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Abstract

Travel and tourism services are among the largest globally traded services sectors. Data representing travelers to the United States from the 50 countries that contributed the most inbound travelers between 1990 and 2010 were assembled. Income levels and religion influenced which countries made it into the top 50 list. These data are then combined with economic, policy, and cultural variables to estimate a demand model of these flows of travelers. These data contained substantial heterogeneity that traditional panel data methods do not adequately account for, and econometric methods that employ a multi-factor error structure, such as those pioneered by Serlenga and Shin and others, are used. These methods, which permit unobserved heterogeneous responses to global events, improved the statistical estimation and produced reasonable economic results. Empirical results provide evidence that income, relative prices, cultural factors, and policies are major determinants of inbound U.S. travel. The Visa Waiver Program and a program that facilitates group travel by Chinese nationals had statistically significant positive effects on the numbers of inbound travelers. Being from a majority English-speaking country or a bordering country (Canada or Mexico) were the most significant cultural or geographic factors.

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1 Antecedents

Economic, policy, cultural, and geographic factors largely determine the source country of inbound travelers to the United States each year. Relative prices and levels of income are shown to be major influences on the numbers of inbound travelers. The Visa Waiver Program and a program to facilitate group travel by Chinese nationals appear to increase the flow of inbound travelers. Variables representing cultural identities and geography, such as being from an English-speaking country or from Canada or Mexico, have a persistent positive effect on numbers of travelers. Cultural and economic factors also determine the countries that appear in the data used for this study, which consists of countries with the 50 largest flows of inbound U.S. travelers. These data contain substantial heterogeneity among countries and over time, and recent techniques that permit a multi-factor error structure improve the statistical estimation.

Transportation and travel-related services are the largest components of global services trade and continue to grow, although other services sectors grew more rapidly between 2000 and 2010.¹ The United States experienced similar trends. U.S. exports and imports of travel services, passenger fares, and related services more than doubled between 1990 and 2010. However, travel services fell from 31 percent of total services exports in 1990 to 20 percent in 2010; similarly, imports of travel services fell from 38 percent of total services imports in 1990 to 21 percent in 2010.² In particular, U.S. trade in royalties and license fees, insurance, and financial services, among others, grew more rapidly than travel and tourism. In 2010, exports of travel services, valued at \$104 billion, were the second largest single industry category of U.S. services exports (after royalties and license fees). U.S. imports of travel services in 2010 were the largest single industry category of services imports and were valued at \$76 billion.

Purchases of transportation and travel services by international travelers are important

¹World Trade Organization, *International Trade Statistics 2011*, table III.2. The World Travel and Tourism Council (WTTC) estimates that travel and tourism directly contributed 3 percent of global GDP in 2011 (WTTC, 2012, 3).

²Bureau of Economic Analysis, *Survey of Current Business*, various issues. The October issue usually has data on services.

sources of economic activity in some areas. Expenditures by international travelers while in the United States are counted as U.S. exports and directly contribute to U.S. employment. Foreigners' expenditures on locally produced goods and services may transform goods and services that are not usually traded into traded goods.

The following section of this paper (part 2) reviews the related literature. Then, geographic, cultural, and policy factors (here collectively referred to as travel frictions) are discussed in part 3. A demand model to explain flows of inbound travelers is developed in part 4. The data on inbound tourism are explored in part 5, and a frictionless model based solely on population is developed in part 6. The results of empirically estimating the demand model using different econometric techniques are shown in part 7. Conclusions are drawn in part 8.

2 Related Literature

This section reviews literature related to flows of travelers and demand for international tourism services. These studies apply a fairly standard demand model to identify the determinants of travel. Most of this work has focused on Australia and developing countries, with only a few studies concentrating on the United States. However, an early article on U.S. domestic travel begins the review because it addresses some key issues.

Long (1970) examined air passenger travel between the 13 largest U.S. cities during 1960–63 and assumed that people travel to shop, to conduct business, and to visit friends and relatives. Curiously he did not consider other reasons, such as cultural activities or recreation, but additional considerations may not have altered his model specification because data on the purpose of a trip were unavailable. He considered business and personal travel to be proportional to the size of the destination and origin because economic and personal relationships become more likely as the number of people increase. He included a population variable to indicate numbers of personal and business trips. Relative prices between the destination and origin and disposable income are important determinants of

shopping trips, and variables for cost-of-living indexes and per-capita income are included to capture these ideas. The cost of transit is relevant for each type of travel. Lacking data on transportation costs, he used distance between the origin and destination as a proxy. The inclusion of variables for distance, population, and income make this model similar to gravity models of trade flows. In fact, he estimated a pure gravity model with population and distance as variables, and these variables alone explained much of the variation in flows of air passengers. Parameter estimates for the price indexes and income were significant however and improved the explanatory power of the model.

Keum (2010) modeled flows of business and leisure travelers between South Korea and its 28 principal trading partners between 1990 and 2002 with a gravity model. In addition to variables for distance and GDP, he included a regressor for economic similarity. He estimated pooled and random effects models, but did not consider fixed effects. A test of the pooled model revealed substantial heterogeneity among countries, and he rejected the pooled model in favor of the random-effects model. The random-effects model took the unobserved heterogeneity into account, but he did not test whether the random effects were correlated with the regressors, and such correlation would call into question the validity of the random-effects model. He found that the number of travelers between countries increased with GDP and decreased with distance, but that the number of travelers did not increase when two countries approach a more similar stage of development.³ He concluded that distance was the single most important factor in explaining these travel flows, as estimates of the parameters on the distance variable were the largest (in absolute value—typically less than -1 depending upon the specification) and were significant at the 5 percent level. Parameter estimates for GDP were also significant and typically less than 1.

Lim (1997) derived the basic demand model of travel flows as a function of income in the originating country, transportation costs to the destination country, and price levels faced by the traveler or tourist. This basic model does not have variables for prices of substitutes and complements and applies the same variables regardless of the purpose of the trip. A

³This is known as the Linder hypothesis, after Linder who stated that trade increases as per-capita income and tastes converge. Linder, 1961.

number of articles apply variants of this basic model. For example, Lim and McAleer (2001) examined the determinants of inbound tourism from Singapore to Australia using quarterly data from 1980 to 1996. They estimated the basic demand model and found that real income in Singapore and relative prices in the two countries were important determinants of inbound tourism. They estimated an OLS model and found that income and price were inelastic. They also estimated a cointegrated model, and airfare and exchange rates (a proxy for price) were elastic in this version.

Divisekera (2003) examined demands for tourism among Australia, Japan, New Zealand, the USA, and the UK, without including all combinations. He argued that regardless of the purpose of the trip all tourists consume attributes of the destination along with other available goods and services. Prices were weighted averages of tourism price indexes of the destination countries and airfares. He found the expected positive income elasticities and negative own-price demand elasticities. Parameter estimates tended to be significant, but many were insignificant at conventional levels.

Eita, Jordaan, and Jordaan (2011) examined the determinants of tourist arrivals to South Africa from 1999 to 2007 from 27 countries. They estimated pooled, fixed-effects, and random-effects models, and the fixed-effects model had the best statistical properties. The source country's GDP was statistically significant, although the elasticity estimate was small (0.132). A novel feature was the inclusion of supply-side variables for electricity generated in South Africa and infrastructure of the source country (measured by number of aircraft departures). The former was included as a measure of South African capacity to absorb tourists, while the latter could be correlated with the income level of the source country. Both measures were statistically significant and positively associated with the numbers of arrivals. A distance variable, a proxy for travel costs, was statistically significant and had the expected sign (-0.144). Dummy variables were also included for EU membership and for sharing a border with South Africa and were statistically significant.

Naude and Saayman (2005) studied the determinants of tourism in 43 African countries between 1996–2000 using a variety of methods. Their approach was more statistical than

economic, and they included variables on hotel capacity, malaria, income, border with South Africa among others. They found that political stability was important to international visitors, particularly North Americans, but that tourism to Africa was not very sensitive to price.

3 Travel Frictions

Differences in geography and culture affect the likelihood that someone from a different country and culture will travel to the United States. Similarly, certain government policies facilitate travel, while other policies hinder travel.⁴ This section looks at some effects that differences in geography, culture, and policy—here collectively referred to as travel frictions—can create.

Cultural factors affect which countries international travelers are likely to visit. For example, studies suggest that Hong Kong nationals are most likely to visit mainland China because of cultural similarities; Saudis are more likely to visit Muslim countries because of negative images of Europe and America (particularly after 9/11); Japanese people are more likely to visit areas where similar cuisine may be found; and people are more likely to visit a different culture if they speak that culture’s language.⁵ Food, sanitation, pace of life, etiquette, perceived risks and security, and recreational opportunities similarly play a role in the traveler’s destination decision.

Language and religion affect tourist flows to the United States according to Vietze (2008) who explored the effects of cultural factors in addition to GDP and distance. Using annual data from 2001 to 2005, he found that tourists from primarily protestant countries preferred to visit the United States much more than those from Muslim countries. He also found that people from English-speaking countries were more likely to visit the United States than those from where English is not spoken.

The potential number of cultural influences is large, and summary measures that capture

⁴In making a similar distinction, Bergstram and Egger (2011, 3–7) broke costs into natural costs influenced by geography and unnatural or artificial costs determined by government policy.

⁵Ng et al. 2007 summarized a number of studies on the impact of cultural distance on travel.

a rich portion of cultural diversity are difficult to develop. One simple summary measure is Clark and Pugh's index of cultural distance based on cluster analysis.⁶ They found an Anglo cluster (Australia, Canada, Ireland, New Zealand, South Africa, and the USA), assign it an index value of 1, and compare other clusters to it. The other clusters, in order of the degree of similarity with the base cluster, are the Nordic cluster (Finland, Netherlands, Norway, Sweden), the Germanic cluster (Austria, Germany, Luxembourg, Switzerland), the Latin cluster (Argentina, Belgium, France, Italy, Portugal, Spain), and the rest of world. The Latin and rest-of-the-world clusters, in particular, combine quite different cultures. It is also surprising that South Africa is included in the Anglo cluster.

The United States shares long borders and many cultural similarities with Canada and Mexico. Substantial economic integration has occurred among the three countries, aided by the North American Free Trade Agreement, although borders continue to restrict the movement of people and goods. Canada and the United States have a common British colonial heritage, and both countries predominantly speak English. There are many cultural similarities, and differences as well, between the United States and Mexico (Kras 1995). Few Mexicans living in Mexico speak English, but most U.S. residents of Mexican origin speak English in addition to Spanish, which is the most widely spoken language after English in the United States (Pew Hispanic Center 2010). Approximately 47 million Hispanics were living in the United States in 2008, according to the Census Bureau's American Community Survey, and they contribute to the prominence of Spanish as a second language in the United States.

Government regulations on legal international travel (the focus of this article) center on controlled admittance of individuals at border check points. An essential part of this system is the selective issuance of travel documents, which most countries require before admitting foreigners to their territory. For example, the Western Hemisphere Travel Initiative requires all travelers to and from the Americas, the Caribbean, and Bermuda to have a passport or

⁶Clark and Pugh 2001. Although developed in a study of UK firms, this measure has been used in several travel studies.

other accepted document.⁷ Besides requirements related to obtaining permission to enter a country, other government programs provide information or lessen restrictions for certain categories of travelers and thereby promote travel. The same basic principles apply to these indirect travel costs in that consumers tend to substitute less expensive services for more expensive ones. Thus, if obtaining permission or meeting other requirements to be able to go to a particular destination take longer or cost more than those needed to travel to an otherwise comparable destination, a traveler will likely choose the alternative comparable destination, all else being equal. A comprehensive analysis of travel policies is beyond the scope of this paper. Instead, a few policies (the Visa Waiver Program; special provisions for citizens from Bermuda, Canada, and Mexico; and an agreement concerning Chinese tourists) that could influence travel to the United States are identified and discussed, and their significance is evaluated later in the empirical part of this paper.⁸

Restrictions on visas impede travel between countries. Neumayer (2010) examined the effect of visa restrictions on travel between countries during 1995–2005. He found large effects, namely that visa restrictions impose reductions of 37 percent and 64 percent on the number of visitors from, respectively, developed and developing countries. However, the variable for visa restrictions was based on a single year of a data (2004) from the International Civil Aviation Association and applied to all years. Although this approach could be problematic, it could still be valid if countries do not quickly change their visa policies.

Temporary visitors to the United States are generally required to have a nonimmigrant visa. There are a few exceptions including the Visa Waiver Program as discussed later in this section. Obtaining a visa to enter the United States requires a commitment of time and funds. An interview at a U.S. consulate or embassy abroad is usually required. The State Department endeavors to process visa requests within 30 days, but applicants must wait 90

⁷ *Federal Register* 71, no. 226 (Nov. 24, 2006): 68412–68430.

⁸ Other programs exist, such as the Global Entry Program that allows pre-approved, low-risk travelers to receive expedited entry into the United States. This program is relatively new, aimed at frequent travelers, and information about its effect is limited.

days after the interview before inquiring about the status of their application.⁹ Applicants for many types of visas, including tourist visas, are charged a \$160 non-refundable processing fee.¹⁰ A visa will be denied if the applicant fails to show eligibility. An applicant who is denied a visa has an opportunity to present additional information, which could reverse the denial. If the application is approved, an issuance fee may also be charged based on reciprocity tables that vary by country, although there is no additional charge for many countries.

The U.S. Congress passed the Visa Waiver Program in 1986 to encourage tourism and short business visits to the United States.¹¹ The program's goals are to eliminate unnecessary barriers to travel, promote the tourism industry, and allow the State Department to channel consular resources to other areas. A country must meet various security and other requirements, including prompt reporting of lost or stolen passports, to qualify for the program. Individuals from eligible countries do not automatically qualify for the program but must apply and meet certain requirements. Admittance to the program entitles one to travel to the United States for tourism or business for up to 90 days without obtaining a visa. UK citizens were the first to become eligible (July 1988) and were followed by the Japanese (December 1988). French, Italian, Dutch, Swedish, Swiss, and West German nationals became eligible in 1989. In 1991, many other European countries and New Zealand and Brunei qualified for the program. Argentina and Uruguay qualified in 1996 and 1999, respectively, but their eligibility was revoked in 2002 and 2003 because of overstays by some citizens. Although entry requirements became stricter after the 9/11 attacks, the number of countries whose citizens are eligible for visa-free entry has increased and numbered 37

⁹http://travel.state.gov/visa/questions/policy/policy_4433.html

¹⁰This rate applied as of January 2013. http://travel.state.gov/visa/temp/types/types_1263.html. In response to the U.S. visa processing fee, Brazil raised the fee that U.S. citizens must pay to obtain a visa for to a similar level as the United States; while charging most other countries only \$20. http://www.brazilsf.org/visa_fee_eng.htm. Argentina similarly increased its entry fee for U.S. citizens in response to the U.S. visa application fee. <http://embassyofargentina.us/embassyofargentina.us/en/consularsection/news.htm>

¹¹Information about the Visa Waiver Program is available electronically from the State Department, Customs and Border Protection, and Wikipedia websites. http://travel.state.gov/visa/temp/without/without_1990.html; http://www.cbp.gov/xp/cgov/travel/id_visa/business_pleasure/vwp; and http://en.wikipedia.org/wiki/Visa_Waiver_Program

as of January 2013. Recent entries into the program include the Czech Republic, Estonia, Hungary, Latvia, Lithuania, and Slovakia in 2008, and Taiwan in late 2012. Although entry for eligible citizens in eligible countries used to be free, the Travel Promotion Act of 2009 imposed a \$14 fee. Despite the small fee, the Visa Waiver Program would appear to decrease the costs and time involved for eligible foreign nationals to obtain permission to enter the United States.

Special provisions apply to Canadians, Mexicans, and Bermudians. Citizens of Canada and Bermuda traveling temporarily to the United States do not typically need a visa, except in some special categories.¹² Mexican citizens generally need a nonimmigrant visa or border crossing card, also known as a laser visa. Also, pursuant to the North American Free Trade Agreement, the TN (Trade NAFTA) visa was created to allow North American professionals to work in the United States on prearranged business activities. Canadian citizens are not generally required to have a U.S. visa in order to apply for this program. In contrast, Mexican citizens need an approved visa to request admission to the program.

Although only a small share of Chinese citizens have traveled in the past, the UN World Tourism Organization estimates that 100 million Chinese will engage in international travel by 2020.¹³ The United States and China signed a Memorandum of Understanding (MOU) in 2007 regarding outbound tourist group travel from China to the United States.¹⁴ The MOU will facilitate travel by Chinese nationals in large groups, which many Chinese apparently prefer, to the United States. Chinese regulations prohibit advertising and selling tour packages for leisure travel to destinations that lack approved tourist agreements, and China concluded a number of such agreements before negotiating one with the United States. This MOU qualifies as an improved destination agreement and allows Chinese travel agencies accredited by the Chinese National Tourism Administration to organize and market tours to the United States. The U.S. government, which did not need to change any U.S. laws to implement the agreement, established a mechanism to interview and process visas for

¹²http://travel.state.gov/visa/temp/without/without_1260.html

¹³“Fact Sheet U.S.-China Group Leisure Travel Memorandum of Understanding,” <http://tinet.ita.doc.gov/pdf/MOU.pdf>

¹⁴<http://www.ntaonline.com/includes/media/docs/USChinaMOU2008.pdf>.

Chinese nationals traveling in groups and did not limit the number of visas that may be granted under the MOU. Implementation began in 2008 and is being phased in for different regions of China.

One would expect the MOU to result in increased visits by Chinese nationals to the United States. Arita, La Croix, and Mak (2012) estimated the effects of approved destination agreements on travel by Chinese nationals to different countries, and different modeling approaches led to different results. A fixed-effects model yielded statistically significant estimates and showed that countries with approved destination agreements had 38 to 40 percent more visits by Chinese nationals over 3 years than countries without such agreements. Another approach, which likely better accounted for serial correlation, resulted in many statistically insignificant parameter estimates and large differences in signs and magnitudes among countries.

Besides U.S. restrictions on entry, other governments sometimes ban international travel by their own citizens. Many restrictions were eliminated by the early 1990s and are believed to have only a small effect on the data used in this study, which begins in 1990. For example, Japan permitted overseas leisure travel beginning in 1964, and South Korea did not fully liberalize leisure travel until 1989.¹⁵ Perhaps more well known, the Soviet Union limited international travel by its citizens. After the dissolution of governments from the communist bloc in the 1980s and 90s, exit restrictions from this region were liberalized. Uzbekistan is apparently the only country from this region that still requires an exit visa.¹⁶ Despite lifting restrictions, travelers from Eastern Europe and countries of the former Soviet Union still constitute only a small share of total inbound travel to the United States; even though as previously mentioned, several countries from this region have recently attained eligibility for the Visa Waiver Program. Cuba, North Korea, and other countries continue to limit their citizens' international travel.¹⁷

¹⁵Mak, 2004, chap. 9.

¹⁶Abulfazal, "Uzbekistan: Propiska and Exit Visa Result in the Lack of Freedom of Movement," *Politics and Society, Uzbekistan*, Sept. 2011. <http://www.neweurasia.net/politics-and-society/uzbekistan-propiska-and-exit-visa-result-in-the-lack-of-freedom-of-movement/>.

¹⁷The United States as well restricts travel by its citizens to Cuba.

4 Model

Any international trip requires time and money and competes against other potential uses of resources that a prospective traveler may have. Although many factors affect the travel decision, travelers generally choose less costly alternatives, assuming cultural, policy, and personal factors are equal.¹⁸

Flows of travelers (X) are viewed in a standard demand framework in which a representative consumer from each country decides whether to travel to the United States based on prices and income.¹⁹ The prices of goods and services purchased as part of the trip (P), the prices of other goods and services available to representative consumers (S), and consumers' incomes (Y) are key components of demand for travel to the United States. Transportation is often a large component of total trip costs, and separate transport prices (Q) are included. This setup in equation form follows, where i indexes the originating countries and t indexes time. Travel frictions (F) as discussed in the previous section are included as factors that could shift demand.

$$X_{i,t} = f(P_{i,t}, Q_{i,t}, S_{i,t}, Y_{i,t}; F_{i,t}) \quad (1)$$

The focus is on the flow of a single entity, temporary travelers to the United States. It is assumed that the United States has adequate infrastructure (including hotel rooms) to accommodate travelers, and no infrastructure variables are included as is sometimes done, especially in studies about tourism in Africa. Although there are certainly individual exceptions, the United States has generally had adequate capacity to lodge incoming travelers. The time period is one year. There are no feedback effects, and the model is static.

The numbers of inbound travelers are small relative to others purchasing goods and services, and it is assumed that representative inbound travelers are price takers in the U.S. market and that prices are thus exogenous. However, these price variables are not

¹⁸Vogel provides a framework for competing uses of time and money. Vogel, 3–9. He states that the primary determinant of long-term increases in leisure activity is the rising trend in per capita output.

¹⁹Thus, here, the number of trips is the dependent variable. For a study that examines the duration of trips, see Belenkiy (2012).

directly observed, and adjustments to the variables in the model, such as the use of indexes, could be needed. Also, measures of the frictions variables are often not directly observable. Therefore, the available data, discussed next, will affect the form of the estimating equation.

5 Exploration of U.S. Inbound Travel Data

This study uses commonly available aggregate data. For travelers to the United States, annual data based on surveys of inbound travelers to the United States are available for 21 years (1990–2010) from the U.S. Department of Commerce, International Trade Administration, Office of Travel and Tourism Services.²⁰ Data are generally available for the 50 countries with the largest flows of travelers to the United States. Early in this period, data were available for all countries, but due to budget reductions, the Office of Travel and Tourism Services now only provides some products for a fee and publicly reports less data. For 2010, eight of the 50 countries could not be found in the published reports. Data on the total number of travelers to the United States are continually reported. Data for the top 50 countries represented 97 percent of total inbound travelers from 1990 to 2009 (with a small standard error of 0.309). For 2010, the available data represented 91 percent of total travelers. Because the missing data are a fairly small share of total inbound travelers with a small standard error, a maximum likelihood procedure (based on other variables in the model including total numbers of travelers) was used to estimate the numbers of inbound travelers for the missing countries in 2010.²¹ Use of this procedure makes a balanced dataset possible, which is important for some estimation procedures, with 1050 total observations.

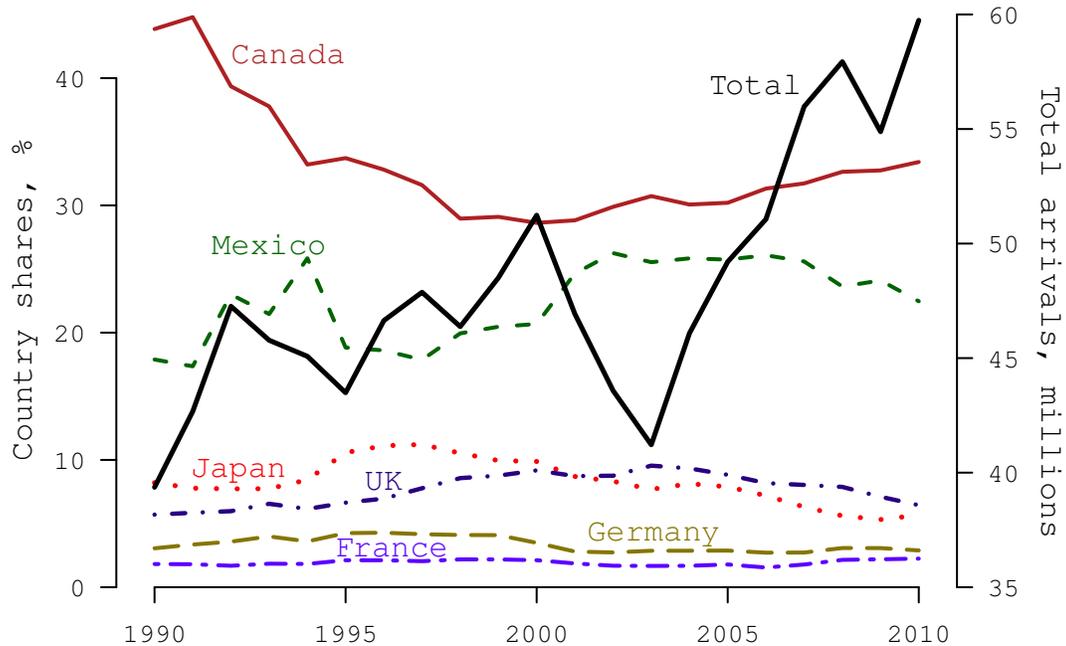
The total numbers of travelers grew somewhat erratically during 1990–2010 (figure 1). Related to the 9/11 events, numbers of travelers fell markedly between 2000 and 2003, with smaller downturns occurring after 1992 and 2008. Most travelers originated from Canada, Mexico, Japan, or European countries. Canada and Mexico were, respectively, the first and second largest sources of travelers for each period. The UK overtook Japan for the third

²⁰Information is based on the I-94 and I-92 surveys collected by the Department of Homeland Security. Data are weighted based on annual participation rates.

²¹An approach outlined in Su et al (2011) was followed. Other data were available for the full period.

spot in 2001, which was the only change in rank among the top six countries.

Figure 1: **Inbound travelers to the United States: total arrivals (right axis) and shares of top six sources (left axis), by year 1990–2010**



Source: Author's calculations

More movement in rankings occurred among other countries. For example, China was in 42nd place in 1990, but moved up 31 positions to 11th place by 2010. India was in 28th place in 1990, fell to 36th place in 1993, and advanced to 11th place by 2007. On the other hand, New Zealand, which was in 21st place in 1990, fell to 38th place in 2002 and 2003. Table 1 shows the 50 countries included in the data and their high, median, and low rank from 1990 to 2010.

Real GDP data at purchasing power parity are used for the income variable for the representative traveler from each country. GDP data and data on population are from the World Bank's *World Development Indicators*. Average real GDP per country over this period was \$634 billion, and the mean annual growth rate per country was 3.1 percent.

Table 1: **High, median (Mid), and low rank of top 50 countries as sources of inbound travelers to the USA during 1990–2010**

Country	High	Mid	Low	Country	High	Mid	Low
Argentina ^v	10	15	29	Italy ^v	7	9	10
Australia ^v	7	9	13	Jamaica	18	24	29
Austria ^v	24	31	40	Japan ^v	3	3	4
Bahamas	10	18	29	Korea	7	8	17
Belgium ^v	21	23	29	Mexico	2	2	2
Brazil	7	8	11	Netherlands ^v	10	12	14
Canada	1	1	1	New Zealand ^v	21	33	38
Chile	27	36	42	Norway ^v	26	34	39
China	11	24	42	Panama	41	44	47
Colombia	13	17	24	Peru	25	31	37
Costa Rica	31	35	38	Philippines	25	30	38
Denmark ^v	23	32	37	Poland	34	42	49
Dominican Rep.	20	25	30	Portugal ^v	47	48	50
Ecuador	31	34	40	Russia	34	40	49
El Salvador	22	39	45	South Africa	40	44	48
Finland	31	44	47	Singapore ^v	37	40	46
France ^v	6	6	6	Spain ^v	11	15	19
Germany ^v	5	5	5	Sweden ^v	13	19	23
Guatemala	26	28	34	Switzerland ^v	11	16	21
Haiti	41	49	50	Taiwan	12	16	24
Honduras	39	44	49	Thailand	39	47	50
Hong Kong	19	27	41	Trinidad & Tobago	35	38	43
India	11	22	36	Turkey	43	46	50
Ireland ^v	12	21	32	United Kingdom ^v	3	4	4
Israel	16	20	23	Venezuela	8	11	16

Note: ^v indicates that the country was in the Visa Waiver Program for some or all of the 21 year period.

Source: Author's calculations.

China's economy grew at the fastest pace (9.9 percent per year), while Haiti's growth rate was lowest (0.2 percent per year).

The price of goods and services purchased by travelers is not observed, and a proxy was constructed using the ratio of the U.S. consumer price index (CPI) and each country's CPI adjusted by each country's local currency to dollar exchange rates.²² This variable is called travel price and is thus a real exchange rate constructed from CPIs of the United States and the local countries. The price and exchange rate data are from the IMF's *International Financial Statistics*.²³

Direct data on transportation prices were unavailable for this dataset. The BLS has published indexes of air passenger fares for inbound travelers since 1987. The overall index and indexes for selected regions and countries are all indexed to 100 at a specific year and thus represent change over time but not differences between countries. Distances between Washington, DC and the capital of each country were obtained from <http://www.geobytes.com/> and, of course, vary from country to country but not over time. A proxy for transportation price between each country and the United States was constructed by adjusting each relevant airfare index to one in 2005 (the base year for other variables as well) and multiplying by distance. An increase in the index thus magnifies the effect of distance and vice versa; this variable is called distance price.

Many different policies influence the number of travelers to the United States, and no variable is available that accounts for a significant portion of these influences. A few policy variables are considered. A dummy variable was created that indicates the years that countries participated in the Visa Waiver Program. Approximately half of the 37 countries in the Visa Waiver Program are included in these top 50 data for some part of this 21 period; those countries are indicated by a superscript "v" in table 1. The frequency with which a country appeared in the Visa Waiver Program in these data was about 35 percent.

²²Some have criticized the use of CPIs to represent travelers' purchases of goods and services because travelers purchase a smaller set of goods and services than that represented by the CPI. The Bureau of Labor statistics began an index to measure prices for travel-related goods and services paid by foreign visitors to the United States in 2007 but discontinued it in 2008. <http://www.bls.gov/mxp/ettfact.htm>

²³Data for Taiwan are from the Central Bank of the Republic of China (Taiwan), July 2012, *Financial Statistics*.

Because this program reduces the time and costs of obtaining a visa, one would expect this variable to vary positively with numbers of inbound travelers.

Another variable was created to indicate the years that the China–U.S. travel MOU was in force; this variable is expected to vary positively with numbers of inbound travelers. It entered into force at the end of 2007 and appears in these data beginning in 2008.

Two other potential policy variables are also included: visa refusal rates and visa waiting times by country, as reported by the U.S. State Department. Use of these data is explored although only average waiting times are reported, and refusal rates are only available since 2006. During 2005–2010, the average ratio of the standard deviation of each country’s refusal rates to its associated mean was 0.266, which is fairly small and could indicate that there is little variability in these data series. Because the years of availability are limited, averages over time are used for each country. The average wait for an interview and for visa processing was 14.5 days for these 50 countries over this period. One would expect that visa refusals would have a negative effect on numbers of inbound travelers. Longer visa waiting times have an ambiguous effect. If unofficial barriers lengthen waiting times and impede visitors from certain countries from obtaining visas, the effect would be negative. On the other hand, long waiting times could signal that many people from a particular country desire to visit the United States and consulate resources are being crowded out, which would make the effect positive.

No single variable adequately accounts for cultural differences, and different alternatives are considered. These cultural variables are stable over time but vary by country. Language is an important component of cultural identity, and an indicator variable was created that assigns a 1 to countries that speak English as their primary language and a 0 otherwise.²⁴ An indicator for Spanish, a commonly spoken second language in the United States, was similarly formed by assigning a 1 to countries whose primary language is Spanish and a zero otherwise. One would expect these variables to vary positively with numbers of inbound travelers. The means of these variables indicate the proportion of majority English-speaking

²⁴These estimates are based on the Wikipedia entry for list of countries by English-speaking population. http://en.wikipedia.org/wiki/List_of_countries_by_English-speaking_population.

and majority Spanish-speaking countries included in these top 50 countries. Somewhat surprisingly, the mean of the English variable (16 percent) is less than the mean of the Spanish variable (28 percent).

The previously discussed Clark-Pugh index is considered as well. Because this index assigns a 1 to the English cluster and numbers 2–5 to clusters of increasing cultural distance, one would expect it to vary negatively with numbers of inbound travelers. The mean of the Clark-Pugh index in these data is 3.8.

6 Frictionless Model

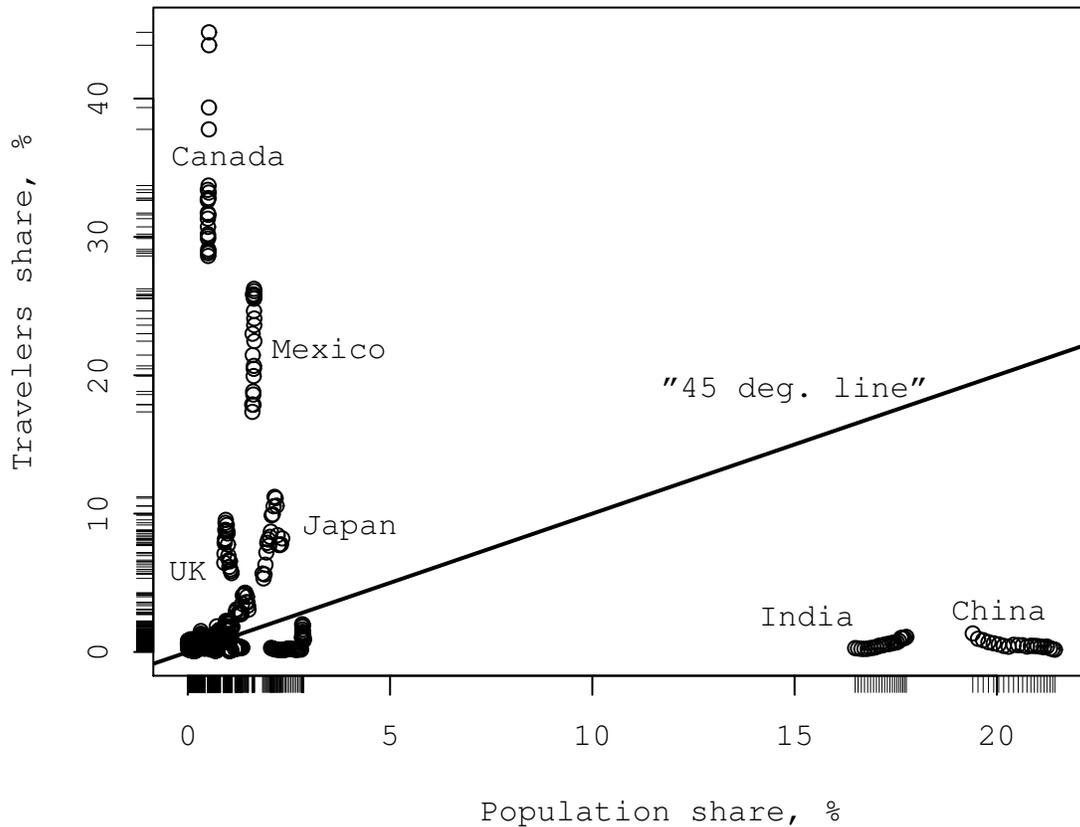
Before estimating the demand model of traveler flows, some important issues emerge from a detour to a simple model of population and numbers of travelers. If travel were frictionless and preferences and prices were the same across countries, one would expect the proportion of country i 's population who travels to the United States to equal the ratio of total travelers to the the United States to world population. Let X_i represent the number of travelers to the United States from country i and let π_i represent the population of country i , including countries that may not be in the dataset. The total number of travelers to the United States is $\sum_i X_i = Z$, and the world population is $\sum_i \pi_i = \Pi$; then, $\frac{X_i}{\pi_i} = \frac{Z}{\Pi}$. Frictionless travel implies that travel to the United States would occur in the same proportion as country i 's share of world population.

$$\frac{X_i}{Z} = \frac{\pi_i}{\Pi}$$

The frictionless model implies that the proportion of travelers should expand along a 45 degree line as each country's population share expands. All combinations of population shares and inbound traveler shares are shown in figure 2 and a "45 degree line" (or what would be a 45 degree line if the box were square and axes equal). Instead, the data are L-shaped and are dominated by Canada and Mexico with relatively small populations and large numbers of travelers and by China and India with large populations but few travelers.

However, a mass of points occurs near the origin, as indicated by the thickness of the rug near the origin, particularly along the population axis. In order to see these points better, a subset near the origin is extracted.

Figure 2: **Proportion of travelers to USA versus proportion of world population**

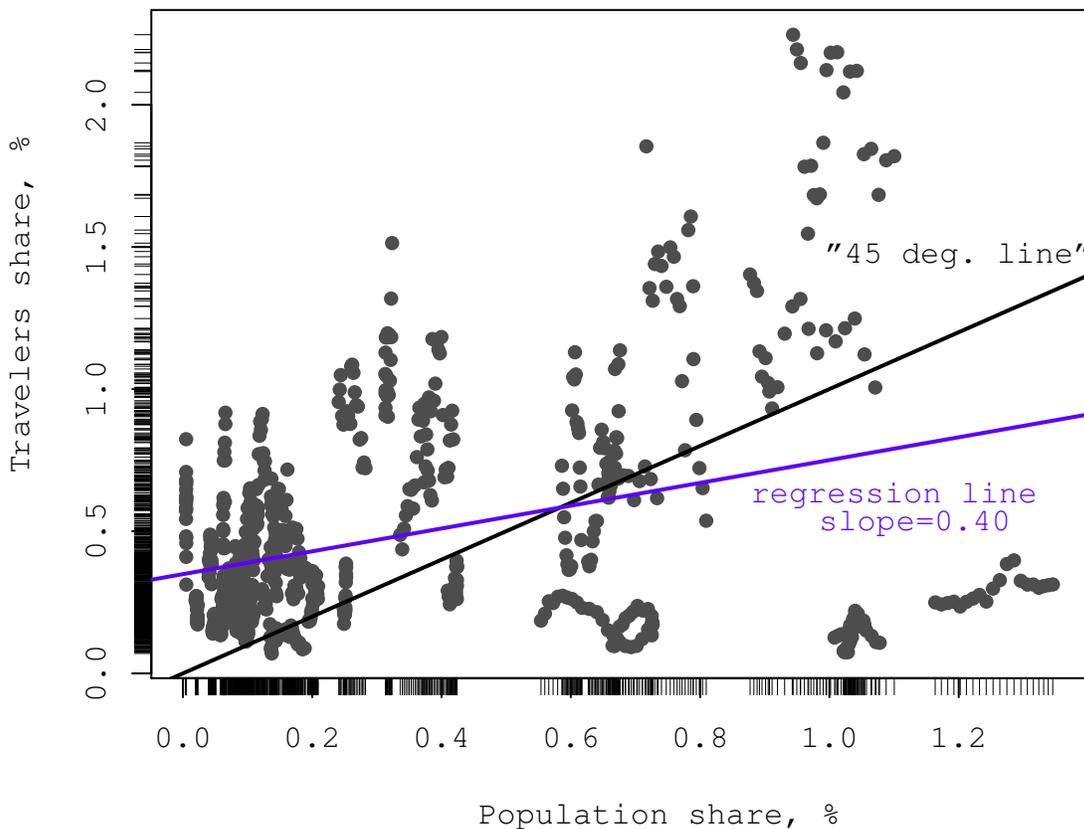


Source: Author's calculations

Over 80 percent of the data occurs where the population share is less than 1.5 percent and the proportion of travelers to the United States is less than 2.5 percent (figure 3). In this subset, the frictionless model (the 45 degree line) appears somewhat plausible, and the rug along the axes shows a more even distribution of points. The best linear fit (regression line) is somewhat close to the 45 degree line but has a positive intercept and a slope less than one. Including more countries than just the 50 countries with the most travelers would not likely result in the regression line approaching the 45 degree line. Currently,

disproportionate numbers of points fall above the 45 degree line. Adding in the more than 150 countries and 32 percent of the world population not currently included in the data would increase the number of points with low population shares and low shares of travelers that fall below the 45 degree line and likely result in a regression line with an intercept closer to origin.

Figure 3: **Proportion of travelers to USA ($\leq 2.5\%$)* versus proportion of world population ($\leq 1.5\%$)**



* This subset represents over 80 percent of the total data.
Source: Author's calculations

However, there are no large countries with large shares of U.S. inbound travelers. In contrast to China and India, other countries with large populations and small shares of travelers do not appear in these data. For example, Indonesia, Pakistan, Nigeria, Bangladesh, Vietnam, Ethiopia, and Egypt (whose respective ranks in world population in 2010 were

4th, 6th, 7th, 8th, 13th, 14th, and 15th) are not among the top 50 countries contributing travelers to the United States. These large omitted countries all have Muslim majorities except Ethiopia and Vietnam. As previously discussed, religious concerns are important to many potential travelers and appear to have largely filtered majority Muslim countries out of the top 50 data. Turkey, the 18th most populous country, is the only majority Muslim country included in the top 50 data. GDP is another delineating factor as the 15 wealthiest countries in 2010 are all included in the top 50 data. South Africa, which has the largest GDP among African countries, is the only African country in the top 50 list. Also, Singapore, a small, non-majority Muslim country with high per capita income is included while larger Indonesia (majority Muslim, low capita income) is not in the top 50 data. In sum, adding all countries would increase the number of countries with low shares of travelers to the United States and decrease the slope of the regression line and thus credibility of the frictionless model.

7 Estimation

This section presents the results from estimating a demand model of inbound flows of travelers. As discussed in the section on data exploration, GDP is used for the income variable, but data for the price variables in equation 1 are unavailable, and travel price and distance price are used instead. The functional form of equation 1 is specified as Cobb-Douglas, and logarithms are taken. The frictions variables are included as demand shifters. The resulting equation to be estimated is shown below where the variables are: flows of inbound travelers (x), travel price (p), distance price (q), income (y), the China-U.S. MOU (M), inclusion in the Visa Waiver Program (V), the Clark-Pugh index (C), English (E), Spanish (S), Canada or Mexico (A), the visa refusal rate (r), and waiting times to obtain a visa (w); where lower case letters indicate that the variable is in logarithms and indicator variables are in upper case; where the β 's are parameters to be estimated and ϵ is an error

term; and i indexes the country dimension and t indexes the time dimension.

$$\begin{aligned}
 x_{i,t} = & \beta_0 + \beta_p p_{i,t} + \beta_q q_{i,t} + \beta_y y_{i,t} + \beta_M M_{i,t} + \beta_V V_{i,t} \\
 & + \beta_C C_i + \beta_E E_i + \beta_S S_i + \beta_A A_i + \beta_r r_i + \beta_w w_i + \epsilon_{i,t}, \\
 & i = 1, \dots, N, t = 1, \dots, T
 \end{aligned} \tag{2}$$

First, equation 2 is estimated by pooled ordinary least squares (POLS), which will serve as a reference point for other approaches. Results are shown in table 2, and parameter estimates for travel price, distance price, GDP, the Visa Waiver Program, the Clark-Pugh index, English, Spanish, Canada-Mexico, and visa waiting times are statistically significant. Although most signs are as expected, estimates for travel price and Clark-Pugh are unexpectedly positive. Estimates for the China MOU and visa refusal rates are not statistically significant.²⁵

Travelers to the United States incur varying costs and face different prices because information and institutions affecting price vary over countries. Cultural differences also influence which representative travelers will journey to the United States. Variables in the model capture much of this heterogeneity, but the price variables based on indexes may not sufficiently represent prices faced by representative travelers from different countries, and despite the variables for cultural and policy frictions, some country-specific heterogeneity may remain. Similarly, business cycles and other global events affect a traveler's ability and willingness to travel in different years. Results from the pooled model will be biased if substantial unobserved heterogeneity exists among different countries or at different times. The Honda Lagrange multiplier test (Honda 1985) was used to test the residuals of the pooled models for unobserved heterogeneity. The result of this test, 84.91 (with a p-value of 2.22e-16), convincingly rejects the null hypothesis of no significant differences among countries and time periods. Thus, there is unobserved heterogeneity that should be addressed.

²⁵To examine the effect of using the maximum likelihood procedure to estimate the missing 2010 data on travelers, the same POLS model was estimated using only the original data, and excluding the intercept, the average difference in the coefficient estimates was 0.0008. This suggests that the procedure to estimate these missing data has little effect on the parameter estimates.

Table 2: Results: POLS, random effects, and fixed effects models

Variable	POLS	Random	Keum	Fixed effects
Intercept	-0.054 (0.578)	-7.191*** (1.395)	4.444*** (1.526)	
Travel price	0.062*** (0.012)	-0.212*** (0.023)		-0.323*** (0.026)
Distance price	-0.453*** (0.045)	-0.004 (0.062)		0.190** (0.077)
GDP	0.562*** (0.022)	0.713*** (0.043)	0.756*** (0.042)	0.937*** (0.055)
China MOU	0.032 (0.390)	0.359*** (0.124)		0.236** (0.119)
Visa Waiver	0.479*** (0.068)	0.099*** (0.037)		0.097*** (0.035)
Similarity			-0.058** (0.024)	
Clark-Pugh	0.087*** (0.026)	0.235*** (0.078)		
English	1.067*** (0.092)	1.463*** (0.304)		
Spanish	0.512*** (0.069)	1.085*** (0.233)		
Canada-Mexico	2.587*** (0.149)	2.436*** (0.426)		
Visa refusal	0.002 (0.002)	0.026*** (0.007)		
Visa wait	0.003*** (0.001)	0.001 (0.003)		
Distance			-1.292*** (0.157)	
R^2	0.729	0.344	0.262	0.320

Significance levels: *($p \leq 0.1$), **($p \leq 0.05$), ***($p \leq 0.01$). Standard errors are in parentheses. Variables below the line vary only by country; those above vary by time and country.

Source: Author's calculations

Two common approaches for taking unobserved heterogeneity into account are fixed-effects and random-effects models. The random-effects estimator is more efficient than the fixed-effects estimator and is considered first although it has stronger assumptions. Both country and year effects are considered in a two-way error component model. The disturbance term from equation 2 is written as the sum of an unobservable time-specific effect λ_t , an unobservable country-specific effect μ_i , and the remaining idiosyncratic errors $\nu_{i,t}$.

$$\epsilon_{i,t} = \lambda_t + \mu_i + \nu_{i,t} \quad (3)$$

The results from estimating the random-effects model are shown in column 2 of table 2.²⁶ The estimate for the travel price now has the expected negative sign and is significant, although the estimate for distant price is no longer significant. The estimate for GDP is larger than in the POLS model and remains significant. The estimate for the China MOU is larger and has become statistically significant. Estimates for the Visa Waiver Program, English, Spanish, and Mexico and Canada are statistically significant and have the expected signs. The estimate for the Clark-Pugh index continues to have a positive sign, contrary to expectations. Also, the estimate for the visa refusal rate is small and does not have the expected sign. The estimate for the visa waiting time is not statistically significant at conventional significance levels.

While on the subject of random-effects models, it is interesting to test Keum's gravity model for Korea with these U.S. data. The results are broadly in line with his findings. The largest estimate (in absolute value excluding the intercept) is for the distance variable. It is negative, and its size is consistent with his conclusion that distance is important in gravity models of travel. The estimate for GDP is less than one and similar in size to the random-effects estimate in column 2; both distance and GDP are statistically significant. Relative similarity is measured as the absolute value of the log difference in per-capita income between the United States and the country of origin of the traveler. As the difference

²⁶Different procedures exist for estimating random-effects models, a type of feasible general linear system estimation. Results are shown for the Wallace-Hussain procedure, but the Swamy-Arora and Nerlove procedures yielded similar results.

in income decreases, travel is expected to increase. Contrary to Keum’s finding, relative similarity here has the expected negative sign and is significant at the 5 percent level.

Although the random-effects approach is more efficient than fixed effects, it relies on the stronger assumption that the random effects are uncorrelated with the explanatory variables. The possible endogeneity of the regressors with the individual effects can be tested via a Hausman test. The Chi-square statistic (with 5 degrees of freedom) from the Hausman test comparing the fixed-effects model to the random-effects model is approximately 18.5, and on this basis the null hypothesis of no correlation between the random effects and the explanatory variables is rejected. Therefore, consideration now moves from the random-effects model to the fixed-effects model.

The fixed-effects estimator is more robust than random effects, and its estimates remain unbiased even when correlation exists between the fixed effects and the explanatory variables. Although small fixed-effects models could be estimated with dummy variables for the country and time effects, it is impractical when there are many individuals or time periods. In these cases, the within transform (Q) is typically used. For the two-way model, the within transform is $Q = I_N \otimes I_T - I_N \otimes J_T - J_N \otimes I_T + J_N \otimes J_T$, where I is an identity matrix of dimension given by the subscript; J is a matrix of ones divided by its dimension (given by the subscript), and \otimes indicates the Kronecker product. Premultiplication of both sides of the regression equation by this idempotent matrix gives the within estimator for the regression coefficients $\beta_{WI} = (X'QX)^{-1}X'Qy$. The within transform sweeps out the country effects (μ_i) and the time effects (λ_t), but unfortunately also sweeps out any variables that do not vary with time.

Fixed-effects estimates are shown in the last column of table 2. Travel price and GDP have the expected signs and are significant at the 1 percent level. Although still quite inelastic, the travel price estimate is larger than in the previous models. Distance price is positive contrary to theory. Estimates for the China MOU and the Visa Waiver Program have the expected signs and are significant, respectively, at the 5 percent level and the 1 percent level. The estimate for the Visa Waiver Program is similar to that of the random-

effects model and smaller than that of the POLS model.

Major global events, including multi-country macroeconomic shocks, could affect numerous countries, but individual countries will likely respond differently to these events. While the error structure in equation 3 importantly allows time-specific effects and country effects, all countries are restricted to a homogeneous response λ_t each period to any global shock. Not taking individual countries' responses to global events into account could result in the idiosyncratic errors being correlated across countries at different times and compromise the unbiasedness and consistency of the estimates. Methods have been developed to test for such cross-section dependency.²⁷ Pesaran's CD test is based on the average of all pairwise correlation coefficients from the model residuals and is centered on 0 under the null hypothesis of no significant cross section dependence. Testing the residuals of the two-way fixed-effect model yields a CD statistic of -3.082, which rejects the null hypothesis of no significant cross-section dependence with a p-value of 0.002.²⁸

Phillips and Sul (2003), Pesaran (2006), and others have developed models with multi-factor error structures that allow heterogeneous responses to common shocks. Here, an approach pioneered by Serlenga and Shin (2007) is used. The first step is to apply Pesaran's pooled common correlated effects (PCCE) estimator.²⁹ In contrast to equation 3, this model assumes the following multi-factor error structure where the γ_i 's are heterogeneous country-specific responses to unobserved common time-specific effects λ_t 's, the μ_i 's are the country-specific fixed effects as before, and the $\nu_{i,t}$'s are the idiosyncratic errors.

$$\epsilon_{i,t} = \gamma_i \lambda_t + \mu_i + \nu_{i,t} \tag{4}$$

²⁷Pesaran, Ullah, and Yamagata (2008) updated an earlier test for cross-section independence by Breusch and Pagan and also compared it to the CD test developed by Pesaran (2004).

²⁸While the two-way fixed-effects model barely fails the CD test, the one-way (country effects only) model (not shown) fails by a large margin, with a CD statistic of about 37.3 and a p-value close to 0, which indicates to the importance of including time-specific effects.

²⁹Pesaran (2006) proved the consistency and asymptotic normality of several common-correlated-effects estimators; the PCCE estimator, which assumes that different countries have the same slope coefficients although the unobserved common effects vary by country, had the best small sample properties and is used in this case.

Setting the pooling weights equal to $\frac{1}{N}$ (the usual case), the PCCE estimator is

$$\beta_{PCCE} = \left(\sum_{i=1}^N \mathbf{x}'_i \mathbf{M}_T \mathbf{x}_i \right)^{-1} \left(\sum_{i=1}^N \mathbf{x}'_i \mathbf{M}_T \mathbf{y}_i \right) \quad (5)$$

where $\mathbf{M}_T = \mathbf{I}_T - \mathbf{H}_T (\mathbf{H}'_T \mathbf{H}_T)^{-1} \mathbf{H}'_T$ and \mathbf{H} is a matrix with a column of 1s and a column for each common factor. The PCCE estimator is a generalization of the within estimator, and as such, in sweeping out the unobserved heterogeneous effects, it also eliminates the time-constant variables, as does the fixed-effects estimator.³⁰

After obtaining the PCCE estimates in the first stage, Serlenga and Shin follow an approach similar to Hausman-Taylor (1981) to generate estimates of the time-constant variables in a second step. They retrieve the residuals (d) from the PCCE estimation and use a set of instrumental variables (\mathbf{W}) to estimate the time-constant variables (\mathbf{C}) in a feasible general linear system approach.³¹ The feasible Serlenga-Shin estimator (δ_{SS}) for the second stage is shown below:

$$\delta_{SS} = (\mathbf{C}' \mathbf{W} \mathbf{V}^{-1} \mathbf{W}' \mathbf{C})^{-1} (\mathbf{C}' \mathbf{W} \mathbf{V}^{-1} \mathbf{W}' d) \quad (6)$$

where \mathbf{V} is the estimated variance of $\mathbf{W}' \epsilon^*$. First, an OLS version of equation 6 is run, and the residuals from this equation (ϵ^*) are used to estimate \mathbf{V} in equation 6. Subsequent iterations are made using new estimates of (ϵ^*) each time to recalculate \mathbf{V} until consecutive estimates of (δ_{SS}) differ by less than 0.0001.³²

To find factors to account for the unobserved common correlated effects, Pesaran recommends considering the cross-sectional means of the exogenous time-varying variables in the model. Here linear time trends for each cross-section are also considered. The first

³⁰Robust standard errors are computed for the PCCE estimates using equation 74 in Pesaran (2006), which is based on equations 51 and 52 and are an adaptation of the Newey-West procedure for computing heteroskedastic and autocorrelation consistent standard errors for panel data. In this case, the Newey-West lag window was set to 3.

³¹They showed the consistency of their approach in Serlenga and Shin 2007 and showed that their estimator outperformed two-way fixed-effects Hausman-Taylor estimation in small samples in Serlenga and Shin (2006).

³²Once the feasible GLS estimator for the coefficients has converged, the covariance matrix is $(\mathbf{C}' \mathbf{W} \mathbf{V}_{FGLS}^{-1} \mathbf{W}' \mathbf{C})^{-1}$.

column of table 3 presents estimates where the first-stage PCCE estimates use the cross-sectional mean of the GDP variable (in logs) and linear trends to account for the common correlated effects, and each variable is used as its own instrument (i.e., OLS) in the second stage to estimate the time-constant variables. There is no Sargan’s statistic when the number of instruments equals the number of variables. All variables except for Spanish are significant. Both price variables have the expected negative signs; GDP is significant and greater than one. The China MOU and the Visa Waiver Program have the expected positive signs. Clark-Pugh has the expected negative sign; English and Canada-Mexico have the expected positive signs. Estimates for visa refusal and visa waiting times are very small (with very small standard errors). Visa refusal is negative as expected, and visa waiting time is positive.

In the other runs in this table, linear time trends and the cross-sectional means of GDP and travel price are used to capture the unobserved common correlated effects, and visa waiting times and visa refusal rates are assumed to be endogenous with the fixed effects.³³ More instruments than variables will be used so that the equation is over-identified, and the validity of the set of instruments will be assessed by Sargan’s test.

The results for the time-varying variables are shown in upper part of column two (table 3). Estimates for distance price and GDP are larger (in absolute value) than those in column one, and estimates for the China MOU and Visa Waiver Program are smaller. In selecting instruments for the endogenous time-constant variables, Serlenga and Shin suggest consideration of potential factors accounting for the unobserved common correlated effects (factor loadings) premultiplied by the idempotent matrix \mathbf{P} , which is defined as $\mathbf{P} = \mathbf{D}(\mathbf{D}'\mathbf{D})^{-1}\mathbf{D}'$ where $\mathbf{D} = \mathbf{I}_I \otimes \mathbf{I}_T$. This approach was followed with factor loadings for GDP, travel price, and relative similarity used as instruments. All the time-constant variables in column 2 are statistically significant, but Clark-Pugh and Spanish do not have the expected signs. The Sargan over-identifying restrictions test was used to check how well the instruments fit the data when there are more instruments than variables. The Sargan

³³The other time-constant variables Clark-Pugh, English, Spanish, and Canada-Mexico are considered exogenous.

Table 3: **Results: Pooled common correlated effects–Serlenga-Shin estimation**

Variable	1	2	3	4
Travel price	-0.391*** (0.064)	-0.336*** (0.045)	-0.336*** (0.045)	-0.316*** (0.044)
Distance price	-0.374*** (0.014)	-0.832*** (0.011)	-0.832*** (0.011)	-0.894*** (0.011)
GDP	1.124*** (0.013)	1.534*** (0.011)	1.534*** (0.011)	1.512*** (0.011)
China MOU	0.411*** (0.009)	0.232*** (0.008)	0.232*** (0.008)	0.246*** (0.008)
Visa Waiver	0.083*** (0.028)	0.068** (0.026)	0.068** (0.026)	0.063** (0.028)
Clark-Pugh	-0.029*** (0.006)	0.050*** (0.018)	0.001 (0.019)	0.052** (0.021)
English	0.141*** (0.019)	0.306*** (0.055)	0.348*** (0.068)	0.423*** (0.092)
Spanish	0.006 (0.016)	-0.498*** (0.116)	0.175* (0.106)	-0.776*** (0.219)
Canada-Mexico	0.981*** (0.028)	1.507*** (0.126)	1.216*** (0.098)	
Visa refusal	-0.006*** (0.001)	-0.023*** (0.003)	-0.029*** (0.003)	-0.025*** (0.004)
Visa wait	0.002*** (0)	0.060*** (0.011)	0.025** (0.011)	0.077*** (0.019)
Sargan test		0.18 [0.671]	7.55 [0.006]	0.34 [0.560]

Significance levels: *($p \leq 0.1$), **($p \leq 0.05$), ***($p \leq 0.01$). Standard errors in parentheses. P-values for the Chi-square Sargan test with 1 degree of freedom are shown in brackets. Variables below the line vary only by country; those above vary by time and country.

Source: Author's calculations.

test for column two is small, and the null hypothesis that these instruments are valid is not rejected.³⁴ From a statistical point of view, the results in column two could be considered the best in the study.

Traditional Hausman-Taylor estimation uses the exogenous time-varying variables pre-multiplied by \mathbf{P} as instruments for the endogenous time-constant variables. Here GDP, travel price, and the Visa Waiver Program are considered exogenous, and the results are presented in column three. The main difference from the instruments used in column two is that the estimate for Clark-Pugh is no longer significant. However, the Sargan test for column three is somewhat large, and one would reject the null hypothesis that these instruments are valid at usual levels of significance.

Because travelers from Canada and Mexico dominate the number of inbound travelers, a check was made on the effect of removing those two countries from the data. A run was made without Canada and Mexico using the same setup as column two (except, of course, an indicator for Canada and Mexico could not be included). The results, presented in column 4, only changed by small amounts, particularly for the time-varying variables, although the effect of distance price is somewhat greater. The most striking changes are that without the inclusion of Mexico, the estimate for Spanish becomes more negative, and the estimate for English becomes more positive. Sargan's test is small, and these instruments, as in column two, are considered valid.

8 Conclusion

The empirical results support the basic demand model and show that many of the travel frictions, but not all, are key determinants of U.S. inbound travel. Estimation methods that allowed for the possibility of common correlated effects produced the most reasonable and statistically valid results.

Income is the most significant determinant of inbound travel to the United States.

³⁴In this case, as in the other columns of table 3, the number of instruments exceeds the number of endogenous variables by one, and the Sargan test has a chi-square distribution with one degree of freedom.

Income as represented by GDP was highly significant with p-values less than 0.01 in every run; additionally, wealthier countries appeared in the top 50 data with high frequency, as detailed in the section on the frictionless model. The income variable was greater than one in all runs that permitted country-specific responses to global shocks. The estimates in this log-log format imply that the income elasticity exceeds one; thus travel to United States increases more than proportionally as income rises (and also declines more than proportionally with falls in income).

Travel price, which represents U.S. prices relative to prices in the originating country, is an important determinant of inbound U.S. travel. In every run with country-specific effects in response to global events, travel price had the expected negative sign and was highly significant with p-values less than 0.01. In these runs, estimates were inelastic, in the range of -0.3 to -0.4, which indicates that numbers of travelers respond less than proportionally to changes in travel prices.

Distance price similarly has a major influence on numbers of inbound travel in most runs. It is negative and significant with p-values less than 0.01 in the runs with the multi-factor errors, but varies more than travel price. These latter estimates are inelastic as well, although not as much so as travel price. Thus, travelers respond somewhat to shorter distances and improving transportation prices.

The estimates representing income and prices, especially those in table 3, affirm the standard demand model. The importance of accounting for the common correlated effects can be seen by contrasting these results with those in table 2 where one of the price variables had an unexpected sign or was not statistically significant in several instances. Thus, economic factors collectively exert a strong influence on numbers of inbound travelers.

The Visa Waiver Program contributed to additional visits to the United States from countries participating in the program; estimates with the common correlated effects show that travelers from countries participating in the program were 7 to 9 percent more likely to visit the United States than travelers from countries not in the program.³⁵ These estimates

³⁵The marginal effect for a dummy variable with a coefficient c from a regression with a logarithmic response variable is $e^c - 1$, Halvorsen and Palmquist (1980) and Giles (2011).

were significant with p-values less than 0.05. The fairly small number of countries in the program moderates the magnitude of this effect. For example, some large countries (e.g., China, India, Brazil, Russia, and Korea) in the top 50 data do not participate in the program, and slightly less than half of the countries in the program appear in the top 50 data. As discussed in the section on travel frictions, many recent inductees into the program, except for Taiwan, are relatively small Eastern European countries.

Parameter estimates for the China MOU had the expected sign, were statically significant with p-values less than 0.01, and imply that the MOU has led to increases of approximately 26 percent in numbers of U.S. inbound travelers for the runs with the common correlated effects. It is somewhat incredulous that a program benefiting a single country (neither of which is Canada or Mexico) would have this large of an effect, at least in the long run. Although the variables accounting for unobserved heterogeneity include country-specific linear time trends, numbers of travelers from China grew much more than trend during 2008 to 2010, a time when numbers of visitors from many other countries were stagnant or declining. Signing the MOU could have released pent-up demand as the United States was one of the last countries with which China negotiated a travel MOU. Three years is short time on which to make an inference, and a longer series of data would likely result in smaller increases in numbers of Chinese visitors. The available data, however, show that the China MOU has a major positive influence on numbers of inbound U.S. travelers.

Parameter estimates for the visa refusal rate were significant with p-values less than 0.01 for the runs with the common correlated effects. However, the effects were very small; a 1 percent increase in the visa refusal rate is estimated to decrease numbers of inbound travelers by 0.02 percent. Visa refusal rates do not thus appear to be an important determinant of inbound U.S. travel.

Parameter estimates for waiting times to obtain a visa tended to be positive, possibly indicating that large numbers of applicants are straining consulate resources in countries where travel to the United States is popular. A one percent increase in visa waiting times is estimated to increase numbers of inbound travelers by approximately 0.06 percent. Al-

though estimates for visa waiting times had p-values less than 0.01 in the runs with the common correlated effects, their low magnitudes show that visa waiting times are not a major determinant of inbound travel.

Sharing a border with the United States is a significant determinant of inbound U.S. travel, as travelers were generally two to three times more likely to be from Canada or Mexico than from any other country. The effects from sharing a border were large and significant with p-values less than 0.01 for every run in which they were included.

Being from an English-speaking country is a significant determinant of inbound U.S. travel; estimates were consistently statistically significant with p-values less than 0.01. Indications (based on table 3, column 2) are that an inbound traveler is about 36 percent more likely to hail from an English-speaking country than from a non-English-speaking one.

Parameter estimates for Spanish in the runs with common correlated effects were either negative, indicating that travelers are less likely to be from Spanish-speaking countries than from other countries, or statistically insignificant. In the section on data exploration, it was noted that majority Spanish-speaking countries constitute 28 percent of the countries in the top 50 data, which was greater than the percentage of English-speaking countries. One explanation is that Spanish-speaking countries are likely to be among the group of countries most likely to visit the United States, but are less likely to be a source of U.S. inbound travelers than other countries in that top group.

The only run in which the Clark-Pugh index had the expected sign and was statistically significant was the common correlated-effects run where each variable was its own instrument. In the other instances, it was not significant or was positive, which indicates that travelers with cultures less like the United States are more likely to visit the United States. Although the Clark-Pugh index is a parsimonious indicator of cultural factors, it could be that the categories, which group the United States and South Africa in the same cluster, Belgium and Argentina in the same cluster, and many different countries in a rest-of-the-world cluster, are too broad to be meaningful in this context. The Clark-Pugh index thus does not appear to be an important determinant of inbound U.S. travel.

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