Propelled: Evidence on the impact of vaccination against COVID-19 on travel propensity

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Abstract:

Do people vaccinated against COVID-19 exhibit a greater propensity to take a vacation trip? This paper answers this research question using nationwide survey microdata for a representative sample of the Spanish population in the summer of 2021. To provide a causal estimate of how COVID-19 vaccine affects travel propensity, our identification strategy uses an Inverse Probability Weighting Regression Adjustment (IPWRA) estimator that deals with selection and compositional effects. Consistent with the Health Belief Model and the Protection Motivation Theory, we find robust evidence that vaccination against COVID-19 increases the probability of taking a holiday trip during the summer period by 8.3 percentage points among the general population and 11.3 percentage points among the vaccinated subsample. Therefore, we document that vaccination propels tourism participation. Our results provide important insights for the recovery of the tourism industry.

Keywords: *vaccination; COVID-19; travel propensity; Inverse Probability Weighting Regression Adjustment*

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1. INTRODUCTION

The capacity to sustain the social interactions needed for the functioning of the economy after COVID-19 outbreak relies on whether countries can achieve the so-called 'herd immunity'. Getting a large share of the population vaccinated against COVID-19 worldwide is nowadays an essential goal for reducing the risk of disease transmission without the need of movement and interaction restrictions. In the tourism context, the restart of international travel is heavily dependent on the effective implementation of vaccines for safe travelling (Hall et al., 2020; Gursoy and Chi, 2021). Indeed, the uptake of the COVID-19 vaccine and the associated health passport (or a negative PCR test) is becoming a requirement for inbound tourists in many countries (Pavli and Maltezou, 2021).

An emerging body of literature has examined travel propensity after COVID-19 outbreak focusing on the role the perceived severity of a potential infection (Das and Tiwari, 2021), exposure to the virus (Boto-García and Leoni, 2021) or acceptance of the health passport (Cabeza-Ramírez and Sánchez-Cañizares, 2021), among many others. However, little is known yet about how whether vaccinated people are more prone to take a vacation trip. The Protection Motivation Theory (PMT) developed by Rogers (1975) predicts that people engage into different types of protective behaviours to minimize health risks, being their propensity to do so proportional to the perceived severity and susceptibility of the risk. Furthermore, according to the Health Belief Model (HBM) firstly introduced by Hochbaum (1958) and later presented in Champion and Skinner (2008), individuals uptake pharmaceutical interventions to lower the threat of getting sick because of self-efficacy expectations.[1] One example of such protective behaviour is to uptake the COVID-19 vaccine. Those who get immunized against COVID-19 are likely to perceive lower risks from travelling through the drop in threat severity and susceptibility to the disease, which might therefore translate into a greater willingness to travel relative to their non-vaccinated peers.

The goal of this paper is to formally examine whether vaccination against COVID-19 enhances travel propensity. Specifically, we seek to uncover whether having already received the vaccine increases travel probability conditional on other personal characteristics. Since the uptake of COVID-19 vaccine cannot be considered *as if* it were randomly distributed across the population, a proper analysis of the relationship between COVID-19 vaccine and travel propensity requires special modelling issues. Travellers have traditionally exhibited important concerns regarding vaccine uptake for several multidimensional reasons (Adongo et al., 2021). In this regard, some scholars have examined individuals' willingness to receive the COVID-19 vaccine in general (Grüner and Krüger, 2020; McPhedran and Toombs, 2021) and for the purpose of taking an international trip in particular (Wang et al., 2021; Gursoy et al., 2021). These studies show relevant heterogeneity in vaccine uptake by sociodemographic group. In addition, the adoption of protective non-pharmaceutical interventions varies by travellers' profile (e.g., Das and Tiwari, 2021). Therefore, to give our estimates a causal interpretation, we implement a doubly robust Inverse Probability Weighting Regression Adjustment estimator

[1] Pharmaceutical interventions are defined in this context as biopharmaceutical treatments (protective antibodies) used to prevent disease (i.e., vaccines).

(IPWRA) (Huber, 2014; Sloczinsky and Wooldridge, 2018) that deals with problems of selection and compositional bias.

To accomplish our study purposes, we use nationwide representative microdata for Spain involving 3,579 respondents collected in July 2021. Spain is one of the countries that first achieved the threshold of having 70% of the population vaccinated. By the end of August 2021, a total of 65 million doses of COVID-19 vaccine have been administered (33.3 million people fully vaccinated, 71.4% of the population) according to Our World in Data (OWID, 2021). Since Spain was also among the European countries with the largest tourism participation rates before the pandemic (Eurostat, 2021), it constitutes an interesting case study to evaluate the link between vaccination status and travel propensity.

The contribution of the work to the literature is twofold. First, this is among the first studies that evaluate the effect of the uptake of the COVID-19 vaccine on the willingness to travel using a large nationwide representative data set. Although vaccination intentions associated with tourism travelling have started to be object of interest (Williams et al., 2021; Zhu et al., 2021; Suess et al., 2022; Ekinci et al., 2022), there is little empirical evidence on whether being vaccinated makes people more prone to travelling relative to unvaccinated peers. We fill this gap in the literature. Consistent with the PMT and HBM frameworks, we show that vaccination against COVID-19 truly enhances travel propensity. The causal mechanism that underlies this relationship is that receiving the vaccine lowers the perceived risks associated with travelling, everything else being equal. Therefore, the paper provides evidence that getting a large share of the population vaccinated is an effective tool to resume the tourism industry. Second, rather than simply providing a descriptive association between vaccination and travel propensity, we implement a sound econometric analysis that deals with confounding factors and compositional effects. Related studies on the topic that relate travel intentions to vaccination status face the risk their findings are affected by the sample composition of vaccinated respondents (Ram et al., 2021; Gursoy et al., 2021). In this vein, the paper illustrates how simple descriptive analysis that ignore compositional bias could lead to misleading implications. We model both the vaccine uptake decision and tourism participation based on vaccination status conditional on a large set of controls. As such, even though we work with observational data, our findings can be given a causal interpretation.

A proper understanding of the relationship between vaccine uptake and tourism consumption behaviour has important implications for policy and management. Following COVID-19 outbreak, many people either stopped travelling to avoid contagion risks (e.g., Neuburger and Egger, 2021) or switched towards short-distance domestic destinations (Moya-Calderón et al., 2021; Li et al., 2021), which has resulted in important economic losses for those areas specialized in tourism activities (Bailey et al., 2020). However, if the COVID-19 vaccine *truly* increases travel propensity by lowering perceived health risks and the associated travel anxieties, vaccines will prove to be an effective tool for the recovery of the industry.

2. LITERATURE REVIEW

2.1.COVID-19 and travel intentions

Several studies have analysed travel propensity after COVID-19 outbreak, its underlying determinants and potential moderators. This stream of research agrees that the pandemic has generated an unprecedented level of public fear that induce people to self-protect against the risk of infection and to adjust their travel plans (Li et al., 2020). Similar to what happened in previous epidemics (e.g., Reisinger and Mavondo, 2005), people have become more anxious and reluctant to travel, delaying their travel plans until they feel secure (Neuburger and Egger, 2021; Zheng et al., 2021). Using large-scale survey data for European countries, Hodbod et al. (2021) find the tourism sector is the one with the largest decline in consumption; sixty-six percent of households report they will travel less for private reasons. Among those who continue travelling, they are predicted to avoid mass tourism and to switch towards domestic (e.g., Li et al., 2021) and more independent trips (e.g., Wen et al., 2021), at least in the short-term.

The Protection Motivation Theory (PMT) developed by Rogers (1975) postulates that when individuals are faced with health risks, there are three components of fear appeal: (i) the magnitude of noxiousness of the risk, (ii) the probability of the risk occurrence, and (iii) the efficacy of potential protective actions. Within this conceptual framework, some authors have studied how travel propensity amid COVID-19 relates to perceived risk and protective strategies. Qiao et al. (2021) report that self-protection motivation strongly depends on vulnerability, severity and response efficacy. Das and Tiwari (2021) show the perceived severity of COVID-19 is negatively associated with travel intentions. However, severity influences the willingness to adopt personal non-pharmaceutical interventions, which reduces the risk of infection and reinforces travel propensity. Similar results are presented in Liu et al. (2021), who show that intentions are affected by one's psychological state and personal attitudes towards the disease. Ram et al. (2021) note that economic stress and health risk factors have little influence on future travel demand. However, they find that non-clinical depression symptoms negatively affect the willingness to travel domestically.

Cabeza-Ramírez and Sánchez-Cañizares (2021) evaluate the relationship between travellers' acceptance of the health passport and their intention to travel. Their analysis suggests that passport acceptance and credibility in preventive measures negatively impact the willingness to travel. Sánchez-Cañizares et al. (2021) study how perceived risk affects intention to travel amid COVID-19 and people's willingness to pay for additional safety measures at the destination. Their analysis shows that travel intentions strongly depend on whether individuals believe they can control the circumstances of the trip. Curiously, greater travel intentions are not significantly associated with a higher willingness to pay for extensive safety measures in travel-related activities. Kim et al. (2021a) investigate the factors that explain people's biosecurity behaviour. This refers to actions intended to protect yourself against getting infected by COVID-19 like wearing facemasks and hand washing. They indicate that having had

COVID-19 or knowing someone who had passed it significantly influences the adoption of biosecurity practices. Biosecurity behaviour has been also found to vary significantly by gender and age (Kim et al., 2021b).

Pappas (2021) evaluates how COVID-19 has affected travel intentions focusing on the role of age, income and the economic and psychological impact of the pandemic. This author shows that elderly people are notably more reluctant to travel because of being more worried about the risks associated with COVID-19. Recently, Shin et al. (2022) examine travel participation and frequency during the pandemic and intentions for the near future. They show that past domestic experience, income, travel attitude and subjective norm positively impact the likelihood of an individual having taken a vacation trip during the pandemic. Political trust, intrapersonal constraints and social distancing by contrast exert negative effects. Concerning future travel intentions, these authors find that education, travel attitude, behavioural control and political trust positively influence domestic travelling. However, health risk perception still constitutes an important deterrent factor.

Overall, existing evidence on travel intentions after COVID-19 outbreak point to a general decrease in the willingness to travel due to health concerns, with notable differences by sociodemographic profile and past travel habits. However, travel fear as a travel barrier decreases as individuals adopt biosecurity behaviour that makes them feel more protected when travelling. Therefore, health protective interventions stand as important travel resilience factors.

2.2. *Vaccination uptake*

A recent stream of research has started to examine people’s attitudes and concerns towards receiving the COVID-19 vaccine. Individuals usually have biased perceptions about mortality risks (Abel et al., 2021) and factors like trust in science (Palamenghi et al., 2020) or exposure to media (Ruiz and Bell, 2021) shape their perceptions about the need for vaccine uptake. Consistent with the Health Belief Model (Champion and Skinner, 2008), the acceptance of health treatments like vaccines depends on the subjective *value* (personal risk) attached to getting sick and the subjective *expectation* that the action/intervention will prevent the illness.

Using survey data from a multi-country European study, Neumann-Böhme et al. (2020) document that concerns about potential side effects are among the most important reasons for hesitance, with relevant heterogeneity across countries. Grüner and Krüger (2020) show the willingness to be vaccinated against COVID-19 is positively associated with trust in the media and the healthcare system, the capacity to think deliberately and fear about health threats due to the virus. McPhedran and Toombs (2021) report efficacy is the main attribute British people asses for deciding whether to vaccinate, particularly among people older than 55. For the case of the USA, Reiter et al. (2020) find that the willingness to vaccinate is enhanced if people consider their healthcare provider would recommend vaccination and if they report high levels of subjective likelihood of getting infected in the future. Interestingly, recent evidence by Barber and West (2022) shows that a conditional cash lottery policy increased the share of vaccinated people in Ohio compared to other US states, which suggests that monetary incentives could be a promising way to encourage vaccination against COVID-19.

2.3. Vaccination and travel propensity

Many airline and hospitality companies are currently implementing vaccine passports policies to enable safe travelling. In the context, an emerging body of literature has started to study travelers' predisposition to take the COVID-19 vaccine. Wang et al. (2021) develop a conceptual framework based on the Protection Motivation Theory. Apart from safety and efficacy concerns, they also consider time, cost and autonomous concerns as potential factors that preclude vaccination. Suess et al. (2022) show that a strong belief in the protection benefits of the vaccine and a higher level of perceived susceptibility to COVID-19 with an anticipation of more severe symptoms are the two main predictors of vaccination intention. Empirically, Williams et al. (2021) document that efficacy and safety are key aspects that predict the willingness to be vaccinated. They also show that older, higher-income males and in economically most developed regions of Italy exhibit greater confidence in COVID-19 vaccine.

Ekinci et al. (2022) investigate whether travel desire could be an important driver of COVID-19 vaccination intention. Their analysis clearly indicates that hesitants of COVID-19 vaccine effectiveness uptake it to compile with vaccination requirements for travelling. Similarly, Zhu et al. (2021) evaluate whether travel-related beliefs and behaviours are associated with vaccination intentions and whether alerting people about vaccination-related requirements increases the willingness to get vaccinated. They show vaccination intention is strongly associated with the history of international travel and the desire to travel internationally in the future. Personal experiences with the virus and risk perceptions are other important predictors. Interestingly, confident respondents are willing to take a vacation trip earlier. Kesgin et al. (2022) find that travel desire and intrinsic religiosity influences COVID-19 vaccination intentions through attitudes and subjective norms. Using longitudinal data, Gursoy et al. (2022) show that loss-framed messages are more effective than gain-framed messages in reducing vaccine risk perceptions and that travel desire lightens the negative effect of vaccine risk perception on vaccination intention.

To our knowledge, Ram et al. (2021) and Gursoy et al. (2021) are the only works that study the relationship between vaccination against COVID-19 and travel propensity. Gursoy et al. (2021) conduct a longitudinal study on the relationship between COVID-19 vaccination intentions and the willingness to travel in the USA based on survey data collected between February and May 2021. These authors find that over 70 percent of their sample is willing to take the vaccine and that hesitancy rates have been stable over time. The willingness to take the vaccine varies across sociodemographic profiles, being greater among males and educated people and with notable differences by labour status and place of residence. Curiously, vaccination intentions are found to be negatively associated with travel intentions in February and March 2021 but unrelated with travel propensity in April and May 2021. Nonetheless, their analysis is quite descriptive and faces the risk that the negative relationship encountered is affected by uncontrolled confounding factors.

Based on three waves of survey data collected in Israel in June 2020, November 2020 and April 2021, Ram et al. (2021) study whether vaccination status will boost intentions and actual travel, both domestically and internationally. Their analysis indicates vaccination has no impact on actual travel or attitudes, which challenges the common wisdom that an effective vaccination campaign will restart the international tourism industry. However, since vaccinated individuals at the time of the surveys are likely to share common factors (i.e. self-selection), it could be the case the non-significant relationship documented in the paper is affected by the sample composition of vaccinated respondents.

We expand existing literature on how vaccination status affects travel propensity by implementing an econometric analysis that deals with compositional bias. We correct for the likelihood of being vaccinated based on observable characteristics to provide a cleaner estimate of the causal impact of COVID-19 vaccine on travel propensity. Since tourists have been shown to be more prone to travel when they perceive infection risks are low, we expect a positive causal relationship between the two (i.e., vaccination uptake increases the probability of taking a vacation trip).

3. DATA

3.1.Dataset and variables

We use a nationwide representative dataset of Spanish residents over 18 drawn from the July 2021 wave of the continuous barometer conducted by the Spanish Centre for Sociological Research (CIS in Spanish). Each month, this public institute surveys a representative sample of Spanish citizens over 18 to ascertain their opinions and attitudes towards current affairs together with political orientation and voting intentions. Surveys are completed through computer-assisted telephone interviews (CAPI) considering 1,223 municipalities and the 50 Spanish provinces. The fieldwork was completed between 2nd and 15th July.[2] The survey protocol combines stratified random sampling (to ensure a proportional representation of all the Spanish Autonomous Communities) plus random sampling within regions.[3]

[2] We use the July wave because it is the only wave in which respondents are asked about their vacation plans for the summer. We exploit the fact respondents are also asked about their vaccination status to link both dimensions.

[3] In particular, the barometer implements a multi-stage sampling procedure, stratified by conglomerates, with primary (municipalities) and secondary (sections) units selected in a proportional random way. Individuals are subsequently selected randomly by gender and age quotas. The sampling protocol ensures that a minimum of 100 respondents are interviewed per each Autonomous Community. Further information about the dataset is available at: http://www.cis.es/cis/opencm/ES/1_encuestas/estudios/ver.jsp?estudio=14577

In the July wave, respondents are asked about their vacation plans for the summer of 2021. Specifically, they are posited the following question: *Do you plan to go on holidays (or have you already been)*?[4] Around 46% of respondents declare to have scheduled/taken a vacation trip. Since the survey is conducted in July and asks about incoming trips or already done ones, this variable is understood as true tourism participation rather than travel intentions. Figure 1 maps the share of sampled individuals (in percentage) that state they take a holiday trip during the summer period per province of residence. The provinces of the Basque Country, Madrid, Zaragoza, Barcelona, Navarre and La Rioja are among the ones with the largest travel propensities. This pattern is consistent with the evidence presented in Boto-García and Leoni (2021) for the summer of 2020 and previous studies in tourism showing that tourism participation increases with the population size of the place of residence (Nicolau and Más, 2005).

Together with standard sociodemographic variables like age, education level or labour status, respondents are asked several questions concerning COVID-19. First, they are posited whether they have already been vaccinated against COVID-19 or not. Almost 75% of the sample declare to have received the vaccine by the moment of the survey. Although because of being self-reported we cannot completely rule out potential social desirability bias, this figure is in line with official statistics. At that time, the vaccination rate was around 60% (Our World in Data, 2021) considering the whole population of the country but 71.4% considering only people over 18.

Figure 2 plots a map of the percentage of respondents that are vaccinated per province of residence. As shown, there is some heterogeneity in vaccination shares across the territory. This is partially the result of differences in the speed of vaccination across geographic units. Beyond that, differences in vaccination percentages across the country can also relate to differences in the incidence of COVID-19 across regions (Gursoy et al., 2021). Indeed, the economics literature has documented that people's vaccination propensity responds to the prevalence of the disease at their place of residence (e.g., Philipson, 1996).

[4] Those who answer affirmatively are subsequently questioned about the length of the trip, whether they intend to travel domestically or abroad, and the mode of transport selected. Most tourists indicate they travel domestically (88%), to coastal destinations mainly (60%) and by private car (78%). Concerning the length of the stay, 12.2% indicate less than one week, 28.2% report one week, 28.7% plan between one and two weeks and the remaining 29.2% state more than two weeks. The analysis of travel preferences regarding these dimensions is beyond the scope of this paper.

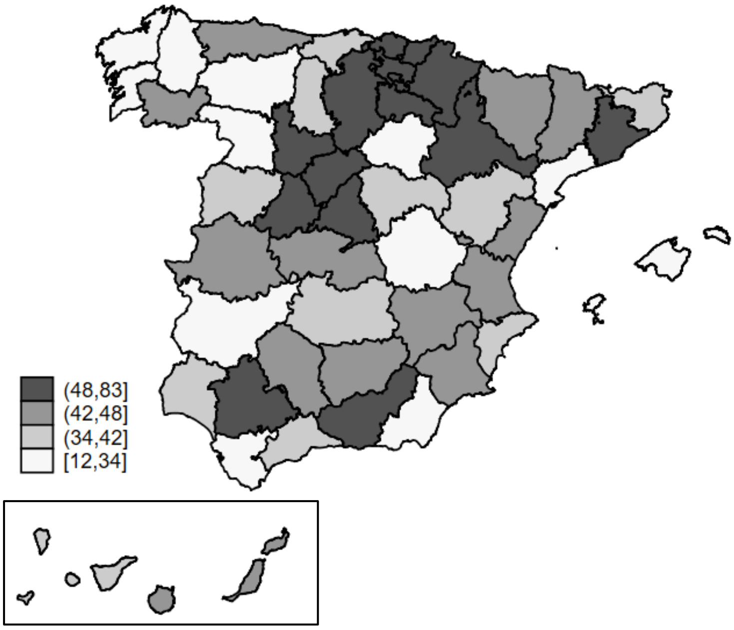

Figure 1.- Share of respondents (%) that plan to take a vacation trip per province of residence

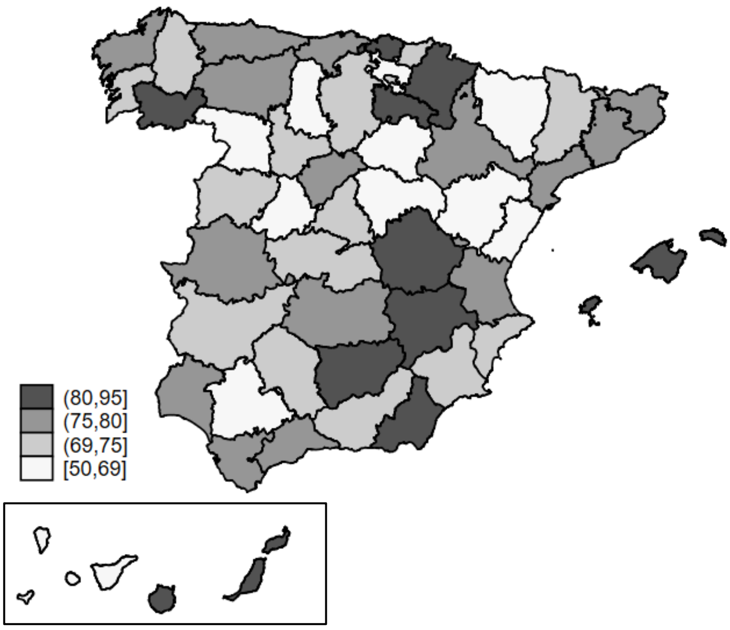

Figure 2.- Share of respondents (%) that are vaccinated against COVID-19 per province of residence

Beyond their vaccination status, respondents are asked whether they have been diagnosed with COVID-19 (through a positive PCR test) at any time. Around 8.6% have suffered the disease. Concerning the measures adopted to minimize contagion risks, 44.6% declare they have substantially reduced their personal contact with their family and friends. When asked whether they deem the worst phase of the pandemic is already over, around 63% of the sample agrees with this statement. Concerning the degree to which the pandemic is affecting the personal life of the respondent, 33% of the sample state 'quite a bit' and 16% report 'a lot'. However, 25% indicate 'slightly' and 24% point out 'almost nothing'.[5]

A total of 3,798 individuals took the survey. This represents 95.5% confidence level with a sampling error of ±1,6%. We do not consider individuals over 80 years old (n=109). Since tourism participation rates among those aged over 80 are very low due to intrapersonal constraints and lack of interest in general (Huber et al., 2018), and after COVID-19 outbreak in particular (Pappas, 2021), including them in the analysis makes little sense. Moreover, almost all people within this population segment are vaccinated in the sample (97%), which results in reduced variation within this age group. After further excluding respondents that provided incomplete answers to some of the variables of interest, we have 3,579 valid observations.[6] Table 1 presents summary statistics of the dataset. The sample is balanced in terms of gender, with a mean age of 49 years old and 58% being currently employed. About 43% attain college studies and 10% lives in municipalities with more than a million inhabitants. Asked about their personal economic situation on a 1-5 scale, 58% rate it as 'good' and only 7.7% as 'very bad'.[7]

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[5] The wording of the question is: *Focusing now on what is happening because of the pandemic, how is it affecting your personal life?* The possible answers are: 'It is affecting me a lot' (*Affects Pers. Life=5)*, 'It is affecting me quite a bit' (*Affects Pers. Life=4)*, 'It is affecting me neither much nor little' (*Affects Pers. Life=3)*, 'It is affecting me little' (*Affects Pers. Life=2)*, and 'It is not affecting me /almost nothing' (*Affects Pers. Life=1).*

[6] The dataset is available for being downloaded without cost at http://www.cis.es/cis/opencm/ES/1_encuestas/estudios/ver.jsp?estudio=14577

[7] The exact wording of the question is: *How would you assess your current personal economic situation?* The possible answers are 'Very bad', 'Bad', 'Ordinary', 'Good' and 'Very Good'. Since these answers have a natural ordering, they are coded 1-5, respectively. The use of 1-5 scales is a common way to proceed when working with qualitative survey questions posited by the CIS Barometer and can be found in related studies that use this monthly poll (Núñez-Barriopedro et al., 2020; Fernández-Prados et al., 2020).

Variable	Definition	Mean (%)	SD	Min	Max
Travels	=1 if respondent has planned a vacation trip in the summer of 2021	46.241			
Vaccinated	=1 if vaccinated against COVID-19	74.909			
Female	=1 if female	50.488			
Age	Age in years	49.411	15.931	18	79
Econ. Sit	Personal economic situation on a 1-5 Likert scale (1='very bad' and 5='very good'.	3.416	0.955	1	5
Prim. Educ	=1 if primary education	6.649			
Sec. Educ	=1 if secondary education	28.359			
Voc. Training	=1 if vocational training	18.999			
High Educ	=1 if university education	43.867			
Employed	=1 if currently working (employee, employed, self-employed, businessman)	58.396			
Unemployed	=1 if unemployed	9.388			
Housewife	=1 if housewife/housekeeper	3.436			
Student	=1 if student	4.219			
Retired	=1 if retired	24.559			
Munsize1	=1 if municipality of residence has less than 2,000 inhabitants	5.113			
Munsize2	=1 if municipality of residence has between 2,000 and 10,000 inhabitants	14.082			
Munsize3	=1 if municipality of residence has between 10,000 and 50,000 inhabitants	26.599			
Munsize4	=1 if municipality of residence has between 50,000 and 100,000 inhabitants	12.517			
Munsize5	=1 if municipality of residence has between 100,000 and 400,000 inhabitants	23.917			
Munsize6	=1 if municipality of residence has between 400,000 and a million inhabitants	7.711			
Munsize7	=1 if municipality of residence has more than a million inhabitants	10.058			
Worst already	=1 if the respondent considers the worst phase of the pandemic is over	62.950			
Suffered COVID	=1 if the respondent has suffered COVID-19 (positive PCR test)	8.605			
Affects Pers. Life	Personal valuation of how the pandemic is affecting their personal life on a 1-5 Likert scale (1='hardly anything' and 5='very much')	3.075	1.481	1	5
Reduces contact	=1 if respondent declares to have reduced his/her contact with friends/relatives as a way to minimize COVID-19 infection risk.	44.593			
N		3,579			

Table 1.- Descriptive statistics of the variables

3.2. Descriptive evidence

Table 2 presents descriptive statistics of the share of people that travels in the summer of 2021 by vaccination status. About 44% of the subsample of vaccinated people against COVID-19 travels in the summer of 2021. However, this share amounts to 51% among the non-vaccinated subsample. As shown in column 5, a proportion test rejects the null of mean equality. Consequently, this would suggest that travel propensity is *lower* among vaccinated people. This is contrary to our expectations but matches the results presented in Gursoy et al. (2021).

Group	n	Mean	SD	t-test	p-value
Vaccinated=0	898	0.517	0.016	3.847***	<0.001
Vaccinated=1	2,681	0.443	0.009		

Table 2.- Proportion test for travel propensity (Travels) by vaccination status. *** p<0.01, ** p<0.05, * p<0.1

However, this finding is clearly driven by a compositional effect. Figures 3 and 4 present binned scatterplots (Cattaneo et al., 2021) of the share of respondents that travels and that are vaccinated by age, respectively.[8] As can be seen, the willingness to travel in the summer of 2021 decreases with age. This is consistent with other studies showing high travel reluctance among the elderly segment after the pandemic outbreak (e.g., Pappas, 2021; Das and Tiwari, 2021). By contrast, the share of vaccinated people exhibits a positive relationship with age. If elderly people are the most likely to be vaccinated because of their greater vulnerability and this segment is at the same time less prone to travel, then the lower travel propensity detected for the vaccinated group could be an artifact caused by the sample composition of the two groups. A similar reasoning could be applied to labour status or educational level; unemployed people are less likely to be vaccinated than employed individuals (58% versus 73%) but travel propensity is larger among the currently employed (54% versus 29%). Similarly, descriptive statistics indicate vaccination is more prevalent among those with primary education whereas travel propensity increases with education.[9] Therefore, we need to move to a formal econometric analysis to properly identify the impact of vaccination on the willingness to take a trip net of confounding factors, both on vaccination likelihood and travel propensity.

[8] Binned scatterplots are a non-parametric tool that is becoming widely used in applied microeconomics as a method to inspect the functional form of the relationship between two variables. It consists of splitting the domain of the variables into a set of predefined bins based on the quantiles and plot the mean values for each bin.

[9] Table A1 in Supplementary Material provides descriptive statistics of the share of respondents that plan to travel, are vaccinated and have suffered COVID-19 per sociodemographic profile.

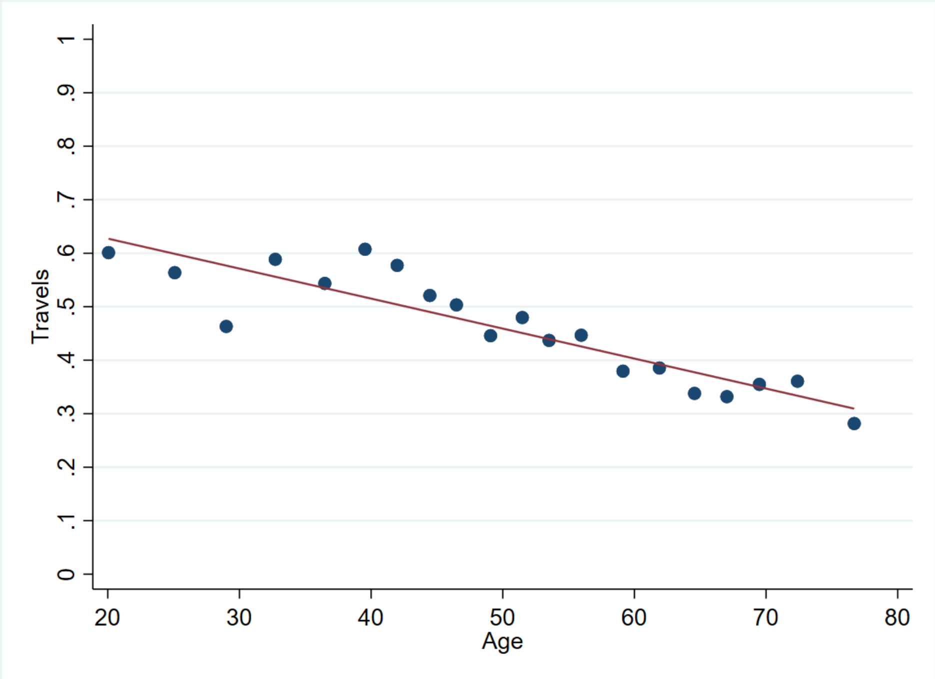

Figure 3.- Binned scatterplot of *Travels* on *Age*

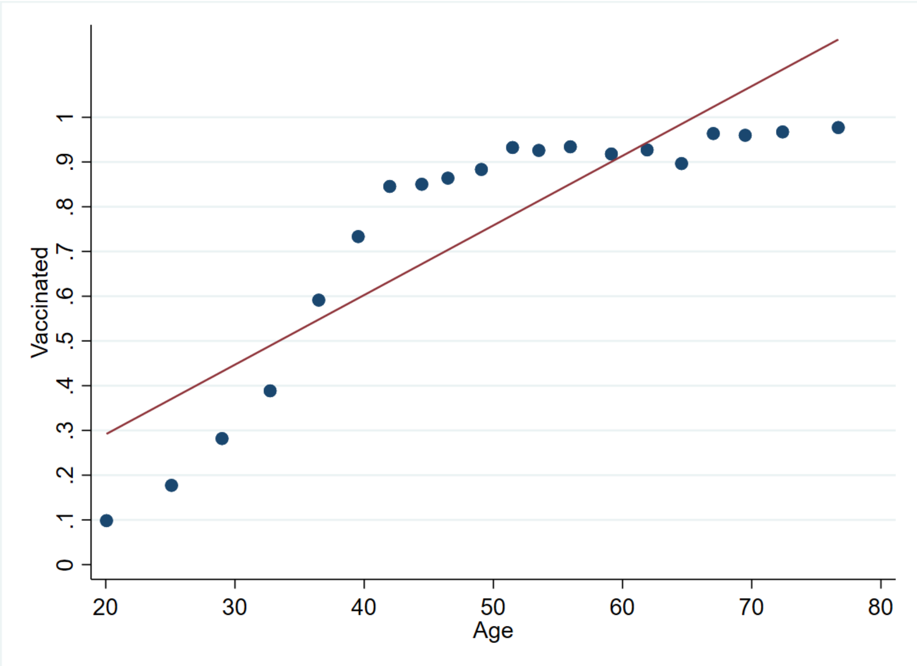

Figure 4.- Binned scatterplot of *Vaccinated* on *Age*

4. METHODOLOGY

4.1.Inverse Probability Weighting Regression Adjustment

In principle, to analyse the relationship between vaccination against COVID-19 and travel propensity, we could run a simple Linear Probability Model or Probit regression of *Travels* on *Vaccinated* while controlling for other factors like sociodemographic characteristics or province dummies. However, as discussed in Section 2, the treatment is unlikely to be randomly distributed across the population. Indeed, a Probit regression of *Vaccinated* on sociodemographic characteristics and province fixed effects (Table A2 in Supplementary Material) shows that vaccination against COVID-19 is significantly more prevalent among elderly people (see also Figure 2), individuals in a good economic situation, employed and that have reduced their social life interactions to minimize infection risks. When the treatment cannot be understood *as if* it were randomly assigned, the coefficient estimate from a linear regression does not identify the Average Treatment Effect (ATE) or the Average Treatment Effect on the Treated (ATT), but a variance weighted ATE (Angrist and Pischke, 2008). Therefore, when trying to infer the causal impact of a treatment on an outcome using observational data, scholars need to move to conditional unconfoundedness (i.e., the outcome is independent of the treatment only after conditioning on a set of observed covariates).

Under the potential outcomes framework developed by Rubin (1974), let *Vaccinated* denote the binary treatment variable and $Y_{\tau}{}^{*}$ denote a latent variable for the (potential) outcome of interest (here travel propensity) under each treatment status τ (for $\tau = 0{,}1$). Let X refer to a set of sociodemographic factors and personal characteristics of the individual that might have an influence on the outcome and on the treatment status. Assuming conditional unconfoundedness:

$$(Y_1, Y_0) \perp Vaccinated|X \tag{1}$$

The two potential outcomes are independent of *Vaccinated* given *X*. As a result, the treatment effect can be identified after conditioning on observables *X* (see Abadie and Cattaneo, 2018). Specifically, the ATE is given by:

$$ATE = E[E(Y|X, Vaccinated = 1) - E(Y|X, Vaccinated = 0)] \tag{2}$$

and the ATET is obtained in the following manner:

$$ATET = E[E(Y|X, Vaccinated = 1) - E(Y|X, Vaccinated = 0)|Vaccinated = 1] \tag{3}$$

Denoting $E(Y|X, Vaccinated = 1) = m_1(X)$ and $E(Y|X, Vaccinated = 0) = m_0(X)$, the ATE and ATET can be understood as conditional difference-in-means estimators (Cerulli, 2015) as follows:

$$\widehat{ATE} = \frac{1}{n}\sum_{i=1}^{n}[\widehat{m_1}(X_i) - \widehat{m_0}(X_i)]$$

(4)

$$\widehat{ATET} = \frac{1}{n}\sum_{i=1}^{n} Vaccinated_i * [\widehat{m_1}(X_i) - \widehat{m_0}(X_i)]$$

(5)

where $\widehat{m_1(X_i)}$ and $\widehat{m_0(X_i)}$ indicate consistent estimators of $m_1(X)$ and $m_0(X)$, respectively. These estimates can be obtained either parametrically or non-parametrically, although the former approach is the most common. Assuming a linear in parameters functional form for the expected value of the potential outcome given covariates for each treatment status, we have:

$$m_1(X) = \alpha_1 + \beta_1 X + \epsilon_1 \quad \text{for } Vaccinated = 1$$

$$m_0(X) = \alpha_0 + \beta_0 X + \epsilon_0 \quad \text{for } Vaccinated = 0$$

(6)

That is, we can run separate OLS regressions on the outcome for each treatment group using *Travels* as the dependent variable and then compute the ATE and the ATET consistently as a difference in means in predicted values for each individual. This is the well-known Regression Adjustment (RA) estimator.

As mentioned before, some individuals are more likely to have received the COVID-19 vaccine because of their age or labour status (see Table A1 in Supplementary Material). As a result, there might be a compositional effect in the sample that could make the difference in means computation of the ATE and ATET as shown in (4-5) imprecise. This is because some segments are likely to be overrepresented (underrepresented) in the vaccinated (non-vaccinated) group. To correct for this, $\widehat{m_1}(X_i)$ and $\widehat{m_0}(X_i)$ are weighted by inverse of the propensity score (i.e., the predicted probability of receiving the vaccine based on characteristics) so that:

$$\widehat{ATE} = \frac{1}{n}\sum_{i=1}^{n}\frac{\widehat{m_1}(X_i)}{\hat{p}(X_i)} - \frac{1}{n}\sum_{i=1}^{n}\frac{\widehat{m_0}(X_i)}{1-\hat{p}(X_i)}$$

(7)

$$\widehat{ATET} = \frac{1}{n}\sum_{i=1}^{n} Vaccinated * [\frac{\widehat{m_1}(X_i)}{\hat{p}(X_i)} - \frac{1}{n}\sum_{i=1}^{n}\frac{\widehat{m_0}(X_i)}{1-\hat{p}(X_i)}]$$

(8)

where $\hat{p}(X_i)$ is the predicted probability of being vaccinated obtained from a Probit regression. This weighting adjustment results in the so-called Inverse Probability Weighting Regression Adjustment (IPWRA) estimator. This estimator is doubly robust to misspecification: it remains consistent if either the propensity score or the conditional mean of the outcome is misspecified (Wooldridge, 2010, p. 931-932). It is asymptotically normal and locally efficient because both the propensity scores and the potential outcomes regressions are M-estimators. The reader is referred to Sloczinsky and Wooldridge (2018) for further details.

4.2.Control variables

We use the following set of variables in the propensity score (probability of having been vaccinated against COVID-19) and the potential outcomes equations (propensity to travel for each group):

- Sociodemographic characteristics: age (in years)[10], gender (dummy for female), educational level (dummies for secondary studies, vocational training and university education, with primary education acting as the reference category), personal economic situation (continuous indicator), labour status (dummies for employed and unemployed, with the reference category collapsing students, retired and inactive people) and the population size of the place of residence (in intervals, with *MunSize1* acting as the excluded category).
- Personal exposure and disease concern: studies in the biomedical literature indicate that past infection events and personal experience with epidemics shape individuals' attitudes towards vaccine uptake (e.g., Wells and Bauch, 2012). In the context of COVID-19, Reiter et al. (2020) and Suess et al. (2022) also find that those having a personal history of COVID-19 infection are more likely to vaccinate. Therefore, we include the binary indicator *Suffered COVID* for whether the respondent has been diagnosed by COVID-19 in the past. This variable is likely to also affect travel propensity through lowering the risk perception of taking a holiday trip. On the other hand, several authors have shown that both travel intentions (Sánchez-Cañizares et al., 2021; Liu et al., 2021) and the willingness to vaccinate (Williams et al., 2021; Suess et al., 2022) are strongly affected by perceived risk and attitudes. To control for this, we first consider a binary indicator for whether the individual has reduced his/her personal contact with family and friends to minimize the risk of infection (*Reduces contact)*. This behaviour might reflect a greater personal concern about the disease (perceived susceptibility) that could make the respondent more likely to be vaccinated but precludes tourism travel (Sánchez-Cañizares et al., 2021; Das and Tiwari, 2021). Additionally, we include a dummy for whether the respondent considers the worst phase of the pandemic is already over (*Worst already)*. This variable is a proxy of the degree of optimism and prospects about the near future, capturing intra-pandemic perception (Li et al., 2020). Economic models of rational epidemics predict that pessimistic expectations are associated with more risk tolerance (Auld, 2003). Finally, we consider the 1-5 continuous indicator about the degree to which the pandemic is affecting

[10] We consider a squared polynomial of age based on the inverse U-shaped relationship documented in Figure 2 between age and travel propensity.

respondent's personal life (*Affects Pers. Life)*. This intends to capture potential non-clinical depression, which has been shown to affect travel intentions (Ram et al., 2021).
- Province fixed effects: as shown in Figures 1 and 2, there is some heterogeneity in travel propensity and vaccination status across provinces that need to be controlled for. Therefore, we consider a set of dummy variables for the province of residence.

5. RESULTS

5.1.Main findings

Table 3 presents the ATE and ATET of COVID-19 vaccine on travel propensity using RA (column 1) and IPWRA (column 2). Standard errors have been clustered at the province level due to the clustered sampling scheme of the dataset (Boto-García, 2022). Survey weights provided in the dataset have been used in the analysis to achieve more precise estimates by correcting for heteroskedasticity and potential endogenous sampling (see Solon et al., 2015 for a detailed discussion).

	RA	IPWRA
ATE	0.056***	0.083***
	(0.021)	(0.027)
ATET	0.074***	0.113***
	(0.037)	(0.032)

Table 3.- Average Treatment Effect (ATE) and Average Treatment Effect on the Treated (ATET) of *Vaccinated* on *Travels*. Clustered standard errors at the province level in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The estimates from the RA analysis indicate vaccination against COVID-19 increases travel propensity by 5.6 percentage points (henceforth pp). However, once we weight observations by the inverse of the propensity scores to acknowledge compositional effects, this effect becomes 8.3 pp. Since the latter method is more robust because it remains consistent even if the linearity of the conditional means of the outcome variable is not sustained (Wooldridge, 2010), we give more credit to the estimates from the IPWRA. The corresponding ones for the unweighted RA method are presented for comparison purposes. Therefore, the weighting adjustment to correct for disproportionate representation of population segments in the vaccinated group provides a cleaner estimation of the effect of vaccination on travel propensity. Once we condition on confounders, the negative descriptive association presented in Table 2 is reverted. Similarly, the average treatment effect on the treated (i.e., the impact of vaccination among the vaccinated subsample) under the RA method is 7.4 pp but becomes 11.3 pp according to IPWRA. A comparison with the ATE indicates that the positive effect of vaccination is larger in magnitude among the vaccinated subsample. Overall, the estimates clearly indicate that vaccination against COVID-19 disease *enhances* travel propensity.

The positive causal effect of COVID-19 vaccine on travel propensity might reflect that the vaccine makes individuals feel more protected against both infection and illness, *ceteris* *paribus*, thereby perceiving lower travel risks. Consistent with the Health Belief Model and the Protection Motivation Theory, we therefore interpret the results as suggestive that threat perception as a travel barrier is diminished after having got immunized against COVID-19. This result is contrary to previous evidence presented in Ram et al. (2021) for the case of Israel and Gursoy et al. (2021) using data for the USA. Leaving aside potential country differences between the samples analysed, it might be the case their findings are affected by compositional bias. Once the analysis considers the non-random selection into vaccination, there is robust evidence that immunization *boosts* travel intention.

The coefficient estimates of the regressions for the potential outcomes for the treated and control groups obtained under the IPWRA estimator (i.e., β_1 and β_0 in equation (6)) are presented in Table 4.[11] Please recall these estimates do not come from separate regressions but are jointly estimated for the whole sample within the potential outcomes framework. The propensity scores (probability of having already taken the vaccine) increase at a decreasing rate with age (+1.4% on average per year) and are significantly higher among employed people (+5.6%), those in good economic conditions (+3.2% per point increase) and those who reduced their contact with friends and relatives to avoid contagion risks (+3.6%). As predicted by the Health Belief Model, the later result suggests that those with greater threat appraisal and perceived susceptibility are more likely to get the vaccine. This falls in line with evidence by Reiter et al. (2020), Williams et al. (2021) and Suess et al. (2022). By contrast, the propensity scores are lower among those who suffered COVID-19 in the past (-13.3%) and those who declare the pandemic has notably affected their personal lives (-1.2% per point increase). The former might be explained by a lower demand for pharmaceutical immunization throughout having already passed the illness, which serves as a natural immunization. The latter might be interpreted in terms of situational depression and personal fears that has been shown to be associated with vaccine hesitancy (e.g., Bendau et al., 2021). Interestingly, the propensity scores are unrelated to education, gender or the size of the municipality of residence. This is contrary to Gursoy et al. (2021), who report males and high educated individuals are more prone to get vaccinated, but in line with Williams et al. (2021), who do not find differences in vaccine confidence by educational level.

Concerning the potential outcomes regressions (probability of taking a holiday trip), travel propensity increases with educational level (around +24% among the high educated relative to those with primary studies) and is higher among those who consider the worst phase is over (+12.8% for the vaccinated subsample, +14.6% for the rest), possibly through an optimism mechanism. This result is consistent with evidence presented in Auld (2003) showing that optimistic versus pessimistic views are associated with greater risk tolerance. In this regard, several works have documented that pessimistic prospects notably deter travel intention and consumption patterns in the COVID-19 context (Liu et al., 2021; Hodbod et al., 2021).

[11] The coefficient estimates for the province fixed effects are not shown to save space but are presented in Table A3 in Supplementary Material.

	(1) Potential Outcomes means for *Vaccinated*=0	(2) Potential Outcomes means for *Vaccinated*=1	(3) Prob. (Vaccinated=1)	(4)
Explanatory variables	Coeff.	Coeff.	Coeff.	AME
Female	0.038	-0.055**	0.016	0.003
	(0.046)	(0.025)	(0.055)	(0.010)
Age	-0.012	-0.011*	0.177***	0.014***
	(0.011)	(0.006)	(0.016)	(3.9e-04)
Age^2	6.7e-05	8.8e-05	-0.001***	
	(1.2e-04)	(5.8e-05)	(1.6e-04)	
Econ. Sit	0.010	0.108***	0.177***	0.032***
	(0.021)	(0.012)	(0.030)	(0.005)
Sec. Educ	0.243***	0.071**	-0.115	-0.021
	(0.075)	(0.034)	(0.119)	(0.022)
Voc. Training	0.193*	0.144***	-0.030	-0.005
	(0.108)	(0.034)	(0.154)	(0.028)
High Educ	0.249***	0.233***	0.008	0.001
	(0.084)	(0.025)	(0.124)	(0.023)
Employed	0.106**	0.070	0.306***	0.056***
	(0.052)	(0.049)	(0.104)	(0.019)
Unemployed	-0.074	0.012	0.056	0.010
	(0.065)	(0.066)	(0.145)	(0.027)
Munsize2	0.063	0.113**	0.018	0.003
	(0.139)	(0.055)	(0.180)	(0.033)
Munsize3	0.068	0.089	0.012	0.022
	(0.133)	(0.055)	(0.182)	(0.033)
Munsize4	0.205	0.102*	-0.129	-0.023
	(0.143)	(0.059)	(0.203)	(0.038)
Munsize5	0.092	0.196***	0.064	0.011
	(0.121)	(0.056)	(0.179)	(0.033)
Munsize6	0.169	0.141**	-0.123	-0.022
	(0.126)	(0.064)	(0.218)	(0.040)
Munsize7	0.147	0.130**	0.002	3.1e-04
	(0.125)	(0.057)	(0.213)	(0.039)
Worst already	0.146**	0.128***	-0.053	-0.09
	(0.058)	(0.018)	(0.063)	(0.011)
Suffered COVID	0.047	0.105**	-0.719***	-0.133***
	(0.054)	(0.045)	(0.119)	(0.024)
Affects Pers. Life	0.011	0.003	-0.065***	-0.012***
	(0.019)	(0.007)	(0.018)	(0.003)
Reduces contact	0.006	0.032	0.195***	0.036***
	(0.043)	(0.021)	(0.055)	(0.010)
Province Fixed Effects	YES	YES	YES	
Constant	0.690**	0.342*	-5.908***	
	(0.343)	(0.192)	(0.459)	
Observations	3,579	3,579	3,579	3,579

Table 4.- Coefficient estimates from Potential Outcomes means and propensity scores using IPWRA. Column 4 presents average marginal effects (AME). Clustered standard errors at the province of residence level in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted categories are *Prim. Educ*; *Housewife, Student* and *Retired*; *Munsize1*; and *Álava*.

Interestingly, vaccinated females are less likely to travel (-5.5%) while there are no significant gender differences in travel propensity among the non-vaccinated group. This is consistent with robust evidence showing a greater risk aversion among females (Kozak et al., 2007; Park and Reisinger, 2010). Additionally, vaccinated individuals who passed the disease are significantly more willing to take a vacation trip (+10.5%). We interpret this as evidence that those who attain both natural and pharmaceutical immunization perceive much lower travel risks, thereby being one the most travel-prone segments. However, travel propensities are not significantly associated with having reduced his/her personal contact with family and friends to minimize the risk of infection or with the degree of personal suffering caused by the pandemic.

5.2.Robustness checks

We have performed several robustness checks to our findings. First, we have examined potential multicollinearity problems. We have run auxiliary linear regressions of the variables of interest (Vaccinated and Travels) on the controls and compute the Variance Inflation Factor. The corresponding values are 5.37 and 5.50, respectively. These figures are far from the commonly used threshold point of 10. Moreover, we computed the correlation matrix between all the variables and all the pairwise correlations are low (the greatest correlation is -0.37 between age and being employed). Therefore, collinearity seems not to represent a major problem.

Second, for the identification of the ATE and ATET of COVID-19 vaccine on travel propensity, we have assumed selection in observables (conditional independence). However, one potential concern could be the existence of shared unobserved factors affecting both the likelihood of being vaccinated and the willingness to travel. One example of this could be risk aversion or any other omitted personal trait. To examine this, we run a recursive Bivariate Probit regression treating *Vaccinated* as potentially endogenous. By allowing the error terms of the two equations to follow a bivariate normal distribution, we can formally test the existence of shared unobservables in the residuals. We use the following two variables as exclusion restrictions for identification: i) a dummy for whether any other cohabiting of the respondent has been diagnosed with COVID-19 (*Cohab. sick*), and ii) a dummy for whether the respondent personally knows anyone (friend, workmate, relative) that has died due to COVID-19 (*Known dead*). These two variables are assumed to be correlated with *Vaccinated* but uncorrelated with *Travels*. Auxiliary regressions (Table A4 in Supplementary Material) confirm this assumption.

The estimation results from the recursive Bivariate Probit regression are presented in Supplementary Material, Table A5. A Wald test does not reject the null hypothesis that the error terms of the two equations are uncorrelated (chi2(1)=0.060, p-value=0.806). Therefore, there is no evidence of common unobserved factors in the residuals, implying that the mean conditional independence assumption seems plausible. In other words, the potential effect of heterogeneity in risk aversion is captured by the sociodemographic controls (see on this Dohmen et al., 2021) so that the treatment unobservables are conditionally independent from the outcome residuals.

Third, we apply a balance test developed by Imai and Ratkovic (2004), which is an overidentification test for covariance balance. We do not reject the null hypothesis that covariates are balanced (chi2(69)=62.52, p-value=0.695). Finally, the survey collects information on religiosity and political orientation. Previous studies have shown differences in vaccination propensity by religious orientation (Gursoy et al., 2021) and political ideology (Ruiz and Bell, 2021). However, these two factors are uncorrelated with both vaccination status and travel propensity in our data (Table A6 in Supplementary Material), so we decided not to consider them among the set of controls to avoid endogeneity problems from measurement error.

6. CONCLUSIONS

6.1.Discussion

This study evaluates how vaccination against COVID-19 impacts travel propensity. Through the lens of the Health Belief Model (Champion and Skinner, 2008) and the Protection Motivation Theory (Rogers, 1975), people are predicted to uptake the vaccine to lower health risks and feel more protected against the disease, which in turn translates into greater travel propensity relative to non-vaccinated people. Using representative survey data for the Spanish population collected in July 2021, we perform a formal econometric analysis to test whether the expected positive effect of vaccination on people's willingness to travel really holds. The study by Gursoy et al. (2021) and descriptive evidence pointed to the vaccinated subsample as being less prone to travelling. However, since vaccination status is not randomly assigned but correlated with age, and elderly people also exhibit a lower willingness to take a vacation trip, the causal mechanism of COVID-19 vaccine on travel propensity is only identified once we control for confounders on both the treatment and the outcome. To this end, we have implemented the IPWRA estimator that weights units by the inverse of their conditional vaccination propensity given a set of sociodemographic and personal characteristics including concern about the disease.

Our estimates indicate that vaccination increases the propensity to take holiday trip during the summer period by 8.3 percentage points among the general population and 11.3 percentage points among the vaccinated subsample, everything else being equal. Our results thus indicate that COVID-19 vaccine is an effective mechanism to counterbalance the deterrent effects of travel risks. These effects, although modest, prove to be economically meaningful for the restart of the sector; vaccines have a *propelling effect*. The paper thus corroborates the held assumption in the literature that the successful implementation of protective antibodies is crucial for the tourism industry to bounce back (Hall et al., 2020; Read, 2021; Helble et al., 2021). It is not only that mass vaccination reduce mortality rates and the virus spread at the aggregate level; at the individual level, vaccines enhance people's sense of protection, increasing their willingness to travel.

As long as a larger share of the worldwide population becomes immunized and international travel restrictions are lifted, it is highly likely that we assist to an acceleration of travel desire and a boost in tourism demand. Some studies point to a surge in travel demand (*compensatory travel*) motivated by the need to compensate for hardship, stress and deficiency caused by COVID-19 (Kim et al., 2021c). Indeed, Boto-García and Leoni (2021) show that the willingness to travel is higher among those who have been more exposed to the disease. Importantly, for such latent travel desire to materialize into actual travelling, tourists must feel secure (Zheng et al., 2021). As illustrated in this study, vaccinated people exhibit a greater willingness to travel than their non-vaccinated peers, and this result is explained by a greater sense of protection that lowers threat severity and susceptibility to contracting the disease. All in all, our findings support the view that increasing COVID-19 vaccination rates is an effective policy to counterbalance the travel fears and anxieties produced by the pandemic disease.

6.2.Contribution

The paper contributes to the tourism literature by being among the first empirical studies about the impact of COVID-19 vaccine on travel propensity. To the best of our knowledge, Gursoy et al. (2021) and Ram et al. (2021) are the only works that have analysed the way vaccines affect tourism participation. We expand existing evidence in different ways. First, we use data from a representative sample exploiting information about respondents' vaccination status rather than their intentions to do so (Gursoy et al., 2021). In this respect, Williams et al. (2021) call for the need to work with representative data to get reliable inference when studying the linkages between vaccination and tourism. Second, both Ram et al. (2021) and Gursoy et al. (2021) conduct correlational analyses that cannot be given a causal interpretation because of shared confounding factors affecting vaccination and travel propensity. Building upon their works, our study implements a sound econometric analysis that deals with compositional bias and the moderating effect of personal characteristics, thereby providing cleaner evidence on how COVID-19 vaccine affects consumers' travel propensity. In this respect, our methodology reverts the negative association between vaccination and travel propensity documented in descriptive statistics. Therefore, descriptive analyses like t-test comparisons that ignore compositional bias can provide misleading implications. The IPWRA estimator implemented in the paper constitutes a valuable methodology for incoming studies that aim to draw causal inference and work with non-experimental data.

6.3.Implications

The study has important implications for the tourism industry. Getting a large share of the population vaccinated is key to speed up the recovery of the tourism sector because it reduces the virus spread and therefore the corresponding social distancing measures needed. From this viewpoint, vaccination *mitigates* the negative effects of COVID-19 and is a necessary condition for the so-called 'new-normal'. We show destination managers and public authorities that encouraging prospective travellers to take the vaccine does not only mitigate propagation, but it also boosts tourism participation. Our findings thus reveal that COVID-19 vaccine has a *propelling effect*. Within the current debate regarding the mechanisms and incentives to increase the share of vaccinated people, there is some agreement that the need to have a health passport to enter some countries (Pavli and Maltezou, 2021) or gain-framing messages (Gursoy et al., 2022) are useful ways to nudge hesitants to get vaccinated. Given the documented benefits of mass vaccination for enhancing tourism participation, greater efforts must be done by public authorities to increase first shots among hesitants and to administrate booster doses to vulnerable individuals.

Vaccination seems to be particularly relevant for the elderly segment, who generally perceive the risks of COVID-19 to be higher (Pappas, 2021) and who exhibit a lower willingness to travel as a result (Das and Tiwari, 2021). This segment has been traditionally very important for the tourism industry in Spain (Alén et al., 2014; Losada et al., 2016) because social tourism programs oriented to seniors like IMSERSO alleviate the high seasonality of tourism receipts (Cisneros-Martínez et al., 2017), allowing some regions to keep tourism-related sectors open during the low season. Due to COVID-19, IMSERSO program has been temporarily cancelled, but it will be relaunched in the 2021-2022 season. According to our findings, vaccinated seniors are predicted to be relatively more willing to travel as compared to their non-vaccinated peers through lower risk perception, which would translate into positive economic impacts on tourism enterprises and local economies.

6.4.Limitations and avenues for future research

Our work is not without limitations. The data used is representative of Spanish citizens. Given the large heterogeneity in travel intention and share of vaccinated people across cultures and countries, future studies should expand our work using cross-country datasets. Additionally, our analysis focuses on the linkages between vaccination and travel propensity but does not pay attention to whether immunization also affects other travel-related decisions like the mode of transport, the length of the stay or the choice of accommodation. Deepening into whether vaccination alters travel behaviour and how this varies across tourist profiles could be a promising avenue for incoming research.

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