Should international tourism fear population aging?[1]

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Abstract

Increases in life expectancy and drops in fertility have slowly but steadily raised the fraction of the population in old-age. While this population aging phenomenon is not new, its speed has increased markedly over past decades in many countries. Given evidence of a decline in international travel with age late in life, should we expect a drop in international tourism, as population aging continues? The answer of this paper is: “no”. The medical progress which leads to longer lives also leads to healthier lives, which allows more old-age households to travel abroad. Furthermore, smaller family sizes make international travel more affordable. Among others, I find that a 1 year gain in life expectancy increases the number of worldwide international travels by 10%.

Keywords: international tourism demand, population aging, life expectancy, fertility.

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1 INTRODUCTION

International travel increases with income and with leisure time but declines with family size and with age towards the end of the life-cycle. Population aging has an impact on all three factors, and could thus either increase or decrease international tourism. A higher life expectancy indeed leads to more time for leisure but only towards the end of the life-cycle, and can reduce yearly household income past retirement. Drops in fertility reduce on the other hand average family sizes. This paper investigates the impact of population aging on international travel, using data on international departures between 2007 and 2018. I find in particular that population aging overall increases international departures.

Glover and Prideaux (2009) and many others have provided marketing analyses to tackle the potential benefits of the senior travel market, destined to increase with population aging. Much however remains to be learned on the impact of demographic changes on international tourism (Hung and Lu, 2016). Existing studies often focus on age effects and cohort effects. Evidence has been found of a decline of travel with age late in life (e.g. Collins and Tisdell, 2002; Fleischer and Pizam, 2002). There is also evidence that old households born recently travel more often than did same-age households born earlier (Sakai et al, 2000; You and O'leary, 2000; Bernini and Cracolici, 2015). Ceteris paribus, the first effect implies a reduction of international travel with population aging and the second effect implies the opposite, but the net impact remains open. Li, Shu et al (2020) provide a first clarification which depends on economic development: when the gross domestic per capita of the departure country is low, international departures decrease with the fraction of the population which is older than 65; when the gross domestic per capita is high, the opposite takes place. It is however unclear at this stage whether population aging leads overall to a worldwide decrease or to a worldwide increase of international travel. The main contribution of the present paper is an answer for international travels from any of 177 countries around the world.

To make the investigation, I start by a theoretical analysis linking population aging and international tourism. I find that one of the two drivers of population aging, drops in fertility, should lead to an increase in outbound international travels. The other driver of population aging, increases in life expectancy, has on the other hand an ambiguous impact on outbound international travels. There is indeed a positive impact through one channel, time, but a negative impact through another channel, income. Which of the two channels dominates is open, from a theoretical standpoint, but can be clarified with an empirical analysis.

The paper then provides an empirical analysis, using a gravity model. Overall, I find that population aging leads to an increase in international outbound departures from any of 177 countries in the world. Medical progress which leads to higher life expectancy also increases health in the latter part of life, allowing retired households to travel more often. In my baseline estimates, 1 more year of life expectancy increases international departures by 10%, on average. Declines in fertility also increase these departures, as average family sizes and thus average family travel costs drop. A 10% decline in the fraction of children in the population is estimated to increase international departures by nearly 4%, on average.

Tourism business managers and policy makers should thus not fear population aging. Findings from the paper imply that marketing efforts to attract international travelers may be more interesting in countries with high life expectancy and low fertility, ceteris paribus.

The paper continues with key facts on population aging. A theoretical analysis follows, in section 3. The empirical approach is presented in section 4 and the empirical analysis in section 5. Business and policy implications are provided in section 6 and concluding remarks in section 7.

2 KEY FACTS

This section presents key facts on population aging.

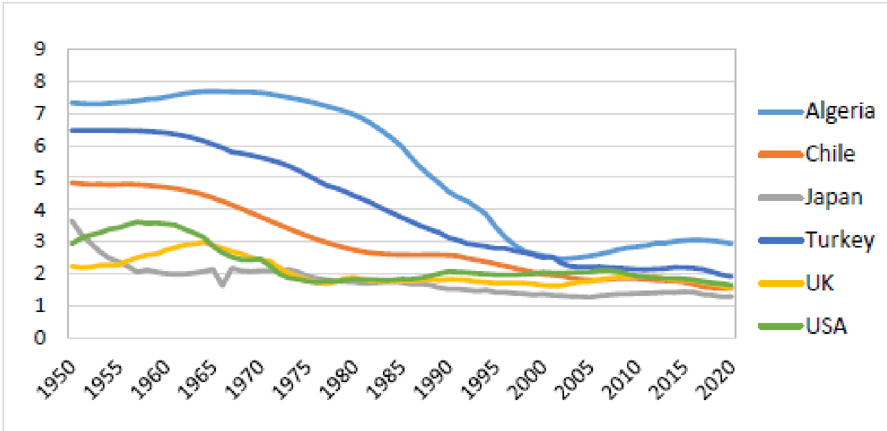
Population aging is not a new phenomenon but its speed has increased over past decades, especially in developed countries. Its main drivers are the decline in fertility and the growth in life expectancy. Figure 1 provides an illustration for Algeria, Chile, Japan, Turkey, the UK and the USA. Part (a) of the figure shows the fertility rate, part (b) life expectancy at birth and part (c) the old-age dependency ratio, equal to the number of persons alive who are 65 years old or older over the number of persons alive who are between 15 and 64 years old. The illustration covers years 1950 to 2020 and uses United Nations data sources.

As the figure shows, the fertility rate (measured here by the total fertility rate, the number of live births per women) has been steadily declining after 1950 in many countries (apart from a small post-WWII baby boom in some countries), from values as high as 7 children per women (in Algeria) in 1950 to less than 3 children per women in 2020, with around 2 children per women in developed countries. A number of factors can explain these drops in fertility rates, starting with the classic economic development argument that industrialization and urbanization lead to growing living expenses, which discouraged parents from building large families (Thompson, 1930). Alternative theories for the decline in fertility have been provided and continue to be debated (e.g. Mason, 1997; Bryant, 2007).

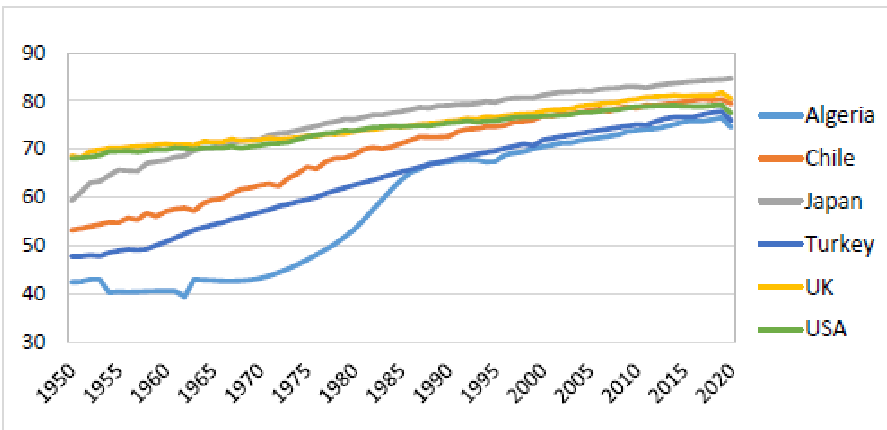
In most countries around the world, life expectancy has regularly increased over the past decades. Part (b) of the figure shows that 10 years or more have been gained between 1950 and 2020 in the selected countries, on average. The largest gains take place in developing countries and can reach more than 30 years (Algeria). Most of the early increases in life expectancy comes from a decline in infant mortality, notably through a decline in infectious diseases. In recent decades, medical progress, vaccination campaigns and regular antibiotics usage have all sustained the rise in life expectancy (for an overview, see Cutler et al, 2006).

The *old-age dependency ratio* (OADR) is a key indicator for the economic analysis of demographic changes, as an approximation for the number of retirees over the number of working-age individuals. The OADR is frequently used in the scientific and policy literature to illustrate the population aging phenomenon and the economic challenges it brings, particularly for the financing of old-age social security expenditures, which cover public pensions, healthcare and long-term care (see e.g. Weil, 1997; Ageing Working Group, 2021).

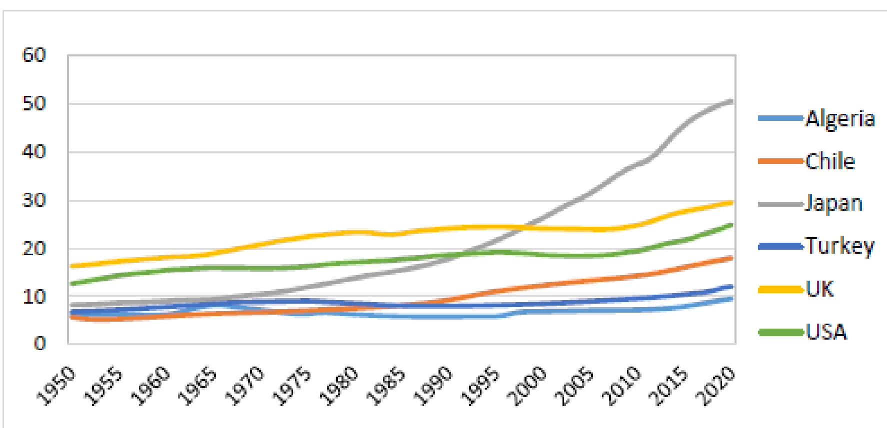
The recent rise of the OADR can be very large. For instance, the Japanese ratio went from 26% in 2000 to 50% in 2020. The Japanese public pension system is mostly financed through a pay-as-you-go structure, where currently active workers are paying for the pension benefits of retired households. As the statutory retirement age is 65 years in Japan, the 26% OADR ratio in 2000 meant that there was one person in retirement age supported by four persons of working age, while the current 50% OADR ratio means that there is now one person in retirement age supported by two persons of working age, putting a large and increasing pension financing burden on the shoulders of workers.



(a) Fertility rate (TFR)



(b) Life expectancy (at birth)



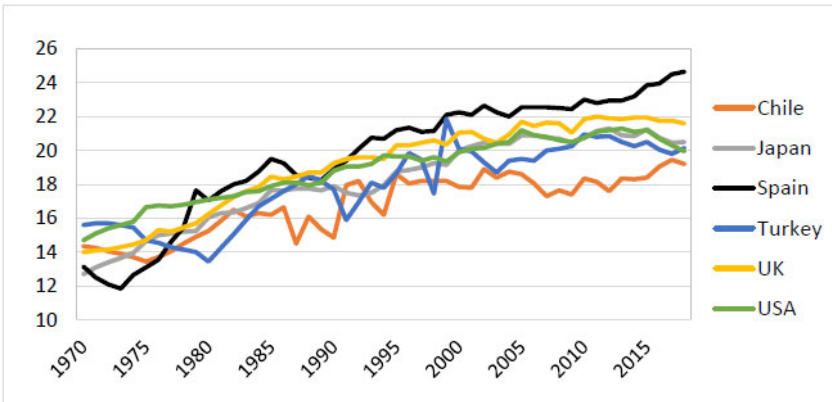
(c) Old-age dependency ratio (%)

Figure 1. Long-run demographic trends for selected countries

3 THEORETICAL ANALYSIS

As seen in section 2, there are two drivers of population aging, increases in life expectancy and decreases in fertility. Both can have an impact on international tourism. Links between life expectancy variations and tourism are considered first. Links between fertility variations and tourism are then considered.

Most countries with a developed public pension system have had to reform it to secure its financing as the population aging is reformed. A standard reform is the increase of the statutory retirement age, which typically leads households to effectively postpone retirement. Even when the effective retirement age does increase, it takes place at a smaller rate than life expectancy. As a result, the average number of years spent in retirement tends to increase over time, as illustrated by figure 2. Differences across countries are also notable in this figure.



(a) Average numbers of years in retirement (average men+women)

Figure 2. Years spent in retirement in selected OECD countries

This slow but steady increase of the number of years spent in retirement means that households have more time for leisure activities at the end of the life-cycle. As time is an important requirement for domestic and international tourism (Papatheodorou, 2001; Alegre et al, 2009), more years in retirement could mean more international outbound tourism. The key questions however are whether these additional years at the end of the life-cycle are spent in good health or not, and whether persons in retirement make use or not of the additional time that they have to travel. As a number studies have shown indeed, domestic and international travels tend to decrease with age, typically after 50 years (e.g. Collins and Tisdell, 2002; Alegre and Pou, 2004). Taking the influence of age into account, some empirical analyses find that travel activity increases after retirement (Alegre and Pou, 2004; Deng et al, 2023), while others find no difference (Blazey, 1992; Losada et al, 2016), without differentiating between domestic and international travel.

Studies have shown that one of the key factor influencing domestic and international travel in old-age is health. The decline of travel with age towards the end of the life-cycle can in part be explained by the decline in health (Zimmer et al, 1995; Fleischer and Pizam, 2002; Huber et al, 2018). A number of factors, on the other hand, play a role in the increases in life expectancy. One of the key factors over the last century is medical progress, including antibiotics, cardiovascular technology and vaccines (Cutler et al, 2006). Whether longer life also means better health in old age is a dominant question in health economics (Howdon and Rice, 2018). While the debate continues, a number of studies find, and literature reviews conclude, that medical progress over past decades allowed persons not only to live longer, but also to live better towards the end of the life-cycle, with fewer diseases and continued autonomy (for studies, see Mathers et al, 2001; Cutler et al, 2014; Kassebaum et al, 2016; for reviews, see Bloom et al, 2010; de Meijer et al, 2013; French and Jones, 2017). In other words, people live longer and also in better health for a larger part of their life. Medical progress thus both leads to an increase in life expectancy and an increase in the average number of years spent in good health, which can allow retired households to travel abroad more frequently[3].

All in all, (i) more years spent in retirement; (ii) an increasing number of years spent in good health at the end of the life-cycle; and (iii) good health a supporting factor for international tourism should all three combined lead to an increase in outbound international tourism, ceteris paribus and seen from a theoretical standpoint. Whether more years spent in retirement, resulting from increases in life expectancy, indeed leads to more outbound international tourism, and to which extent, are empirical questions. These will be part of the empirical analysis performed later in this study.

More years spent in retirement does not only mean more time for leisure and travel, it can also come with a drop in financial resources. Personal savings for instance will have to cover a longer period of time, reducing available capital income every years. Governments may also decide to reduce pension payments to deal with the financing challenge brought by population aging. Yet, the positive influence of income on international travel is well documented (see Crouch, 1996, and many more). Population aging might well support international travel through the time channel, but it might hinder it though the income channel. Which channel dominates will become clear in the empirical analysis provided in this study.

The second driver of population aging, a downward trend in fertility, may also support international outbound tourism. There is indeed evidence that families which have more children travel less abroad (Nicolau and Mas, 2005; Wu et al, 2013; Kim et al, 2019). One study finds that families with more children travel more domestically and less in foreign countries (Eugenio-Martin and Campos-Soria, 2011). If the fertility rate drops then, average family sizes will also drop, which should lead to more international travel.

Research on holidays and travel motivation for children is scarce (as per Small, 2009; Poria and Timothy, 2014). Explaining the decline in international travel with family size thus remains to be done in a robust way. Hypotheses can however be formulated. First, travelling with a large family is more expensive, and there is multiple evidence that larger transportation costs reduce international tourism demand (for a review, see Lim, 2006). Analysis of Spanish data shows further that financial constraints play a larger role in the decision to take any vacations for larger families (Alegre et al, 2010). Second, a number of the preferred children activities during holidays can be performed equally well near or at home. Partial evidence for that hypothesis is provided by a marketing analysis with Danish households (Blichfeldt, 2007) and for families with young-age children (Li, Xu et al, 2020). Third, it could be that many of the travel activities which appeal to adults when travelling abroad, and which justify the travel abroad, do not appeal to children, such as cultural sightseeing. There is some evidence that adults and children have different interests on holidays abroad (Cullingford, 1995), but

[3] International travels towards the end of the life-cycle may remain less frequent than at the middle of the life-cycle, but the medical progress which leads to population aging may reduce the gap between middle- and end-of-lifecycle travel. So, a decline of international travel with age does not imply alone that population aging will reduce international travel.

this third hypothesis requires a full investigation to be confirmed.

Even though the exact reasons why international travel declines with family size are still to be firmly identified and established, the facts and their theoretical consequence remain: international travel does decline with family size, so the long-run decline in fertility should slowly lead to more international outbound tourism, ceteris paribus.

4 EMPIRICAL APPROACH

An overview of the approach is provided first, followed by the detailed econometric model and then by the data.

4.1 Approach

The goal is to investigate the empirical impact of the two drivers of population aging - increasing life expectancy and declining fertility - on international outbound tourism. Higher life expectancy can influence tourism through at least two channels, time and income. Both channels will be included in the analysis. The empirical analysis will be guided by the theoretical analysis provided in the previous section, and its results confronted with implications from the theoretical analysis.

Given the slow pace of the demographic changes considered here, data will be sought to cover as long a time span as possible. Differences across countries will further help to measures the econometric impacts of population aging on international tourism. The resulting dataset will have a panel structure.

The data can be analyzed with several econometric methods. Panel data methods, such as fixed effect or random effects estimation, exploit the panel structure of the data for more accurate results than ordinary least squares regressions. The choice between fixed effect or random effect estimation will be made with an econometric test, whose result depends on data. To further exploit the data structure and gain additional accuracy, I use a gravity model, which originates from the trade literature. As an import, outbound international tourism represents indeed a part of international trade. A number of empirical studies of international tourism thus use methods from the international trade literature, which emphasizes the reliability benefits of gravity models (Anderson, 2011). The gravity model I use is consistent with recent applications to tourism (e.g. Vietze, 2012; Balli et al, 2016; Khalid et al, 2020; Okafor et al, 2022).

4.2 Econometric model and variables

The dependent variable will be international travels between two countries, tourist expenditures being considered as alternative dependent variable in sensitivity analyses.

The main explanatory variables are related to the two drivers of population aging. The first variable is the old-age dependency ratio, defined as the ratio of the population aged 65 or above over the population aged between 15 and 64. It captures the impact of the first driver of population aging, life expectancy variations. It is a standard measure of the fraction of the population in retirement age. The larger life expectancy indeed, the larger that ratio. The second variable is the young-age dependency ratio, defined as the fraction of the population aged between 0 and 14 over the population aged between 15 and 64. It captures the impact of the second driver of population aging, fertility declines. It is a measure of the average family size in the country. The lower fertility, the lower that ratio. The third variable is the average number of years in retirement, effective retirement age. The lower the effective retirement age, the larger the number of years in retirement.

Alternative explanatory variables related to population aging will be considered in sensitivity analyses.

Beyond population aging, other factors can influence international travel. To capture these influences, I use standard control variables from empirical analyses of international tourism demand. According to the literature review by Song and Li (2008), household income, tourism prices and exchange rates are three factors which are consistently found to influence the demand for international tourism products, a conclusion drawn again in the more recent review by Song et al (2019). The review by Lim (1999) adds transportation costs, which are difficult to measure and often proxied by the travel distance (Lim, 2006). I also use the average temperature at destination of travel to capture the possible impact of long-run climate variations (as done for instance by Hamilton et al, 2005). Finally, I use economic growth as another control variable, as catch-up growth is another important long-run phenomenon which may influence international travel. I will thus use household income, tourism prices, exchange rates and travel distance, temperature as destination and growth rate as control variables. Relative prices and nominal exchange rates will be considered jointly, combining them in real exchange rates.

The resulting regression model is

$$\begin{aligned} A_{ijt} = c + \alpha\, OADR_{it} + \beta\, YADR_{jt} + \gamma\, YRET_{jt} + \\ \rho_1\, GDP_{it} + \rho_2\, RP_{ijt} + \rho_3\, D_{ij} + \rho_4\, TE_{jt} + \rho_5\, g_{it} + \varepsilon_{ijt} \end{aligned} \quad (1)$$

where A_{ijt} is the per capita number of international arrivals from departure country i to destination country j at time t, while the main explanatory variables are the old-age dependency ratio $OADR_{it}$, the young-age dependency ratio $YADR_{it}$, the average number of years in retirement $YRET_{it}$, all in the departure country. Control variables are the per capita gross domestic product GDP_{it}, which serves as proxy for household income, relative tourism prices RP_{ijt}, proxied by the real exchange rate, the travel distance D_{ij}, a proxy for transportation costs, the average temperature at destination TE_{jt} and the yearly growth rate (of per capita gross domestic product) in the departure country g_{it}, while ε_{ijt} is an error term.

The coefficients of interest are α, β and γ, as they will capture the impact of life expectancy, fertility and the retirement age on international outbound departures, respectively.

Without transformation of the variables model (1) is linear. When variables are taken in a logarithm format, (1) is a log-linear model, which provides a gravity model and will be used for the baseline estimation. In this case, coefficients in (1) correspond to elasticities. All variables will thus be considered in their log formats.

4.3 Data

Data availability defines the geographical scope and time horizon of the empirical study. A key piece of information is the actual, effective age of retirement. In many countries, individuals retire at a different age than the statutory retirement age, which defines the age for receiving full public pension payments. Often, households decide to retire before that age, either taking lower benefits or using early-retirement pathways to secure the full benefits. Retiring later also happens, even if it is less frequent. Yet, what matters for travelling in old-age is whether one is actually retired or not, not if one has the theoretical possibility of being in retirement. As data on effective retirement ages is only available for OECD (or affiliated) countries, the baseline scope of the study are OECD (or affiliated) countries for the origin of the international travel, but any country around the world for the destination of the travel. I end up with a dataset covering 38 departure countries, listed in the appendix, and 172 destination countries.

Because international travel was much affected by the COVID19 pandemic, a short-run phenomenon, and the purpose of my analysis is the impact of long-run demographic factors, I only include data until 2018. The data I use on international travel being available from year 2007, the resulting panel dataset covers the years 2007 to 2018.

Robustness analyses include countries of departure neither members nor affiliated with the OECD. There is much fewer data sources covering non-OECD countries. Retirement information in particular is scarce, but will be exploited to the largest extent possible, sometimes using distant proxies.

The main data sources for the empirical analysis are the OECD, the United Nations and the Penn World Table version 10.0 (Feenstra et al, 2015), all publicly available. Descriptive statistics for the key variables of interest, at the aggregate level or per capita, are provided in table 1. Details on data sources are provided in the continuation.

Table 1. Descriptive statistics for the main variables of interest.

Variable	Bilateral	Mean	Std Dev	Min	Max
International travels	X	117,588	771,652	0.1	33,505,900
Per capita international travels	X	0.007	0.03	0.0	0.9
Tourist expenditures	X	137.2	767.5	0	26,992.1
Per capita tourist expenditures	X	7.8	43.9	0	1,715.5
Life expectancy at age 60		23.9	1.70	18.3	26.4
Old-age dependency ratio (%)		23.9	6.7	8.8	48.1
Young-age dependency ratio (%)		26.6	6.3	17.5	49.5
Effective retirement age		63.7	3.2	57.0	73.8
Years in retirement		21.4	2.2	14.7	26.1
GDP in country of departure		1,572,717	3,282,596	14,318	2,03 E7
Per capita GDP in country of departure		41,256	16,494	11,653	111,502

Notes: for bilateral variables, the value is attached to a couple (country of departure, country of arrival). Aggregate tourist expenditures and GDP data are provided in millions USD. Per capita figures refer to the population size in the country of departure. Values are provided for countries in the regression baseline scope.

International travels: the number of international travels is given by the number of international arrivals from all travelers from one county into another country. It is provided by Euromonitor, who consolidates data from the UN World Tourism Organization (UNWTO). Data comes as a bilateral matrix for each year. International arrivals follow the UNWTO classification and cover all transportation means for all non-resident visitors, excluding same-day visitors. Inbound travels by foreign temporary and permanent workers, in particular, are not counted. As the initial legs of travels are counted but not the return legs, the bilateral matrices are not symmetric.

Tourist expenditures: the total tourist expenditures from all travelers from one country into another country come from Euromonitor, who again consolidates data from the UNWTO. Data comes as a bilateral matrix for every year. Tourist expenditures are valued at the retail selling price paid by the consumer, including sales and excise taxes (except for the US and Canada).

Life expectancy, old-age dependency ratio, young-age dependency ratio: life expectancy at age 60, the old-age dependency ratio (number of people aged 65 or more over number of people aged 15 to 64) and the young-age dependency ratio (number of people aged 0 to 14 over number of people aged 15 to 64) all come from the World Population Prospects 2022, published by the population division of the United Nations.

Effective retirement age, years in retirement: the effective retirement age and the average number of years in retirement, averaged over men and women, are publicly available from the OECD (Pensions at a Glance publications).

Population size: the number of residents living in each country of the world for every year is taken from the Penn World Table version 10.0.

Gross domestic product: the expenditure-side real gross domestic product at current purchasing-power-parity (PPP) exchange rates for every country and for every year is taken from the Penn World Table version 10.0.

Relative prices: relative prices between two countries, or the relative cost of living between the two countries, is measured by the purchasing-power-parity (PPP) conversion factor between the two countries divided by the nominal exchange rate. That measure is also known as the real exchange rate. It is taken from the Penn World Table version 10.0, for every year.

Distance: the bilateral distance between two countries is taken as the geodesic distance (combining latitudes and longitudes with the great circle formula) from the most populated city of one country to the most populated city of the other country. The symmetric bilateral distance matrix is taken from CEPII's databases (Mayer and Zignago, 2011).

Average temperature: the average yearly temperature comes from the Climate Change Knowledge Portal, maintained by the World Bank.

5 EMPIRICAL RESULTS

I provide baseline results first and robustness checks next. A summary of findings closes the section.

5.1 Baseline results

The goal is an estimation of the gravity model defined by equation (1), presented in section 4.2. Given the panel nature of the data, I use a panel estimation technique, choosing between a fixed-effect estimation and a random-effect estimation with the outcome of a Hausman specification test. The resulting p-value associated to the chi-squared statistic from the Hausman test is smaller than 0.005), which suggests the use of a fixed-effect estimation.

The result of the fixed-effect estimation is presented in table 2. Estimated coefficients show that the demographic structure has an impact on international outbound travels, all in a statistically significant way.

First of all, the positive coefficient on the OADR shows that population aging overall has a positive impact on international outbound travel. According to the estimated coefficient, international outbound departures will increase 12% on average if the fraction of the population which is old is 10% higher (measured by the OADR, the ratio of the number of 65 years old and above over the number of 15 to 64 years old). Estimates also show that both forces that lead to population aging, a fertility decline and an increase in life expectancy, have an impact on international travel. The coefficient on the YADR shows that international outbound departures will increase by 3.9% on average if the fraction of children in the population declines by 10% (measured by the YADR, the ratio of the number of individuals aged 0 to 14 over the number of 15 to 64 years old), while international outbound departures will increase on average4.4% if the number of years in retirement increases by 10%, following for instance an increase in life expectancy.

Expected signs for other coefficients are found. Per capita GDP, as in other empirical studies, lead to more international outbound departures. Higher prices in the destination, relative to the departure country, reduce international travels to the destination, as expected.

Other control variables also matter in the estimation. There are less international departures in fast-growing countries, which can be explained by the fact that households in those countries are too busy working and thus lack time for travel. Table 2 also shows that there are more departures towards countries with a higher average temperature. As departure countries belong to the OECD, they tend to be colder on average than other countries in the world. This may explain why travelers seek higher temperatures.

Because distances do not vary with time, the fixed effect estimation ignores this data and does not provide an estimate for the distance coefficient (ρ_3 in the regression model 1).

Table 2. Impact on international travels (baseline).

Old-age dependency ratio (OADR) (departure country)	1.253*** (47.23)
Young-age dependency ratio (YADR) (departure country)	-0.388*** (-10.24)
Years in retirement (departure country)	0.444*** (9.08)
GDP/capita (departure country)	0.802*** (39.68)
GDP/capita growth (departure country)	-0.015*** (-7.62)
Average temperature (destination country)	0.109*** (5.80)
Relative prices	-0.101*** (-10.51)
Constant	-13.990*** (-51.67)
Model	Gravity
Panel	Yes
Regression	Fixed-effects
Years	2007-2018
N	68,855
Departure countries	38
Destination countries	172
R^2	0.164

***Notes**:* asterisks indicate significance at the ***1%, **5%, and *10% levels; *t* statistics in parentheses; *N* represents the number of departure-destination country pairs over the time span*; international travels* is expressed in per capita terms for the country of departure; all variables are expressed in logarithm.

5.2 Robustness analysis

Table 3 provides results with alternative data or estimation approaches, to assess the robustness of the baseline results[4]. Overall, results are comparable, suggesting that baseline estimates are robust. Some of the robustness cases shed another light on results of the paper.

4 alternative specifications are considered. I present and discuss each in turn. Column (1) of the table 3 provides the results for the baseline regression, for easier comparison.

In column (2), another measure of international tourism is used as dependent variable in the regression. The number of international travels from country A to country B is replaced by the tourist expenditures in country B by travelers from country A. Naturally, the value of the coefficient differs. The order of magnitude, statistical significance and sign are however identical to the baseline results, with two exceptions. First, the coefficient for years in retirements has the same sign, but it loses its statistical significance. It may be natural to witness an increase in international trips if people have more time in retirement. An increase in expenditures per trip, however, may not be natural. The fact that the coefficient is not statistically significant in column (2) should thus not be cause for worry. Second, the coefficient for the relative prices changes sign, which is due to endogeneity (if prices are higher at destination, tourist expenditures there will naturally be higher). That coefficient should thus be ignored in column (2).

In column (3), the same specification as in the baseline is used, except that a different estimator is used. As per the Hausman test (see section 5.1), fixed-effect estimation is preferrable to random-effect estimation. Column (3) provides the estimation with random effects. Outcomes are close to the baseline, with the exception of the coefficient for the temperature at destination, a control variable which does not lie at the core of the analysis. The random-effect estimation allows the inclusion of distance information in the analysis. The sign of the estimated coefficient, negative, is consistent with previous empirical studies.

In column (4), the impact of life expectancy on international travel is investigated differently. In the baseline, the impact is indirect, through the average number of years in retirement (a higher life expectancy increases the number of years in retirement, and vice-versa) and through the old-age dependency ratio (a higher life expectancy increases the fraction of individuals aged 65 or more in the population). In column (5), the impact of life expectancy at age 60 is measured directly. To avoid collinearity issues, the life-expectancy-at-60 variable replaces the OADR variable[5]. Estimation outcomes are consistent with the baseline. They show in particular that life expectancy as a strong impact on international travel: the average for life expectancy at 60 are 24 years, in the dataset; if life expectancy increases by 1 year, a roughly 4% increase, the estimated coefficients implies a 10% increase in international travels.

In column (5), the geographical scope of the baseline study is broadened at a double cost: the panel structure of the data is lost and key pension information, on effective retirement, is also lost. The

[4] Regressions for the robustness analysis, including the baseline case, include another control variable related to pension systems. Conclusions are unaffected.

[5] The collinearity risk is smaller with the years-in-retirement variable, because the effective retirement age also influences that variable. By contrast, nothing else than life expectancy in the regression influences the old-age dependency ratio.

number and type of departure countries however increase much. Instead of 38 OECD countries, which tend to have high income, 126 countries from all parts of the world are included as possible points of departure. Outcomes are generally consistent with the baseline. The coefficient for the young-age dependency ratio is no longer statistically significant, while the signs for relative prices and average temperature switch. Importantly, the impacts of the old-age dependency ratio are consistent, even though magnitudes differ (smaller than in the baseline). Demographic-related findings from the baseline however thus extend without reservation to any countries of the world.

Table 3. Impact on international travels (robustness analyses).

	(1)	(2)	(3)	(4)	(5)	Notes
OADR	1.121***	0.943***	1.009***		0.100***	(1) = baseline estimates
	(28.15)	(21.64)	(27.16)		(2.33)	
Life expectancy at 60				2.482***		(2) = impact on tourist expenditures, rather than on international travels
				(16.47)		
YADR	-0.389***	-0.160***	-0.205***	-0.181***	-0.092	(3) = random effect, rather than fixed effects
	(-7.55)	(-2.82)	(-4.26)	(-3.54)	(-1.14)	
Years in retirement	0.235***	0.065	0.132*	0.131*		
	(3.41)	(0.86)	(1.94)	(1.89)		(4) = life expectancy, rather than OADR
GDP/capita	0.783***	0.802***	0.901***	1.079***	0.604***	(5) = cross-section on worldwide departure countries
	(24.30)	(22.68)	(30.47)	(34.27)	(16.94)	
GDP/capita growth	-0.012***	-0.020***	-0.014***	-0.009***	-0.066***	
	(-5.45)	(-8.29)	(-6.29)	(-3.86)	(-3.22)	
Average temperature	0.097***	0.154***	-0.053***	0.137***	-0.461***	All data for the departure country except average temperature (at destination), relative prices (destination relative to departure) and distance (between destination and departure); gravity model used for all estimates; panel data used for all estimates except (6)
	(4.60)	(6.62)	(-2.72)	(6.49)	(-15.21)	
Relative prices	-0.085***	0.047***	-0.040***	-0.066***	0.205***	
	(-7.65)	(3.88)	(-3.68)	(-5.96)	(7.34)	
Distance			-1.37***		-1.35***	
			(-46.81)		(-69.72)	
Regression	Fixed-effects	Fixed-effects	Random-effects	Fixed-effects	OLS	
Years	2007-2018	2007-2018	2007-2018	2007-2018	2018	
N	52,060	51,023	52,060	52,060	15,108	
Departure countries	38	38	38	38	126	For more: see notes table 2
Destination countries	172	172	172	172	172	
R^2	0.129	0.105	0.314	0.120	0.393	

6 SUMMARY AND IMPLICATIONS

The analysis presented in the previous section shows the influence of evolving demographic structures on international travel. In general, population aging, either driven by an increase in life expectancy or a reduction in fertility, leads to more outbound international travel.

Specifically, two key findings emerge from the analysis of the data covering years 2007 to 2018, 38 to 177 departure countries and 172 destination countries. First, increases in life expectancy leads to more international travel abroad. A 1 year increase in life expectancy is estimated to boost international departures by 10%, on average. The health improvements which generate life expectancy gains can also explain the findings, as energy and time available for leisure is boosted. Second, lower fertility increases international outbound departures, fewer kids freeing time and resources for travel abroad. A 10% decline in the fraction of children in the population (as measured by the young-age dependency ratio) is estimated to increase international departures by nearly 4%, on average. The findings apply to any of 177 departure countries in the world.

In general, the empirical findings from the study have the following management and policy implications. First of all, there is no reason to fear a reduction in international outbound departures from countries subject to population aging. Second, marketing efforts to attract international travelers may be more interesting, ceteris paribus, in countries (i) where the effective retirement age is low; (ii) where life expectancy is large; (iii) where the fertility rate is low. Data provided in the appendix can support the corresponding decision making.

7 CONCLUDING REMARKS

The empirical analysis presented in this paper has shown that population aging, driven by slow declines in fertility and increases in life expectancy, is associated with an increase in international travels from any country in the world to any other. As people have less children over time, resources and time are freed up for travel abroad. Health improvements in old age, which lead to increases in life expectancy, also boost energy and time for international tourism.

Findings have implications for tourism policy makers and operators. Marketing efforts to attract international visitors may be more successful when performed in countries with a low effective retirement age and low fertility rate.

APPENDIX

List of departure countries in the baseline regression, with key demographic and pension data in 2018

Country	YADR	OADR	Life expectancy at age 60	Effective retirement age
Australia	28.65	23.90	25.96	64.80
Austria	21.60	28.06	24.18	62.15
Belgium	26.33	29.22	24.19	61.05
Canada	24.10	25.70	25.11	64.75
Chile	27.67	17.19	23.91	68.35
Colombia	32.95	11.45	22.16	n/a
Costa Rica	31.31	13.90	22.91	n/a
Czech Republic	24.26	29.99	21.99	62.25
Denmark	25.83	30.59	23.49	63.80
Estonia	25.59	30.77	21.94	65.60
Finland	25.79	34.68	24.35	63.85
France	28.83	32.84	25.64	60.80
Germany	20.81	33.09	23.86	63.80
Greece	22.41	33.76	23.82	60.85
Hungary	21.93	28.87	20.15	61.70
Iceland	28.72	21.18	24.84	67.00
Ireland	31.76	21.35	24.40	64.85
Israel	46.95	19.12	25.00	67.70
Italy	20.72	35.58	25.33	62.40
Japan	20.80	49.10	26.50	69.95
Latvia	24.36	32.56	20.05	65.20
Lithuania	22.84	30.60	20.51	63.65
Luxembourg	23.15	20.64	24.18	60.90
Mexico	39.61	11.59	20.63	68.90
Netherlands	24.49	29.14	24.07	63.85
New Zealand	29.93	23.00	25.36	68.10
Norway	27.02	26.18	24.90	65.10
Poland	22.51	25.55	21.69	61.70
Portugal	21.32	33.66	24.27	66.95
Slovakia	22.88	23.04	21.18	60.50
Slovenia	23.05	29.29	23.40	61.60
South Korea	17.53	19.86	25.14	72.30
Spain	22.57	29.30	25.40	61.70
Sweden	28.38	31.86	24.68	65.90
Switzerland	22.50	27.55	25.68	65.70
Turkey	35.17	11.14	21.02	65.60
United Kingdom	28.08	28.73	24.08	64.15
United States	28.79	23.44	23.64	67.20

Data sources: see section 4.3

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