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Determinants of international tourism: a three-dimensional panel data analysis

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International tourism is a fast growing industry generating half a trillion dollars in annual revenues and accounting for almost 10% of total international trade, and almost half of total trade in services. Yet, it has so far failed to receive the attention it deserves from mainstream economics. This paper attempts to provide an initial understanding of the determinants of international tourism. This paper claims that international tourism, as other forms of trade in services, is driven by unique factors of production, and may be better dealt with in a single industry study rather than in a general equilibrium trade model. In order to understand these determinants the world is viewed as a market of differentiated products, and a discrete choice estimation technique is applied to a large three-dimensional data set of tourist flows. It is shown that a relatively simple estimation technique, combined with a rich data set, can deliver reasonable substitution patterns. It is found, among other things, that political risk is very important for tourism, and that exchange rates matter mainly for tourism to developed countries. These have exchange rate elasticity of about one.

I. INTRODUCTION

While industries such as the petroleum industry and the automobile industry have evoked a host of research projects by economists, one may wonder why an industry comparable in size, the tourism industry, has yet failed to attract much attention from mainstream economists. A glimpse at some summary figures for this industry reveals a striking picture of its size and growth. According to the World Tourism Organization (henceforth WTO, which should not be confused with the World *Trade* Organization), in 1990 countries' receipts from international tourism were 264 billion dollars, in 1995 they were 401 billion dollars, by 2000 they reached almost half a trillion dollars, and for the year 2020 they are expected to reach the two trillion dollar mark. But even these numbers do not fully reveal the importance of this industry. Consider the following facts. international tourism is the world's largest export earner. Foreign currency receipts from international tourism in 1996 exceeded those from petroleum products, motor vehicles, telecommunication equipment, and textiles.[1] Moreover, it is a labour-intensive industry, employing an estimated 100 million people around the world. Tourism has an important role in stimulating investments in new infrastructure, as well as in generating government revenues through various taxes and fees. Acknowledging these facts and the evidence that tourism comprises a huge portion of GNP in many developing and small countries[2] makes clear the profound importance of tourism for development. Finally but not least important, one cannot overlook the role of international tourism in promoting world peace, both by providing an incentive

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[1] Source: WTO website at http://www.world-tourism.org
[2] Examples include (tourism receipts as percentage of GNP in 1998 in parenthesis): The Maldives (94%), Antigua and Barbuda (46%), Cyprus (18%), The Dominican Republic, (14%), Jordan (14%), Belize (13%), Namibia (11%), The Czech Republic (7%) and Indonesia (6%). Source: WTO for tourism receipts, WDI (2000) for GNP.

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for peacekeeping and by building 'a bridge between cultures'.

Even though international tourism is a form of international trade it may be better dealt with in a single industry study rather than in a general equilibrium trade model. The latter may be inadequate to capture its peculiarities, as is the case with trade in other services. The fact that tourism amounts to almost 10% of all international trade suggests that better understanding of this industry can promote empirical understanding in various fields such as international trade, international finance, growth, and development. This study makes a first step in this direction. By viewing the world as a market of differentiated products and applying a discrete choice estimation technique to a large three-dimensional dataset of tourist flows one can deliver reasonable substitution patterns and arrive at a better understanding of the determinants of international tourism. It is hoped that by doing so further attention of economists can be drawn to this important industry.

It is found that tourism to developed countries has a price elasticity of about one, while tourism to less developed countries is unresponsive to price fluctuations. As the September 11 terrorist attacks confirmed, the political risk of the destination is shown to be important for destination choice, for both developed and less developed countries.[3] Other variables, such as common border, common language, and distance, are all important in determining tourism flows. Since the results are based on a more detailed dataset than previously used and a more rigorous estimation technique is used, they can provide more accurate and stable estimates than those one is aware of in the existing literature.

The structure of this paper is as follows. Section II surveys the existing tourism literature and discusses the relevance of the international trade literature to international tourism. Section III lays the empirical foundations for this study by describing the estimation technique and its properties. The data used for this estimation are presented in Section IV. Section V presents our findings and Section VI concludes.

II. RELATED LITERATURE

A search for economic literature that can shed light on the tourism industry leads one to two distinct strands of literature. The first is the international trade literature, which is a natural starting point since tourism is essentially a form of international trade. Among the different types of international trade, perhaps the closest to tourism are other types of trade in services (financial and others). However, despite the fact that trade in services accounted in 1999 for almost 20% of the value of all international trade,[4] relatively little research has been done on this topic. The second strand of literature, which is closer to the agenda, is the empirical tourism literature. Each strand is discussed in turn.

A review of the international trade literature uncovers a few aspects that make it unattractive for incorporating international tourism. The Heckscher–Ohlin paradigm, which is the main departure point for both the theoretical and the empirical international trade literature, explains trade flows mainly based on relative factor endowments. This approach is attractive once factors of production can be adequately approximated by a low dimensional vector (e.g. labour and capital). For tourism, however, the most important 'factors of production' are unique and hard to quantify or measure (e.g. the Eiffel Tower, the Pyramids, or nice beaches). This makes the exercise of explaining cross-sectional tourism flows around the world not theoretically appealing—the ability of the Eiffel Tower to attract tourists is best measured by the number of tourists who visit it. A more interesting line of research when dealing with tourism is investigating the effects of variables that vary over time on tourism demand. For example, since in international tourism, as in some other types of trade in services, the exporting country supplies *itself* and not only its products, tourism flows are more sensitive to such factors as ethnic tensions and external conflicts. These are usually overlooked in standard trade models. Section III shows that the single industry approach can be useful for estimating the impact of such variables, as well as the effects of changes in exchange rates on tourism.[5]

We now turn to the empirical tourism literature. The vast majority of the empirical papers on international tourism are found in journals that specialize in tourism studies and cater to both academic tourism scholars and to non-academic practitioners.[6] This literature is of two main types. The first consists of papers that use time series and co-integration models in an attempt to forecast future tourism flows between one or several pairs of countries.[7] The second type includes papers that estimate the determinants of tourism demand using multivariate regressions.[8] These latter papers mainly apply cross-sectional Ordinary Least

[3] It is important to note that our dataset is pre-September 11, 2001.
[4] Up from about 15% in 1980. Source: World Trade Organization.
[5] It should be noted that since additional benefits (and costs) are associated merely with crossing borders and since the visit to each country is generally a different experience, international tourism is a good example of the Armington (1969) assumption.
[6] Notable examples are *Annals of Tourism Research, Journal of Travel Research* and *Tourism Economics*.
[7] Examples are Wong (1997), Kulendran (1996) and Turner *et al.* (1997).
[8] For a survey of this literature, see Crouch (1994a, 1994b) and Witt and Witt (1995).

Squares techniques for a limited number of countries around the world. This type will be discussed in more detail since it is closely related to current work.

The necessity to include in the estimation exercise variables that represent tourism prices imposes a big challenge to empirical tourism research. The problem mainly stems from the fact that indices for tourism prices are not generally available. Instead, researchers have used exchange rate variables to proxy for tourism prices. One popular version is the use of relative nominal exchange rates, measured as an index relative to a base year. The motivation behind using this variable is that people are aware of changes in exchange rates but do not have information on nominal price changes in destination countries. However, this argument is weak if some of the costs of tourism are paid in advance, as is often the case with hotels, car rental, etc. Another version is the use of relative real exchange rates, which are similar to nominal exchange rates but adjusted for inflation in both the origin and the destination countries. This adjustment better accounts for changes in actual cost of living in both countries. The common thread in both of these versions is that they are indices that are measured relative to a base year. They can therefore trace changes in costs over time, but cannot capture the actual differences between countries in costs of living.

Another component of tourism costs is the price of transportation. Yet, due to the complexities of the price structure of transportation, no consistent data exists on transportation prices. Instead, researchers often included the distance of travel as a proxy for these costs (as well as for the forgone time spent and inconvenience of transportation). Some models also included a price index of competing destinations to account for potential competition.[9]

The estimation results found in this literature regarding prices are rather discouraging, since there seems to be no agreement about the appropriate range for these coefficients. Estimated price elasticities vary dramatically both within and across papers. For example, Witt (1980) finds elasticities between -0.05 and -0.69, and Loeb (1982), in a study on tourism to the USA, estimates these elasticities to be between -0.42 and -6.36.

Another variable that was widely used is income in the origin country. The results here seem to support the fact that tourism is a luxury good, with income elasticity roughly between one and two.[10] A still unresolved issue, however, is the effect of income distribution on tourist trends. Additional variables that were used occasionally are weather indices, trade flows between countries, and special events (such as Expo's and Olympic games).

In conclusion, it seems that the results in the literature vary considerably from study to study, and do not seem to be reliable. This reality was perhaps best summarized in a review article by Crouch (1994b): 'It is apparent from the wide variety of results that a narrative review of the research cannot adequately reveal the underlying nature of the relationships between the demand for international tourism and its determinants' (p. 21).

There are a few directions that can be pursued in order to improve upon this literature and enable it to yield more convincing results. Primary among these is the use of a more extensive dataset, which will improve the estimation accuracy and flexibility relative to the small data sets used so far. In particular, in the existing literature no attempt to perform a rigorous panel data analysis was found, however, many use a three-dimensional panel data set (i.e. flows between pairs of countries over time) as is done in this study. The virtues of using a panel dataset are discussed in Section III. In addition, better estimation techniques can be used in order to overcome some of the limitations of the simple reduced form OLS models that have been used so far.[11] This study views countries as differentiated products, and a multinomial logit model used that is better equipped to deal with demand systems for such goods.

III. EMPIRICAL STRATEGY

As mentioned above, the basic approach is to treat international tourism flows as a demand system for differentiated products, where different destination countries are viewed as the different products supplied. Each country of origin in a certain year is treated as a separate demand market. The consumers in each market make the discrete decision regarding their most preferred destination.

The motivation for concentrating efforts on consumer choice is that tourism supply, at least in the long run, is very elastic with respect to total tourism costs. There are a few reasons why it might be so. First, the most important factors of production are non-substitutable (the Pyramids cannot be used to produce any other good) or non-rival goods (the fact that tourists enjoy good weather in a country does not 'waste' this resource for other tourists or for other industries). They therefore determine the level of demand, but their supply does not respond to prices. The

[9] In this study such a variable is redundant since it explicitly models the multinomial choice, which takes into account all alternative destinations.

[10] For example, Little (1980) finds income elasticities between 1.4 and 2.2.

[11] One notable attempt to use a more structural model in order to calculate price elasticities was made by Papatheodorou (1999), who applied an AIDS (Almost Ideal Demand System) analysis.

supplementary inputs of tourism services (accommodation, restaurants, etc.) are likely to adjust to any level of demand without having a drastic effect on tourism prices.[12] Moreover, tourists consume non-tourist goods as well, the supply of which is elastic with respect to the tourism industry. Tourism prices, therefore, cannot be completely disentangled from the general price level of the destination country. For these reasons, most of the variation over time in tourist flows can be captured by modelling the demand as a function of the cost of the destination country and other variables. The exogenous changes in the price level of the country (i.e. the exchange rate) shift the elastic supply curve and identify the downward sloping demand curve.[13]

In order to estimate this demand system, McFadden (1973) is followed and a standard multinomial logit technique used. Each destination country in a given year can be described as a bundle of characteristics, so that the utility of consumer i, resident of origin country o, from travelling to destination d in year t, is given by:

$$u_{iodt} = X_{odt}\beta^o + \xi_{odt} + \varepsilon_{iodt} \tag{1}$$

where X_{odt} denotes the different characteristics of the origin country and the destination country, which may either be fixed (e.g. language) or vary across years (e.g. relative price). ξ_{odt} is the unobserved (to the econometrician) perceived quality of destination d in a given year t for residents of origin o, and ε_{iodt} is an individual error term, which is distributed i.i.d. across individuals and country pairs, and over time. β^o is a vector of parameters to be estimated, which may be allowed to differ across origin countries.

Consumer i of country o in year t evaluates his utility from any destination d given by Equation 1 and chooses the destination that maximizes his utility. One possible choice is the outside good (denoted as destination zero), i.e. the choice not to travel abroad.[14] Since only the differences in utilities between the destinations are identified in this model, the utility from the outside good is normalized to be zero in each market.

If it is assumed that the ε_{iodt} are distributed according to a type I extreme value distribution (whose cumulative distribution function is $F(x) = \exp(-e^{-x})$, then they can be integrated out, so that the predicted market share of destination d in market o in year t becomes:

$$s_{odt} = \frac{\exp(\delta_{odt})}{1 + \sum_k \exp(\delta_{okt})} \quad \text{where} \quad \delta_{odt} = X_{odt}\beta^o + \xi_{odt} \tag{2}$$

Equation 2 can be rearranged so that one obtains the following equation, which can be then taken to the data:

$$\log(s_{odt}) - \log(s_{o0t}) = X_{odt}\beta^o + \xi_{odt} \tag{3}$$

The observed market share used for the estimation is the annual number of tourists arriving from origin country o to destination d divided by the total population in origin o. This implies that each resident decides once a year whether to go abroad, and to which destination.[15] The above specification, with prices in natural logarithms,[16] implies the following own and cross price elasticities (the time subscript is dropped for simplicity):

$$\eta_{od} = \frac{\partial s_{od}}{\partial p_{od}} \frac{p_{od}}{s_{od}} = \beta^o(1 - s_{od}) \tag{4}$$

$$\eta_{odh} = \frac{\partial s_{od}}{\partial p_{oh}} \frac{p_{oh}}{s_{od}} = \beta^o s_{oh} \tag{5}$$

where η_{od} is the own price elasticity of destination d in the market of country o, η_{odh} is the elasticity of tourism to destination d with respect to the price of destination country h, in the market of origin country o, and p_{od} is the relative price in destination d with respect to the origin o. β^o is the coefficient on the logarithm of price, which may be allowed to vary across origins. These equations display the well-known limitations of the implied elasticities. In particular, the logit specification implies that the semi-elasticities depend only on the market shares of the different destinations, while one would expect that consumers who substitute away from a certain destination would be more likely to choose their new destination based on similar characteristics.[17]

[12] This may result from the fact that capital needed for tourism can usually be imported relatively easily, and the labour used is mostly unskilled.

[13] An obvious limitation of such approach is that it does not deal with capacity constraints and cannot measure the part of tourism demand generated by increasing supply (e.g. resorts development). The existing literature, as well as the discussion above, suggests that such factors do not play a major role in explaining short-run variation in tourist flows. Nevertheless, this is an interesting topic for further research.

[14] The outside good in this application may be either domestic travel or the choice not to travel at all. It is impossible to distinguish between the two in the absence of data on domestic travel.

[15] While it may definitely be the case that people travel more than once a year in some countries and less in others, the results are robust to changes in this assumption. Yet, it should be noted that the results might be sensitive to the assumption that the market size is proportional to the origin population. Nevertheless, this seems a natural choice in this case.

[16] Note that since prices are in logarithms, they cancel out in Equations 4 and 5.

[17] This is known as the IIA (Independence of Irrelevant Alternatives) problem. It implies, for example, that if the share of US tourism to Iceland and to Aruba were the same, then the elasticity of tourism from the US to The Bahamas with respect to the price of Aruba would be the same as that elasticity with respect to the price of Iceland. Obviously, the former should be higher, given the similarities between Aruba and The Bahamas as a tourist destination for US residents.

There are several generalizations of the multinomial logit model that partially solve this problem, such as the nested logit (Cardell, 1997) or random coefficients (Berry *et al.*, 1995). While these are possible directions to follow, they are not essential here since the use of a three-dimensional dataset can somewhat compensate for the limitations of the logit model, allowing it to yield reasonably flexible results. This is true because, in the authors' view, for most practical applications the parameter of interest is not the own (or cross) price elasticities for tourists from a single origin, but the own (or cross) price elasticities from the overall world market. This requires aggregating data from different market segments. Doing this, one gets (again, the time subscript is dropped for simplicity):

$$\eta_d = \frac{\partial arr_d}{\partial p_d}\frac{p_d}{arr_d} = \frac{\sum_o \beta^o M_o s_{od}(1 - s_{od})}{\sum_o M_o s_{od}} \tag{6}$$

$$\eta_{dk} = \frac{\partial arr_d}{\partial p_k}\frac{p_k}{arr_d} = \frac{\sum_o \beta^o M_o s_{od} s_{ok}}{\sum_o M_o s_{od}} \tag{7}$$

where η_d is the own price elasticity of destination d and η_{dk} is the elasticity of tourism to destination d with respect to the price of destination country k. arr_d is the total arrivals to destination d in a given year, M_o is the size of the market of origin country o, which in this case is just the population size, and p_d is the price level in destination d. Equation 7 implies that the overall cross-elasticity of destination d with respect to any country now depends on the full vector of market shares from all origins, where a higher weight is given to markets in which destination d has a larger market share. A corollary is that if, say, country k is more similar to destination d than country h is, then the cross-price elasticity of d with respect to k is expected to be higher than that of d with respect to h. The reason for this result is that k would have larger market shares in those markets that obtain higher weights (s_{od}), whereas the converse is true for destination h. This allows one to produce estimates of the substitution matrix that are more flexible than those obtained by standard applications of the multinomial logit estimation. It should also be noted that elasticities could be derived this way for all explanatory variables and not only for the price variable.

Section V estimates the above model using several specifications, and including alternative sets of fixed effects. There are a few important things to note about the different specifications and their interpretations. First, in this application the unobserved characteristics of the destination (or unquantifiable, such as the Eiffel Tower or the Pyramids) may be of great importance. This is also the case with cultural links between pairs of countries. The three-dimensional data set proves very useful for overcoming these difficulties, by allowing the inclusion of destination as well as country-pair fixed effects in the utility function. This specification significantly improves the identification power of the parameters of interest, by basing them on the within variation in the data.

Second, as mentioned earlier, a market is a given origin country in a given year. Therefore, any set of explanatory variables that depend only on the origin (o) and the year (t), but do not vary across products (destinations), can be interpreted as affecting the utility level of the outside good. For example, year fixed effects can be interpreted as varying degrees of the propensity to travel abroad over time. It is apparent that over the observation period people travel more, so the utility of the outside good (not travelling abroad) is decreasing. Similarly, origin fixed effects capture the variation in the propensity to travel across origins. In principle, one does not aim at explaining variations in the propensity to travel, so year and origin fixed effects are included in all specifications.

Finally, it is interesting to note that even though the estimation model is based upon the aggregation of individual decision-makers, eventually an estimable equation is reached that resembles a gravity equation. As is shown in Section V, some regularities of gravity equations for trade in goods carry over also to international tourism. Yet, the use of gravity equations seems here less founded, since *a priori* there is no reason to believe a country should attract and export tourists in proportion to its GDP.

IV. DATA AND VARIABLE CONSTRUCTION

The main series used to create the dependent variable is data on annual origin-to-destination tourist flows between the years 1985 and 1998. This dataset includes all countries worldwide, both as origins and as destinations. It is based on national sources, and was compiled and published by the WTO,[18] which is also responsible for imposing a uniform definition regime across all countries. Tourism, for this purpose, is defined as 'the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year'. In particular, international tourists are 'tourists who stay at least one night in a country where they are not residents,' where a resident is 'a person who has lived for most of the past year in a country'.[19]

Before continuing, some limitations on the use of this variable deserve attention. First, despite the fact that the data, in principle, includes all countries in the world as

[18] These data are published in annual publications titled *Yearbook of Tourism Statistics*. See references.
[19] For more on tourism definitions see the WTO website at http://www.world-tourism.org.

origins and as destinations, some values are missing, mainly flows between small countries and for earlier years. Fortunately, the multinomial logit specification is quite handy and flexible for the treatment of missing data. Such 'missing destinations' can be interpreted as part of the outside good, without creating any obvious biases or restrictions on the set of observations one can use.[20]

Second, the data is limited in dealing with trips to multiple destinations. The data document the number of entries, and hence do not distinguish between a single trip to multiple destinations and multiple trips, each one to a single destination. In the authors' estimation each destination is simply treated as a choice and hence as a separate trip, practically imposing on the data that each two destinations must be substitutes. However, once two or more destinations can be visited in a single trip, some destinations may become complements. This may be the case for neighbouring small countries.[21] One approach to dealing with such complement products could be to estimate a demand system that is not based on discrete choice. Such is the Almost Ideal Demand System (Deaton and Muellbauer, 1980), which does not restrict the cross-price elasticity to be positive. However, this method uses the product space rather than the characteristic space, and hence suffers from the dimensionality problem. There does not seem to be a natural unique way to group destinations, and hence solving the dimensionality problem through imposing hierarchical structure on the travel decision will impose *ad hoc* restrictions on the substitution pattern that would be rather arbitrary.

Third, there is no comprehensive information on length of stay. Clearly, if a price of a country increases then potential visitors can either substitute to a different destination or shorten the length of stay. This latter effect cannot be captured with the available data. Data on length of stay is available through the WTO, but only for a limited set of destinations. In future research, if such data becomes available, it could be used for analysing the industry, treating tourists' actions as a two-step decision: where to go and for how long to stay. The discrete choice modelling would then be modified to accommodate the continuous choice of length of stay. With the current available data, however, a discrete choice model seems the natural path to follow.

The fourth limitation concerns the scope of the definition of tourism. The WTO classifies tourism into five groups according to the purpose of travel: leisure tourism, visiting friends and relatives, business and professional travel, travel for religious purposes, and other purposes. While all these groups are interesting and worthy of independent studies, an aggregation of all types of tourism may have undesirable results. The main problem is that the appropriate explanatory variables might vary by purpose of visit. Leisure tourists, for instance, are probably much more sensitive to price than travellers visiting relatives. Business tourists, on the other hand, may be more responsive to economic growth in the destination country. Including all these groups in one study may therefore alleviate the ability to interpret the results. In this paper it was therefore decided to focus on leisure tourism, defined by the WTO as tourism for the purposes of 'sight-seeing, shopping, attending sporting and cultural events, recreation and cultural activities, non-professional active sports, trekking and mountaineering, use of beaches, cruises, gambling, rest and recreation for armed forces, summer camp, honeymooning, etc.' We therefore choose only explanatory variables that are equipped to explain this type of tourism. However, the existing data on tourist flows between pairs of countries do not allow distinguishing between tourists on the basis of their purpose of travel. Therefore information one *does* have on this breakdown at the aggregate country-year level is used. That is, for each year it is known what fraction of the total tourist arrivals to any destination entered for leisure purposes. The total flow between the origin and the destination is then multiplied by this fraction, implicitly imposing that any destination is associated with an annual intensity of leisure tourism, regardless of the origin.[22]

The final step towards creating the dependent variable is dividing the adjusted tourist flows by the population of the origin country. The latter series was obtained from the World Development Indicators (WDI, 2000).

Turning to the explanatory variables, these can be grouped into the price variable and three additional groups: variables that describe the origin-destination relationship, variables that are destination specific, and variables that are origin specific.

The price variable we use for this study is the relative cost of living in the destination with respect to the origin. Our proxy for cost of living is the reciprocal of the PPP conversion factor, which represents the purchasing power of one dollar in the country. The relative purchasing power, therefore, shows how many 'baskets' of goods a tourist has to give up in his home country in order to buy a 'basket' of goods in the destination. Given that

[20] Some other techniques, such as the AIDS model, require a 'full matrix' of data in order to perform the estimation. Therefore, any missing destination may be problematic for the estimation of the full origin country market.

[21] For example, people may not find it optimal to travel only to Belize, but may visit Belize as part of a trip to Guatemala. Therefore, an increase in the risk or in the price of Guatemala may actually decrease incoming tourism to Belize.

[22] The fact that only tourist outflows from developed countries are included in the regressions makes the results less sensitive to this assumption. Moreover, it is certainly an improvement relative to the alternative of making no adjustment at all, which embodies the assumption that these intensities are uniform worldwide and over all years. Table 1 suggests that this is not the case.

specific tourism price indices do not exist, we believe that this variable best represents what tourists take into consideration while making their decision about if and where to travel (see also discussion in Sections II and III). Not only does this variable capture changes in real exchange rates over time, but it also captures the cross-sectional variation in the cost of travel.[23] This can be important for specifications that do not include destination fixed effects because, for example, the choice of whether to travel to Turkey or to Iceland is undoubtedly influenced by the respectively low and high cost of travel to these destinations. The variable allows capturing such differences in a consistent and simple manner.

The group of variables that control for origin–destination relations consists of economical, cultural, and geographical variables. To proxy for the intensity of the economic relations between the countries, one uses the gross annual value of bilateral trade in goods between the countries (i.e. the sum of trade in both directions).[24] We standardize this figure by dividing it by both countries' GDPs (from the WDI), in line with the gravity equation. An additional benefit of using this variable is that it can control for the number of business tourists travelling between the countries. To control for similarity in culture between the origin and the destination, one creates a dummy variable that is equal to one if the countries have at least one common language.[25] Finally, the geographical variables include the following: a dummy for a common border, the distance between the countries, and a set of dummies that capture differences in climate. For measuring the distance between the countries the location of a country is taken to be at its capital. This variable is important since it proxies for transportation costs.[26] The dummies for differences in climate are constructed by calculating the difference in the distance to the equator between the origin and the destination (again, measured at the capital city) and then clustering them into seven groups, each represented by a dummy variable. Note that the cultural and the geographical variables are superfluous in specifications that include dummies for origin–destination pairs since they do not vary over time.

Included in the destination variables group is a risk variable, an economic variable, and geographical variables. To measure the riskiness involved in travelling to a destination country three annual indices are used for the levels of internal, external and ethnical conflicts. These are produced by the *PRS group* for the years 1985–1998. These indicators are scaled between 1 (worst) and 12 (best), and are constructed by adding up sub-indices that are based on 'expert opinion'. The minimum of the three is used as the risk variable.[27] The economic variable used is GNP per capita, PPP adjusted (WDI, 2000).[28] This variable proxies for the level of development of the destination country. Finally, in those specifications that do not include destination dummies three geographical variables are used: the surface area (WDI, 2000), a set of dummies for distance from the equator clustered into seven groups, and thirteen regional dummies interacted with a dummy for landlocked countries. The rational behind a dummy for countries with access to the sea is that these countries may attract 'beach tourism'.

For the origin only a single variable is included: GNP per capita (WDI, 2000). This variable is used to measure how the travelling habits of people in the origin country respond to a change in their wealth. Additional origin-specific variables are not used since origin dummies are included in all specifications. As explained in Section III, no attempt is made to explain differences in the general propensities to travel across nations that may depend on unobservable cultural factors.

Table 1 shows a list of the top ten world tourist destinations, as of 1998, and the breakdown of entries by purpose of visit. Table 2 provides summary statistics, by region, for selected variables from the data.[29] This table displays the wide differences between different regions of the world in tourist arrival and departure patterns, and in tourism determinants. This emphasizes the need for good control variables, and fixed effects in particular, that allow correct inference of the parameters of interest.

V. ESTIMATION RESULTS

Using the variables constructed above, in this section the estimation based on the empirical strategy of Section III is performed. The estimation will be done in two steps. First,

[23] The latter cannot be captured by the real exchange rate, since it is indexed relative to a base year.
[24] Source: World trade analyzer (CD-ROM), Statistics Canada, ITD (1998).
[25] Source: The CIA factbook at http://www.odci.gov/cia/publications/factbook.
[26] The distance captures the cross sectional variation in transportation costs, but does not account for changes in them over time (which, for example, may result from shocks to oil prices). The latter are captured by including year dummies in all the specifications (assuming, roughly, that the cost per mile of travel changes uniformly across different routes).
[27] The idea behind using the minimum of the three risk variables is that when considering risk, a tourist is most likely to care about the worst possible scenario rather than the average risk. As an analogy, driving a car with damaged brakes is dangerous even if all the other systems are well functioning.
[28] Throughout GNP is used rather than GDP because the coverage of this variable in the WDI database is better.
[29] It should be noted that for simplicity of exposition only two dimensions of the data are described in Table 2, namely the cross-section of destinations over time.

Table 1. *Top 10 tourist destinations and breakdown of purpose of visit, 1998*

	Total arrivals (millions)	Leisure (% of arrivals)	Business (% of arrivals)	Other purposes (% of arrivals)
France	70.0	72	13	15
Spain	47.7	88	7	5
US	46.4	73	21	6
Italy	34.8	62	25	13
UK	25.8	42	25	33
China	25.1	N/A	N/A	N/A
Mexico	19.8	31	4	65
Canada	18.8	56	16	28
Poland	18.8	42	28	30
Austria	17.4	58	24	18

Source: WTO.

Table 2. *Descriptive statistics of worldwide tourism trends, by region, 1985–1998*

Region	Period	Arrivals[a]	Arrivals/ area[b]	Leisure[c]	Receipts[d]	Cost of living[e]	Risk index[f]	Propensity to travel[g]
North Africa	1985–1989	1548	1.35	56.3%	3.09%	0.43	5.8	3.82%
North Africa	1990–1994	2217	1.93	51.5%	4.08%	0.38	7.3	5.84%
North Africa	1995–1998	2227	1.94	52.1%	4.23%	0.38	7.7	2.99%
Rest of Africa	1985–1989	137	0.24	46.7%	2.28%	0.47	4.8	0.52%
Rest of Africa	1990–1994	224	0.39	46.4%	2.61%	0.41	4.7	1.01%
Rest of Africa	1995–1998	375	0.64	46.1%	2.94%	0.37	6.7	1.29%
Middle East	1985–1989	763	1.61	45.8%	2.52%	0.70	3.5	3.34%
Middle East	1990–1994	1128	2.49	33.9%	2.89%	0.61	6.6	4.48%
Middle East	1995–1998	1570	3.57	47.6%	3.82%	0.61	7.7	4.89%
Asia	1985–1989	1756	1.88	58.4%	2.14%	0.44	4.9	0.89%
Asia	1990–1994	2658	3.02	55.9%	2.36%	0.44	6.1	2.54%
Asia	1995–1998	3500	3.98	60.5%	2.55%	0.46	8.4	3.39%
North America	1985–1989	22 331	2.31	48.1%	0.81%	0.95	9.9	26.43%
North America	1990–1994	29 577	3.06	64.3%	1.04%	0.98	9.1	28.34%
North America	1995–1998	31 829	3.29	63.3%	1.22%	0.92	7.3	27.55%
Central America	1985–1989	1851	5.97	72.2%	2.43%	0.46	4.0	7.83%
Central America	1990–1994	2367	7.64	62.7%	3.80%	0.42	6.3	10.20%
Central America	1995–1998	2890	9.32	56.4%	4.68%	0.45	8.8	9.01%
Caribbeans	1985–1989	468	30.98	80.3%	21.00%	0.63	6.2	3.95%
Caribbeans	1990–1994	616	40.57	82.0%	22.20%	0.65	7.2	3.89%
Caribbeans	1995–1998	771	50.74	80.8%	17.10%	0.65	8.5	4.13%
South America	1985–1989	591	0.43	58.1%	3.42%	0.41	6.0	2.63%
South America	1990–1994	813	0.59	58.8%	4.29%	0.46	7.3	3.47%
South America	1995–1998	1205	0.88	53.9%	4.39%	0.54	8.3	4.32%
Oceania	1985–1989	1270	0.32	52.7%	1.69%	0.85	10.0	24.00%
Oceania	1990–1994	1902	0.47	57.2%	2.30%	0.90	10.8	26.24%
Oceania	1995–1998	2787	0.70	56.1%	2.99%	0.94	9.5	30.25%
Western Europe	1985–1989	7592	46.78	63.2%	4.31%	0.91	9.4	35.20%
Western Europe	1990–1994	9680	61.97	64.7%	4.50%	1.10	10.3	61.18%
Western Europe	1995–1998	10 950	70.29	65.7%	4.30%	1.09	10.2	65.92%

All figures are averages across all countries in the region and all years of the period. Equal weights were used unless otherwise specified.
[a] Total tourist arrivals, in thousands.
[b] Tourist arrivals per squared kilometre *(weighted by the country's surface area)*.
[c] Leisure tourists as a percentage of total tourists.
[d] Tourism receipts as a percentage of GNP.
[e] Country's cost of living (reciprocal of the PPP converter).
[f] Risk index (varies between 1 to 12, 12 being the safest) taken as the minimum of three risk indices (external conflicts, internal conflicts and ethnical tension).
[g] Total tourism outflow as a percentage of the origin's population *(weighted by the country's population)*.

Table 3. *Multinomial logit estimation of leisure tourism determinants*

	High GNP destinations			Low GNP destinations		
log(destination cost/ origin cost)	−1.002**	−0.992**	−1.271**	0.021	−0.027	−0.890**
	−22.27	*−11.34*	*−11.02*	*0.59*	*−0.37*	*−6.77*
Country-pair						
Country pair dummies	yes			yes		
log(trade)	−0.002	0.322**	0.292**	0.013	0.288**	0.230**
	−0.16	*7.62*	*6.44*	*0.99*	*11.26*	*6.03*
log(distance)		−0.978**	−0.984**		−0.939**	−0.924**
		−14.11	*−12.34*		*−15.02*	*−8.68*
Same language dummy		0.313**	0.313**		0.931**	0.667**
		2.99	*2.58*		*9.88*	*4.16*
Common border dummy		0.175	0.186		1.329**	1.475**
		0.98	*0.90*		*2.72*	*3.07*
diff. in DFE[a] dummies		yes	yes		yes	yes
Destination						
Destination dummies	yes	yes		yes	yes	
Destination risk index	0.043**	0.041**	0.040*	0.050**	0.038**	0.016
	8.12	*3.61*	*2.04*	*10.65*	*4.29*	*0.96*
log(dest. GNP pc)	0.301**	0.118	0.805**	1.400**	1.293**	1.372**
	4.05	*0.76*	*7.74*	*19.89*	*8.90*	*23.85*
log(land area)			0.621**			0.400**
			13.77			*9.99*
DFE[a] dummies			yes			yes
region × sea dummies			yes			yes
Origin						
Origin dummies	yes	yes	yes	yes	yes	yes
log(origin GNP pc)	1.552**	1.392**	1.289**	1.484**	0.824**	0.414
	16.86	*5.34*	*5.00*	*11.32*	*3.07*	*1.05*
Year dummies	yes	yes	yes	yes	yes	yes
No. of observations	5474	5474	5474	8870	8870	8817
Adjusted R-squared	0.973	0.901	0.878	0.951	0.879	0.659
R-squared within	0.498	0.538	0.554	0.294	0.324	0.308

The dependent variable in all regressions is $\log(s_{odt}) - \log(s_{o0t})$ as given by Equation 3.
The table is based on a specification that imposes the same coefficients across different origins.
High GNP countries are those with GNP per capita that exceeds $10,000 US in 1998. Low GNP countries are all the rest.
The regression includes only flows from origins with high GNP.
* significant at 5%. ** significant at 1%.
Robust *t*-statistics below estimates, clustered by country pairs.
[a] DFE = Distance from Equator.

a pooled logit regression was run, imposing a uniform set of coefficients across all origin countries. This allows one to arrive at a better understanding of general tendencies in the tourism market. In the second step key coefficients were allowed to vary by origin country. This enables one to calculate country-specific own and cross-elasticities in a more flexible and accurate way, as depicted by Equations 6 and 7.

The results of the first step estimation are described in Table 3. A few important remarks should be made to explain this table before turning to the findings themselves. First, we include only observations for which the origin country has a high GNP, where a high GNP country is defined as a country with GNP per capita that exceeded 10 000 US dollars in 1998.[30] Thirty-six countries qualify for this group. The reason why we want to omit observations on outflows of tourists from less developed countries is that it is believed that from these countries leisure tourism, a luxury good, is rather scarce. Therefore, tourist outflows may be mostly due to other reasons (e.g. immigration), with which we do not wish to deal in this study. Second, separate sets of regressions were run for low GNP

[30] This study also tried using different cutoff points, such as 8000 and 5000 US dollars, and obtained almost identical results.

destinations and for high GNP destinations. High GNP destinations are defined the same as high GNP origins, and low GNP destinations are the remainder, i.e. countries where GNP per capita in 1998 was below 10 000 US dollars. The reason for this separation is that it is presumed, and this is later confirmed by the results, that factors that affect tourists' choices of visiting less-developed countries are different from those influencing their choice of travelling to developed countries. Moreover, the difference in the experience of travelling to the two types of countries suggests low cross-substitutability between them, and therefore supports the decision of treating them as separate markets. The third remark is about the three different specifications used. The first regression includes dummy variables for every destination–origin pair. These account for relationship-specific unobservables, as well as for origin and destination fixed effects. The goal then remains to explain variation over time in flows of tourists between countries. The second regression drops the pair dummies, but leaves the origin and the destination fixed effects. Hence, now one also attempts to explain, with the help of the economical, geographical, and cultural variables, why there are more tourist flows between some country pairs than between others. The last regression also drops the destination dummies, leaving only the origin dummies. Here the explanatory variables try to explain the attractiveness of each destination, rather than just assume a country has an unobserved attractiveness that is fixed over time. While this may be an interesting exercise, it is perhaps less appealing than the other regressions since many country characteristics are fixed over time and cannot be captured by any variable (e.g. the pyramids of Egypt). Note also that in all these specifications year dummies are included to account for worldwide trends of travelling.

We now move to a discussion of the results. First, it is reassuring that all coefficients in all regressions obtain the expected signs and reasonable orders of magnitude. Furthermore, the key coefficients are stable across the different specifications that were tried.

The coefficient on price[31] is about one for travel to high GNP destinations, but is statistically insignificant for travel to low GNP countries (with one exception, which is discussed below). This result is in line with economic intuition. The fact that potential tourists to low GNP countries are not very sensitive to fluctuation in prices can be explained by the fact that prices in these countries are relatively low. The cost of travel, therefore, is mainly driven by other costs such as transportation costs, costs of organized tours or the alternative cost of leisure, which are all independent of the cost of living in the destination country. On the other hand, travel to high GNP destinations does respond to price fluctuations and better resembles 'standard' consumption. The price elasticity of about one for these countries is quite stable across specifications, especially when compared to the wide range of elasticities found in the literature. It is interesting to see that once destination dummies are omitted from the specification, the price coefficient for low GNP destinations becomes closer to that of the high GNP countries and statistically significant. This may suggest that the general level of prices in destinations is taken into account by travellers when making travel decisions, even to low GNP countries, and only the fluctuations in prices over time are unimportant. Alternatively, it may be the case that once destination dummies are omitted, the price coefficient is biased downwards because of a negative correlation between the destination price and the unobserved quality of the destination. Therefore, it is believed that one should be cautious in interpreting the price coefficient for this case.

The destination risk index enters all specifications with a positive sign and is statistically significant. The coefficient is quite stable around 0.04, suggesting that, on average, an increase of one point in the risk index (which is scaled from 1 to 12, high being better) increases incoming tourists by about 4%.[32] The coefficient is of similar magnitude for both high and low GNP destinations, suggesting that risk in the destination countries always plays an important role as a determinant of international tourism. This result, as emphasized in Section II, is one of the main characteristics that differentiate international tourism from standard international trade,[33] and was confirmed with the tourist plunge following the September 11, 2001 terrorist attack (which took place after the end of the present dataset). The risk coefficient becomes insignificant once destination dummies are omitted for low GNP countries. One possible interpretation for this result is that while the risk variable is a reliable predictor of tourism within a country over time, once destination dummies are omitted it absorbs cross-sectional variation in unobservables, which make the estimation of risk much noisier and less reliable. For example, Egypt may score lower on risk than Botswana, but it may still attract more tourism due to reasons not captured by the other variables. A different explanation for this result may be that the construction of the risk index makes it more accurate in describing variation in risk over time

[31] Since market shares of single destinations are small, the coefficient on price is approximately the price elasticity, as can be seen from Equation 4.
[32] Substituting the minimal risk index by the average risk index, coefficients of about 0.07 are obtained in all specifications.
[33] An interesting empirical exercise is to run a similar model but with trade in goods as the dependent variable. Doing so, much lower coefficients were obtained on the risk variable, ranging from insignificant to about 0.015.

Table 4. *A sample of calculated own- and cross-price elasticities*

	Australia	Brazil	France	Israel	Italy	Jordan	Spain	Tunisia	Turkey	UK	USA
Australia	−0.9294	0.0004	0.0248	0.0005	0.0090	0.0002	0.0191	0.0006	0.0018	0.0082	0.0197
Brazil	0.0004	−0.4101	0.0263	0.0004	0.0079	0.0001	0.0146	0.0008	0.0010	0.0041	0.0063
France	0.0015	0.0014	−0.8681	0.0014	0.0348	0.0003	0.0919	0.0038	0.0053	0.0188	0.0198
Israel	0.0014	0.0008	0.0632	−0.9683	0.0192	0.0002	0.0433	0.0021	0.0040	0.0114	0.0159
Italy	0.0016	0.0013	0.1062	0.0013	−1.0200	0.0003	0.0615	0.0034	0.0055	0.0160	0.0183
Jordan	0.0002	0.0001	0.0049	0.0001	0.0018	−0.1040	0.0034	0.0002	0.0006	0.0013	0.0019
Spain	0.0015	0.0010	0.1212	0.0013	0.0266	0.0002	−0.8837	0.0036	0.0052	0.0155	0.0176
Tunisia	0.0005	0.0005	0.0478	0.0006	0.0142	0.0001	0.0343	−0.4783	0.0025	0.0083	0.0069
Turkey	0.0011	0.0005	0.0523	0.0009	0.0179	0.0003	0.0389	0.0019	−0.6280	0.0097	0.0101
UK	0.0019	0.0008	0.0721	0.0010	0.0201	0.0003	0.0451	0.0025	0.0038	−0.9930	0.0206
USA	0.0013	0.0004	0.0225	0.0004	0.0068	0.0001	0.0151	0.0006	0.0012	0.0061	−0.4949

- The table provides a sample of point estimates for the price elasticities, based on an estimation of the model that allows for different price coefficients for each origin country. The main diagonal in the matrix provides the own-price elasticities, while the rest of the matrix shows cross-price elasticities.
- If X is the row country and Y is the column country, the corresponding figure should be read as the elasticity of tourism to X with respect to the price of Y. Thus, for example, the elasticity of tourism to Brazil with respect to the price of France is 0.0263, while the elasticity of tourism to France, with respect to the price of Brazil, is 0.0014.

within a country, but less accurate for cross-country comparison.

The coefficients on GNP for both the origin and the destination are almost all positive and statistically significant.[34] Many of them are around one, which is in line with the regularities found in the trade literature for the gravity model (see, for example, Bergstrand, 1985). However, the coefficients on origin GNP are generally higher, implying an income elasticity of between one and two. This is consistent with previous results in the literature, suggesting that tourism is a luxury good.

The coefficients on language, distance, and common border all obtain the expected signs, and are all statistically significant. Generally, these coefficients are higher for low GNP destinations. Perhaps a common language or geographical proximity may facilitate the generally more difficult trip to less developed countries.

The volume of bilateral trade becomes significant only when pair dummies are omitted. This implies that bilateral trade captures the 'stable' unobserved links between pairs of countries. However, fluctuations over time in trade for a given pair of countries are uncorrelated with fluctuations in international tourism.

Finally, in all the specifications high serial correlation is obtained in the error term (correlation coefficient of 0.4 to 0.5 in most cases), even when country pair dummies are included. This may suggest that fashions play an important role in the choice of destinations. This result is further strengthened by the fact that a similar serial correlation is found even when the destination dummies are interacted with the year dummies (omitting the pair dummies). Hence, fashions are localized within the origin. Further tests of the fashion hypothesis, however, require a more detailed data set.[35]

Now one proceeds to the second set of results, which are illustrated in Table 4. In this part the same model is estimated but the price coefficients are allowed to vary across origins. Then the own and cross-price elasticities are calculated, using Equations 6 and 7.[36] Table 4 illustrates the results for a selected sample of destination countries. The main diagonal of the matrix shows the own price elasticities, while the rest of the matrix reports the cross-price elasticities. A figure in the table stands for the elasticity of tourism to the row country with respect to the price in the column country. For example, a 1% increase in the price of France increases demand for Brazil by 0.0263%.

Looking first at own price elasticities, Table 4 shows what has also been seen in Table 3: developed countries obtain higher own price elasticities of about one. Brazil and Tunisia, which have lower GNP per capita, obtain

[34] One may be worried that the coefficient on destination GNP is biased upwards because higher tourism receipts increase the GNP, thus creating a possible endogeneity problem. Endogeniety concerns can also be raised regarding the price variable. However, when one estimated the reported regressions omitting the destination countries for which tourism receipts accounted for a high fraction of the GNP (5% was used as the cutoff) very similar results were obtained, suggesting that endogeniety is not driving these results.

[35] In particular, it may be interesting to check whether the fashion effect is because tourists tend to return to the same country over the years, or because they tell their friends about their visit and stimulate them to go as well.

[36] Recall that own- and cross-elasticities can be found in the same fashion for other variables of interest. In particular, the elasticity of tourism with respect to risk may be of interest. It can be valuable in answering questions such as 'what is the increase in tourist inflow to Italy as a result of the war in Yugoslavia?'

elasticities of about 0.4, and Jordan, which has the lowest GNP per capita in the selected group, obtains the lowest price elasticity. The US is the only exception with a relatively moderate price elasticity. Regarding cross-price elasticities, the elasticities with respect to the most popular destinations are highest. The three-dimensional dataset also allows one to obtain that the cross-price elasticities among the leading European destinations are much higher than their cross-elasticities with respect to the US. Similarly, tourism to other Mediterranean destinations such as Tunisia is much more responsive to fluctuations in European prices than to the US one. Similar results were obtained for other destinations not presented in this table.[37]

VI. SUMMARY

International tourism is a fast growing industry, accounting for more than a third of all trade in services and for almost 10% of total international trade. Yet, economists have seldom analysed this industry, and have not addressed its peculiarities. This paper has taken an initial step in doing so.

Using a three-dimensional data set (of flows of tourists between pairs of countries and over years) demand was estimated for international tourism. An estimation technique was used which is common in the industrial organization literature, and those aspects that are important for leisure tourism demand emphasized. It was also shown that a relatively simple estimation technique, combined with a rich data set, can deliver reasonable substitution patterns.

The main findings are that tourism to developed countries has a price elasticity of about one, while tourism to less developed countries does not respond to price fluctuations. Destination risk, which is not very important for trade in goods (beyond, perhaps, its indirect effect through GDP), is shown to be quite important for destination choice, for both developed and less developed countries. Fashions seem to have an important role as well. Other variables such as common border, common language, and distance, are all important in determining tourism flows, especially for less developed countries.

Compared to previously obtained results, the results are based on a more detailed dataset and a more rigorous estimation technique is used. They are quite stable across specifications and may provide more subtle evidence for the determinants of international tourism.

Further research on this topic is important and may be feasible once more data becomes available. It can follow several paths. To name a few, one could take advantage of data on length of stay (that already exists for a small sample) in order to allow for a mixed discrete–continuous travel choice. Also, data on multi-destination trips should be used in order to analyse whether country pairs are substitutes or complements. Individual-level data can shed light on tourism habits and complement aggregate level studies such as the present one. Finally, one may extend the framework to allow for the possibility that a country develops tourism facilities to endogenously increase its inflow of tourists.

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[37] The entire table, as well as corresponding tables for other variables, are available from the authors upon request.

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