingdom, France, Australia, Canada, Russia, Republic of Korea and Italy. It is worth mentioning that tourism spending by the United States increased 9 percent over the previous year and Russia rebounded strongly at the rate of a 30 percent increase over the previous year.

In Mexico, tourism is an activity of vital importance for the generation of foreign exchange; this activity is usually between the third and fourth place in terms of income. According to an article by Rojas (2018), the highest net income in dollars in the first months of 2018 was led by the automotive industry, which has boomed in recent years, followed by remittances, which have increased despite the anti-immigrant policy of the U.S. government, and finally in third place is the tourism sector, which contributed with a net foreign exchange income of 2,090 million dollars accumulated from January to February of that year.

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International tourist arrivals to Mexico in 2017 according to the Bank of Mexico (2019) amounted to 39.3 million which translates into an increase of 12 percent over the previous year placing the nation in the number 6 place in the world ranking, the average annual growth rate for the period of time between 2008 and 2017 (10 years) is 6.2 percent and the corresponding to the time span from 2013 to 2017 is equivalent to 12.9 percent, which allows observing that the country has a positive trend for some time in this area.

In relation to foreign currency collection with data from the Bank of Mexico (2019), in 2017 Mexico managed to collect the amount of 21 thousand 333 million dollars higher than the 19 thousand 650 million dollars observed in the previous period, which means a positive percentage change of 8.6 percent, although it must be said that according to the world ranking of the World Tourism Organization it lost a position by moving from 14th to 15th place. With regard to the average annual growth rate from 2012 to 2017 it is positive at a rate of 10.9 percent.

This analysis focuses on U.S. inbound tourism in Mexico, which represents approximately 80 percent. According to data from the Ministry of Tourism (SECTUR, 2019), the arrival of U.S. tourists shows a growing trend, this prevailing condition is mainly due to several causes that make Mexico attractive to this market, among the causes that are glimpsed are: geographical proximity, cultural diversity, natural diversity, business, gastronomy, connectivity, infrastructure, tourism offer, exchange rate, etc. Figure 1 shows how the arrival of these tourists has grown over the last thirty-seven years.

Tourist arrivals from the United States have an average annual growth rate of 9.9 percent from 2009 to 2016, which demonstrates the great dynamism of this market in the Mexican tourism sector. The average annual growth rate for the time span from 1980 to the year 2000 amounts to 5.1 percent and regarding the time period from the year 2000 to the year 2016 it is 4.4 percent. These hard data give veracity to what has been argued in the previous paragraph and makes it evident that the U.S. market is of utmost importance for international tourism arriving to Mexico, so it is convenient to make an analysis of the demand for tourism by this market.

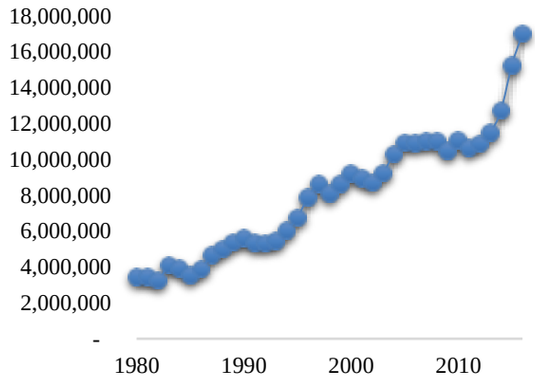

Figure 1 U.S. inbound tourism to Mexico, 1980-2016
Source: Own elaboration with data from the Ministry of Tourism, 2019

Due to the importance represented by U.S. inbound tourism arriving in Mexico, the present study has the firm objective of determining the best econometric model to explain the demand for international tourism by U.S. inbound tourism, in the period of time from 1980 to 2016 (with annual data), within the framework of the methodology known as "From the general to the specific".

The hypothesis to be contrasted is basically causal or statistical according to Dieterich (2001), said hypothesis is that Mexico's international tourism demand measured through U.S. inbound tourism has a direct relationship with the real income of U.S. tourists and the real trade volume between these two nations, in addition to the fact that the price of tourism paid by U.S. tourists to acquire the Mexican tourism product is inelastic.

Methodology to be developed

The methodology "From General to Specific" was proposed by Davidson *et al*. (1978) and later refined by Mizon and Richard (1986), this methodology consists of the construction of an autoregressive model of distributed lags which was developed by Sargan (1964) by linking the economic theory of static equilibrium with dynamic empirical models containing a range of variables suggested by economic theory. According to Hendry *et al*. (1984) and Hendry (1995) these autoregressive distributed lags models house a specific number of models such as: the autoregressive model, static model, growth rate model, leading indicator model, partial adjustment model, finite distributed lags model, dead start model and error correction model.

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This methodology is distinguished by being a process where a general dynamic equation can be reduced to simpler models such as those mentioned in the previous paragraph by imposing certain constraints and statistical diagnostics. The approach is contrary to the methodology known as: "From the specific to the general" where we start with a much simpler model that is estimated using ordinary least squares, it is expected that such model has statistical significance, a high coefficient of determination (R^2), significant coefficients of the explanatory variables and with the correct sign according to the economic theory that it is intended to explain, and that the estimated residuals of the model do not exhibit problems of autocorrelation and heteroscedasticity (Song and Witt, 2003).

According to Song and Witt (2003) and Narayan (2004) the advantage of employing the "general to specific" approach is that it has a clear strategy in the specification, estimation and selection of the appropriate model that tends to overcome the issue of data mining. In addition, it is well founded that the error correction model which emanates from the autoregressive distributed lagged model completely eliminates the problem of spurious regressions, in which the correlations between the independent and dependent variables are exaggerated due to the use of trended time series. Finally, the selected models must pass a battery of statistical tests in order to comply with the regression assumptions.

The "general to specific" methodology has been very popular in the analysis of tourism demand and has been used to explore the determinants of tourism demand in destinations in various parts of the world such as: Australia, Asia, Korea, Denmark, Europe, Latin America. It has also been tested for its good performance in tourism demand forecasting. However, one of the possible problems of this methodology is that the structure of the final model selected relies heavily on the data used, although economic theory plays a crucial role in the initial form of the general model (Song and Witt, 2003).

As alluded to in previous paragraphs, this methodology begins with a general so-called autoregressive distributed lagged model for the home country, i.e., the United States, in which tourism demand is related to a number of variables that influence that demand.

According to this framework, if a variable y_tes determined by k explanatory variables, the data generating process can be written as a distributed lag autoregressive model as follows:

$$y_t = \alpha + \sum_{j=1}^{k}\sum_{i=0}^{p}\beta_{ji}x_{jt-i} + \sum_{i=1}^{p}\Phi_i y_{t-i} + \varepsilon_t \quad (1)$$

Where p is the lag length, which is determined by the type of data used, which according to Song and Witt (2000), $p = 1$for annual data, $p = 2$for semi-annual data, $p = 4$ for quarterly data and so on. On the other hand the tourism demand model for the country of origin can be represented as follows:

$$TREU_t = f(PIBREU_t, VCRMEXEU_t, IPR_t) \quad (2)$$

Where $TREU_t$ the demand for tourism measured by tourist arrivals from the United States (inbound only) which is the country of origin, the data for this variable were obtained from the Secretary of Tourism (2019). As for $PIBREU_t$ which is the real income measured by the real Gross Domestic Product of the United States base year 2010, $PIBREU_t$which is the real trade volume measured by the sum of imports and exports between the country of origin and destination base year 2010, e IPR_t is a relative price index for tourists from the origin country who will spend in the destination country (base year 2010), data were compiled from the International Monetary Fund (IMF, 2018).

Regarding the variable IPR_t, this was constructed according to Song and Witt (2000) and Song and Li (2009) in which to obtain this variable, the Mexican National Consumer Price Index (INPC) must be divided by the exchange rate pesos per dollar, and then the quotient obtained must be divided by the National Consumer Price Index of the country of origin (United States). According to these researchers, this index takes into account the effects of both inflation and the exchange rate on the tourist demand that this country has on Mexico. Something very important to mention is that both Consumer Price Indices must have the same base year. The general form of the tourism demand function has already been addressed by several researchers with special emphasis on the most important explanatory variables that have been used in the main econometric studies of tourism demand, such as Witt and Witt (1995), Dwyer and Forsyth (2006), Saayman and Saayman (2008) and Frechtling (2011).

Thus, there is already a solid theoretical basis on the variables that can influence tourism demand at the international level, always bearing in mind that much depends on the countries under analysis, since destinations face diverse economic, political, environmental and social situations. The double logarithmic linear functional form is employed in the estimation of the model because according to Gujarati and Porter (2010) and Maddala (1992) this form allows the estimated coefficients of the explanatory variables to be interpreted directly as the elasticities, in this case, as the elasticities of international tourism demand by U.S. tourists. From equation 2, the general tourism demand model is as follows:

$$lTREU_t = \alpha_1 + \alpha_2 lTREU_{t-1} + \alpha_3 lPIBREU_t + \alpha_4 lPIBREU_{t-1} + \alpha_5 lVCRMEXEU_t + \alpha_6 lVCRMEXEU_{t-1} + \alpha_7 lIPR_t + \alpha_8 lIPR_{t-1} + e_t \quad (3)$$

Where $\alpha_1, \alpha_2, \ldots, \alpha_8$ are the parameters to be estimated and $e_t$the error term. In specifying the model in equation 3, the lag length is set to one because annual data are being employed. As mentioned above, this equation encompasses a specific number of econometric models that can be obtained by imposing different restrictions on the parameters whose significance is tested, these models are: the static model, the autoregressive model, the growth rate model, the leading indicator model, the partial adjustment model, the common factor model, the finite distributed lags model and the dead start model (Peng *et al*., 2012). Table 1 shows the models covered by the autoregressive model with distributed lags and their respective equations (for simplicity the constant term has been omitted).

Model	Equation
Static	$y_t = \beta_0 x_t + \varepsilon_t$
Autoregressive	$y_t = \Phi_1 y_{t-1} + \varepsilon_t$
Growth rate	$\Delta y_t = \beta_0 \Delta x_t + \varepsilon_t$
Main indicator	$y_t = \beta_1 x_{t-1} + \varepsilon_t$
Partial adjustment	$y_t = \beta_0 x_t + \Phi_1 y_{t-1} + \varepsilon_t$
Common factor	$y_t = \beta_0 x_t + \varepsilon_t, \varepsilon_t = \beta_1 \varepsilon_{t-1} + u_t$
Finite distributed lags	$y_t = \beta_0 x_t + \beta_1 x_{t-1} + \varepsilon_t$
Dead start	$y_t = \beta_1 x_{t-1} + \Phi_1 y_{t-1} + \varepsilon_t$
Correction of errors	$\Delta y_t = \beta_0 \Delta x_t + (\beta_1 - 1)(y - Kx)_{t-1} + \varepsilon_t$

Table 1 Variations of the Distributed Lag Autoregressive Model
Source: Song H. and Witt F. S. (2010). Tourism Demand Modelling and Forecasting: Modern Econometric Approaches

Equation 3 can be reparameterized into an Error Correction Model as follows:

$$\Delta lTREU_t = \alpha_3 \Delta lPIBREU_t + \alpha_5 \Delta lVCRMEXEU_t + \alpha_7 \Delta lIPR_t - (1 - \alpha_2)\left[lTREU_{t-1} - \beta_1 - \beta_2 lPIBRUSA_{t-1} - \beta_3 lVCRMEXEU_{t-1} - \beta_4 lIPR_{t-1}\right] + u_t \quad (4)$$

Where:

$\beta_1 = \alpha_1/(1 - \alpha_2)$

$\beta_2 = \frac{\alpha_3 + \alpha_4}{1 - \alpha_2}$

$\beta_3 = \frac{\alpha_5 + \alpha_6}{1 - \alpha_2}$

$\beta_4 = \frac{\alpha_7 + \alpha_8}{1 - \alpha_2}$

Δ is the first difference operator
u_t the error term

Concerning the terms found in the brackets in equation 4, it is what is called the error correction mechanism which according to Banerjee *et al*. (1993), error correction terms were employed by Sargan (1964), Hendry and Anderson (1977) and Davidson *et al*. (1978) as a way of capturing adjustments in a dependent variable which does not depend on the level of some explanatory variable, but on the degree to which an explanatory variable deviated from an equilibrium relationship with the dependent variable.

Hendry (2010), argues that a crucial aspect of error correction models is that deviations from their expected value are attenuated and eventually eliminated if no additional external influences appear, in addition to the fact that this mechanism is present in other types of models such as: all regressions, autoregressions, linear simultaneous equations, autoregressive vectors, etc. The isomorphism of this error correction model with cointegrated relations has actually been the feature that has ensured its considerable popularity in empirical applications. According to Song and Witt (2003), the construction of an error correction model has two advantages over other econometric models. The first is that the model incorporates both long-run and short-run demand relationships, the coefficients of the variables in levels reflect the long-run demand elasticities while the coefficients of the differenced variables are the short-run elasticities.

The term $-(1-\alpha_2)$ is known as the error correction parameter, which implies that the model adjusts itself towards equilibrium, which in other words means that there is a long-run cointegrating relationship. The second advantage is that this model avoids the problem of spurious regression, which is an issue that was initially addressed by Yule (1926) by naming them as nonsense regressions, later Granger and Newbold (1974) concluded that a good good goodness of fit with significant serial correlation in the model residuals was a symptom associated with nonsense regressions. Therefore this problem is overcome since the differenced time series are stationary and also the combination of variables in levels is stationary.

The "From general to specific" approach to modeling the demand function involves the following steps: First, a general autoregressive distributed lag autoregressive model is estimated based on economic theory. Second, constraint tests are conducted based on the assumptions imposed by the specific models on the coefficients of the autoregressive distributed lagged model. Third, diagnostic tests are performed on the specific models that are superior to the autoregressive distributed lagged model according to the constraint tests. Finally, the best model is selected based on the results of the diagnostic tests and the consistency of the models with economic theory (Song and Witt, 2003).

The constraint tests mentioned in the previous paragraph can be performed using the "*F*". statistic. If the restrictions are proven to be valid then the specific model in question is preferred to the general autoregressive model of distributed lags but if the restrictions for one or more specific models are not rejected the best specific model for this analysis will have to be selected on the basis of a battery of statistical diagnostics that has to do with the fulfillment of the regression assumptions. In case all the restrictions are rejected, the general model will be chosen and its respective error correction model will be derived.

The residuals of the final model must fully comply with the regression assumptions, i.e. the error term must not present problems of non-normality, heteroscedasticity, autocorrelation or misspecification of the model.

For this analysis the following diagnostic tests were carried out: for normality the Shapiro-Wilk contrast (1965), for heteroscedasticity the Breusch-Pagan contrast (1979), for autocorrelation the Durbin-Watson (1950) and Durbin-Watson (1951) first order contrast, for models with lagged or autoregressive dependent variable the Durbin's h-test (Durbin, 1970) and the higher order contrasts of Breusch (1978), Godfrey (1978) and Ljung-Box (1978) and finally for the good or bad specification of the model the Ramsey test (1969).

Results

Prior to the estimation of the general autoregressive model of distributed lags, it is convenient to analyze the characteristics of the variables used, specifically the orders of integration of the variables must be determined, this with the purpose of testing cointegration relationships between the variables if no model is accepted under the due restrictions. The cointegration or long-run equilibrium relationship requires that all the variables used in the tourism demand function have the same order of integration I (1), that is, that the equation is balanced (Banerjee *et al*. 1993) and that the combination of these variables results in a variable I (0). For this, the Augmented Dickey-Fuller (1979) test (ADF, Table 2) and subsequently the Phillips-Perron (1988) test were used, both tests verify the orders of integration of the variables in equation 1 and the results show that all the variables in levels have order of integration one I (1).

Critical value 5%					
Variable	Estadt ADF	25 Obs.	50 Obs.	Backlog	$T\ y\ \beta_0$
lTREU	2.26	3.6	3.5	4	$T\ y\ \beta_0$
⊿lTREU	3.53	3.0	2.9	4	β_0
lPIBREU	2.72	3.6	3.5	2	$T\ y\ \beta_0$
⊿lPIBREU	4.89	3.6	3.5	1	$T\ y\ \beta_0$
lVCRMEXEU	1.57	3.6	3.5	4	$T\ y\ \beta_0$
⊿lVCRMEXEU	3.84	3.0	2.9	1	β_0
lIPR	1.81	3.0	2.9	2	β_0
⊿lIPR	6.38	3.0	2.9	1	β_0

Table 2 Dickey-Fuller Augmented Test Results
Source: Own Elaboration

Table 2 shows the results of the Augmented Dickey-Fuller test both for the variables in levels and for the differentiated variables, given that there are 37 observations, the critical values of twenty-five and fifty observations were considered, the optimal number of lags was chosen based on the adjusted coefficient of determination $\bar{R}^2$and the Akaike and Schwarz information criteria of the regressions. The last column indicates whether the test regressions employed constant (β_0) or also trend (T). By differencing each of the variables, they achieve stationarity at both the critical value of twenty-five and fifty observations.

The estimation of the general autoregressive model of distributed lags is based on annual time series data ranging from the year 1980 to the year 2016. The results obtained are shown in Table 3, in which it can be observed that the lagged dependent variable is highly statistically significant while the variables trade volume, lagged trade volume, lagged income and lagged price index are not significant (figures in parentheses are standard errors and the asterisk indicates statistical significance at 5 percent).

Explanatory variable	Coefficients
Constant	-2.062 (2.794)
$lTREU_{t-1}$	0.563* (0.169)
$lPIBREU_t$	1.406* (0.679)
$lPIBREU_{t-1}$	-0.984 (0.669)
$lVCRMEXEU_t$	0.114 (0.091)
$lVCRMEXEU_{t-1}$	-0.01 (0.096)
$lIPR_t$	-0.260* (0.114)
$lIPR_{t-1}$	-0.077 (0.140)
$\bar{R}^2$	0.982
Standard Error	0.061
F(7, 28)	268.568
Sum of squares of residues	0.104

Table 3. Estimates of the general model of equation 3, 1980-2016.
Source: Own Elaboration

Once the general autoregressive model of distributed lags has been estimated, the "*F*" statistic has to be used to test several restrictions on the parameters and see if any of the specific models shown in Table 1 explain better the U.S. inbound tourism demand than the general model.

In Table 4, the results of the tests on the restrictions are shown, it is observed that the specific models that can explain the tourism demand are the partial fit model and the dead start model according to the calculated value of the "*F*" statistic compared to its critical value. If the calculated value of the "*F*" statistic is lower than its critical value it means that the specific model is superior to the general model, it is worth mentioning that the significance level of the test is 5 percent.

Specific models	F calculated	Critical value F
Static	4.65	F(4, 28) = 2.71
Autoregressive	4.67	F(6, 28) = 2.45
Growth rate	3.78	F(4, 28) = 2.71
Main indicator	4.38	F(4, 28) = 2.71
Partial adjustment	1.71	F(3, 28) = 2.95
Distributed lags	13.67	F(1, 28) = 4.2
Dead start	2.89	F(3, 28) = 2.95

Table 4 Results of the restriction tests ("*F*" Statistic)
Source: Own Elaboration

According to Song *et al*. (2009), when two specific models can explain a dependent variable better than a general model, it is necessary to verify whether one of them is nested in the other and vice versa through an encompassing test. The concept is associated with Mizon and Richard (1986), this test is very useful when a researcher has to choose only one model to carry out policy analysis or forecasting but in this situation, of the two specific models that best explain U.S. tourism demand, the error term of the partial fit model meets the regression assumptions, i.e. it is normal, independent and with constant variance unlike the dead start model which suffers from autocorrelation problems so it has been discarded. The estimated partial fit model is shown below in Table 5 and the p-values of the tests of compliance with the assumptions in Table 6.

Variable	Coefficient	Standard error	t-statistic
Constant	-2.92	2.705	-1.079
$lTREU_{t-1}$	0.516	0.16	3.232
$lPIBREU_t$	0.535	0.273	1.961
$lVCRMEXEU_t$	0.094	0.048	1.980
$lIPR_t$	-0.301	0.093	-3.250
Average Var. Dep.	15.826	Error Est. Var. Dep.	0.45
S. C. Residues	0.123	Regression std. error	0.063
R^2	0.983	R^2 corrected	0.98
F(4, 31)	440.59	p-value of "F"	7.85e-27
Log-Ver.	51.19	Criterio Akaike	-92.378
Criterio Schwarz	-84.46	Criterio Hannan-Quinn	-89.614
rho	0.097	h de Durbin	2.026

Table 5 Partial adjustment model estimation results, 1981-2016 (Dependent variable lTREUt).
Source: Own Elaboration

In Table 6, the Breusch-Godfrey and Ljung-Box tests were carried out from one to seven lags and in all of them it was concluded that there is no evidence of autocorrelation, the Reset test was also run separately (with only squares and with only cubes) and the results were satisfactory. In addition to these tests, the autoregressive effect contrast with conditional heteroscedasticity (ARCH) was also performed, obtaining good results up to lag seven; additionally, the CUSUM contrast of Brown *et al*. (1975) was performed to verify the stability of the parameters, obtaining a positive result. The only detail presented by the partial adjustment model is some multicollinearity.

Supposed	Contrast	p-value
Normality	Shapiro-Wilk	0.896
Homocedasticity	Breusch-Pagan	0.198
Independence (1 backlog)	Breusch-Godfrey	0.403
	Ljung-Box	0.554
Good specification	Reset (squares and cubes)	0.684

Table 6 *p*-values of the behavior of the error term of the partial fit model
Source: Own Elaboration

Regarding Table 5, it can be seen that the goodness of fit of the model is high at 0.98, the variables used to explain U.S. tourism demand are statistically significant according to the value of the *"t"* statistic and the value of the *"F"* statistic, in addition to the fact that the signs of the variables agree effectively with the economic theory. As mentioned above, by using logarithms in the demand function, we directly obtain the economic elasticities of the variables in the model, which are explained below.

The elasticity of the income variable, measured by the real economic growth of the United States, is positive and according to Nicholson (2004), with a positive elasticity the product in question must be classified as normal, so the Mexican tourism product is a normal good or service for inbound tourism from the United States. Now, with an income elasticity of 0.535 it means that with an increase of one percent in the Real Gross Domestic Product of the United States, keeping other variables constant (Ceteris Paribus), the international demand for tourism in Mexico would have a positive variation of about 0.54 percent.

Regarding the trade volume variable between Mexico and the United States, its elasticity is very small at 0.094. This variable was included in the model because business tourism has become very important in the country in recent decades, mainly due to the fact that the United States is Mexico's main trading partner and that between these countries there is a trade agreement that came into force in 1994 and is currently being restructured under the name of T-MEC. With this elasticity, a one percent increase in the volume of trade between these two nations *Ceteris Paribus*, there would be an increase of 0.094 percentage points in the demand for international tourism in Mexico.

The elasticity of the Relative Price Index variable is less than one, which, according to Nicholson (2004), should be classified as inelastic, therefore, this variable, which represents the price of tourism for tourists classified as inbound from the United States, is inelastic with a coefficient of -0.301, which means that with a unit percentage increase in this variable (keeping all other variables constant), the international demand for tourism will decrease by 0.301 percent.

The dependent variable that was lagged one period to make a partial adjustment model has a rationale, which according to Witt and Witt (1995) is justified in the field of the habit of persistence of tourists who have already visited the destination once and the word-of-mouth recommendation made by tourists to other people in the previous period, which reduces the uncertainty of potential tourists. The estimated elasticity of this variable presents a positive relationship with respect to the demand for international tourism whose economic elasticity is approximately 0.52 percent.

Conclusions

The objective of this research was fully achieved by determining the best econometric model based on statistical procedures to explain the demand for international tourism in Mexico by inbound tourism from the United States based on the methodology from the general to the specific, as for the causal hypothesis, this was contrasted and corroborated with the results yielded by the model proposed, which satisfactorily met the regression assumptions.

The real Gross Domestic Product of the United States taken as a proxy variable to reflect the income level of U.S. tourists has a direct relationship with the demand function specified in this analysis, which according to its elasticity of 0.54 percent classifies the Mexican tourism product as a normal good. Given the income level of Americans, which is one of the highest in the world, actions must be taken to conserve and increase this market, among which the mitigation of insecurity in the country stands out, since in recent years it has worsened. According to Graph 1, the demand for international tourism by U.S. tourists has an upward trend that has been maintained despite the insecurity situation in Mexico, but if this problem were reduced and more certainty of security were given to tourists visiting the country, perhaps much more would be received. On the other hand, U.S. tourists should be encouraged to consume more services and products derived from tourism through the diversification of the Mexican tourism product and achieve a greater economic spillover that generates a greater multiplier effect in Mexico's economy.

The coefficient of the trade volume variable between the two nations represents a direct relationship, although it is small, there is no doubt that business tourism and conventions have been on the rise, it should not be overlooked the fact that the United States is the country's main trading partner and that on many occasions corporations and companies from both countries hold congresses, exhibitions, fairs and various types of events so it is important to facilitate the way in which business is done in the country and what needs to be done is to make Mexico a much more attractive country to attract foreign investment. In addition, the connectivity factor in means of transportation has an important specific weight within the tourism industry.

The relative price of tourism in Mexico for U.S. tourists turned out to be inelastic, this means that the reaction of consumers to a change in the price of the good or service is small, it should not be forgotten that the construction of this variable was carried out with the consumer price indexes of both countries and the exchange rate concerning the currency of the destination country with reference to the currency of the country of origin. A high exchange rate favors the country's export sector and tourism activity via international visitors.

Currently in Mexico the exchange rate is no longer determined by any government instance as it was before 1994, so it cannot be suggested to devalue the currency to favor the tourism industry since now the exchange rate is determined by the supply and demand of the foreign exchange market, but what is recommended is to give due promotion to the activity and facilities to foreigners when the exchange rate is high in order to attract more tourists. In addition to this, the country's inflation should be watched and monitored, which is an important function that falls under the jurisdiction of the Bank of Mexico. This will make Mexico a more competitive nation in the industry.

The partial adjustment econometric model through its lagged dependent variable indicates that there is a risk aversion effect that causes a habit of persistence to consume the Mexican tourist product on the part of U.S. tourists since the country has satisfied them, This is of utmost relevance since the experience lived by tourists in the destination spreads among their circles of coexistence achieving a word-of-mouth recommendation, which can seduce future potential tourists, therefore it is essential to build a positive and attractive image of the country from an integral perspective that contributes to the development and growth of the national tourism industry.

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