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Travel Restrictions and Tourism in Switzerland during the COVID-19 Pandemic

Kenza Benhima and Aurore Billon

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UNIL | Université de Lausanne
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HEC Lausanne
CREA Swiss Institute of Applied Economics
Bâtiment Internef | CH-1015 Lausanne
Phone +41 21 692 33 53 | crea@unil.ch
www.unil.ch/crea

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Abstract

We construct two indices of bilateral travel restrictions for Switzerland vis-à-vis 10 foreign countries during the COVID-19 crisis: an index of inbound restrictions (reflecting restrictions imposed by Switzerland on travellers from each of the 10 foreign countries) and an index of outbound restrictions (reflecting restrictions imposed by each of the 10 foreign countries on travellers coming from Switzerland). We examine how these indices affected expenses by foreign residents in Switzerland. We find that travel restrictions substantially affected foreign expenses in Switzerland. Both inbound and outbound mattered, but especially inbound measures , which had a stronger and more lasting effect. Other important insights are the following. First, the impact of measures are non-linear. Namely, inbound (outbound) measures have a negligible effect when strong outbound (inbound) measures are already in place, like a quarantine or a total ban, but have a strong effect when outbound (inbound) measures are absent or mild, like when only tests are imposed. Second, a quarantine is about as costly as a total ban in terms of foreign consumption (inbound or outbound). Third, expenses from neighboring countries (Italy, France, Germany) were less affected than expenses from remote countries (like the US or the UK). Finally, other factors that affected negatively foreign expenses are the severity of the COVID crisis in the foreign country, the stringency of lockdown measures in Switzerland, and the relative number of COVID cases in Switzerland.

Keywords: COVID-19, tourism, panel and time series analysis.
JEL codes: E65, F14, F43, Z38

*University of Lausanne and CEPR, email: kenza.benhima@unil.ch.
†University of Lausanne, email: aurore.billon@unil.ch.

Executive summary

To limit the spread of COVID-19, one of the first decisions governments made was to impose conditions on or completely restrict entry into their territory to travelers from abroad. In this work, we try to assess the impact of these restrictions on international tourism in Switzerland. To measure international tourism in Switzerland, we used data that identifies card payment transactions for 10 foreign countries. Regarding entry restrictions, we collected information regarding restrictions that Switzerland imposed on travellers from abroad and restrictions that were imposed on travelers from Switzerland who wanted to enter a foreign country. We used this information to build a chronology of the measures that were imposed by Switzerland on 10 foreign countries, but also the measures that these 10 countries imposed on Switzerland. We then constructed an index of inbound restrictions and an index of outbound restrictions for each of these 10 countries. We also collected other relevant data that affect the capacity or ability to travel to Switzerland (number of COVID cases, mobility index, lockdown measures, etc.). We then used different techniques (panel data analysis, time series analysis) to estimate the effects of both travel restrictions indices on tourism.

Our results show that travel restrictions substantially affected foreign expenses in Switzerland. Both inbound and outbound mattered, but especially inbound measures (i.e. measured imposed by Switzerland on travellers from abroad coming to Switzerland), which had a stronger and more lasting effect. Other important insights are the following. First, the impact of measures are non-linear. Namely, inbound (respectively outbound) measures have a negligible effect when strong outbound (respectively inbound) measures are already in place, like a quarantine or a total ban. On the opposite, inbound (respectively outbound) measures have a strong effect when outbound (respectively inbound) measures are absent or mild, like when only tests are imposed. Second, a quarantine (inbound or outbound) is about as costly as a total ban (inbound or outbound) in terms of foreign consumption. Finally, expenses from neighboring countries (Italy, France, Germany) were less affected than expenses from remote countries (like the US or the UK).

Our time series analysis provides additional policy-relevant insights. First, the severity of the COVID crisis in foreign countries affected negatively foreign spending in Switzerland. The negative effects of the pandemics in a given country thus spills over other countries through tourism. Second, the overall stringency of Swiss measures (that aggregates measures like closing restaurants, limiting public gatherings, etc.) had a negative impact on foreign consumption. Finally, the relative number of COVID cases in Switzerland had also a negative effect on foreign spending. The relative spread of the virus in Switzerland has thus a deterring effect on tourism. This suggests that authorities face a trade-off: controlling the spread of the virus through travel restrictions measures affects tourism negatively, but, on the other hand, limiting the number of cases benefits tourism. One important avenue for future research would be to identify the effects of travel restrictions on cases. Indeed, one key part of the equation that policy-makers need to solve is whether (and under what conditions) travel restrictions help control the pandemics.

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1 Introduction

Like many others, the tourism sector has particularly suffered from the ongoing COVID-19 crisis. During the first quarter of 2020 and the emergence of the first COVID-19 cases, countries gradually closed their borders. Even though national tourism was still possible for some time, establishments such as hotels and restaurants were forced to finally close their doors in many countries, due to governments' policies to fight the spread of COVID-19. At the end of the coronavirus' first wave of infections, European Governments decided to reopen their borders but established risky area lists to restrict entry to their territory for persons coming from a country or an area where the number of COVID-19 confirmed cases was higher than a certain threshold. Airline companies, hotels and other travel-related professions were financially harmed by these restrictions.

In Switzerland, the tourism sector suffered from the situation. Figure 1 displays the percentage change in the number of overnight stays recorded by 100 cities in Switzerland from 2013 to 2020 for 11 countries where the reference year is 2019.[1] The panel shows a sharp decline in the number of overnight stays in 2020.

Based on this observation, this project aims at studying the decline in tourism as illustrated by the decline of overnight stays in Switzerland for the 10 foreign countries in Figure 1, and, more precisely, to determine the extent to which this decline can be imputed to international travel restrictions imposed by governments.

Even though the COVID-19 crisis is still ongoing and emerged only one year and a half ago, economic research on this topic is rapidly expanding. Nevertheless, the topic of the effects of this crisis on the tourism sector is lacking. Through this work, we tried to contribute to fill this gap, by focusing on Switzerland.

Moreover, many researchers conducted their analysis about COVID-19 with the very useful Oxford COVID-19 Government Response Tracker [2] index. Travel restriction indicators are included in the index, but these indicators are aggregated at the country level. Namely, they summarize restrictions imposed by the country on multiple countries. To perform the analysis, we have constructed two bilateral daily indices regarding travel restrictions in Switzerland during the COVID-19 crisis. The first index represents the international travel restrictions imposed *by* Switzerland to travelers coming from 10 foreign countries ("inbound" restrictions), and the second one represents the travel restrictions imposed by the 10 foreign countries *to* travelers coming from Switzerland ("outbound" restrictions). We study the impact of these inbound and outbound restrictions on foreigners' expenses in Switzerland.

To perform this analysis, we used daily data on the consumption of foreigners in Switzerland from the Monitoring Consumption Switzerland project. These data record all

[1] Data provided by the Federal Office of Statistics, downloadable at: https://www.bfs.admin.ch/bfs/fr/home/statistiques/tourisme.html

This Figure illustrates the context of the health crisis. These data are only available on an annual basis and therefore cannot be used in the analyzes that will follow.

[2] https://www.bsg.ox.ac.uk/research/research-projects/COVID-19-government-response-tracker

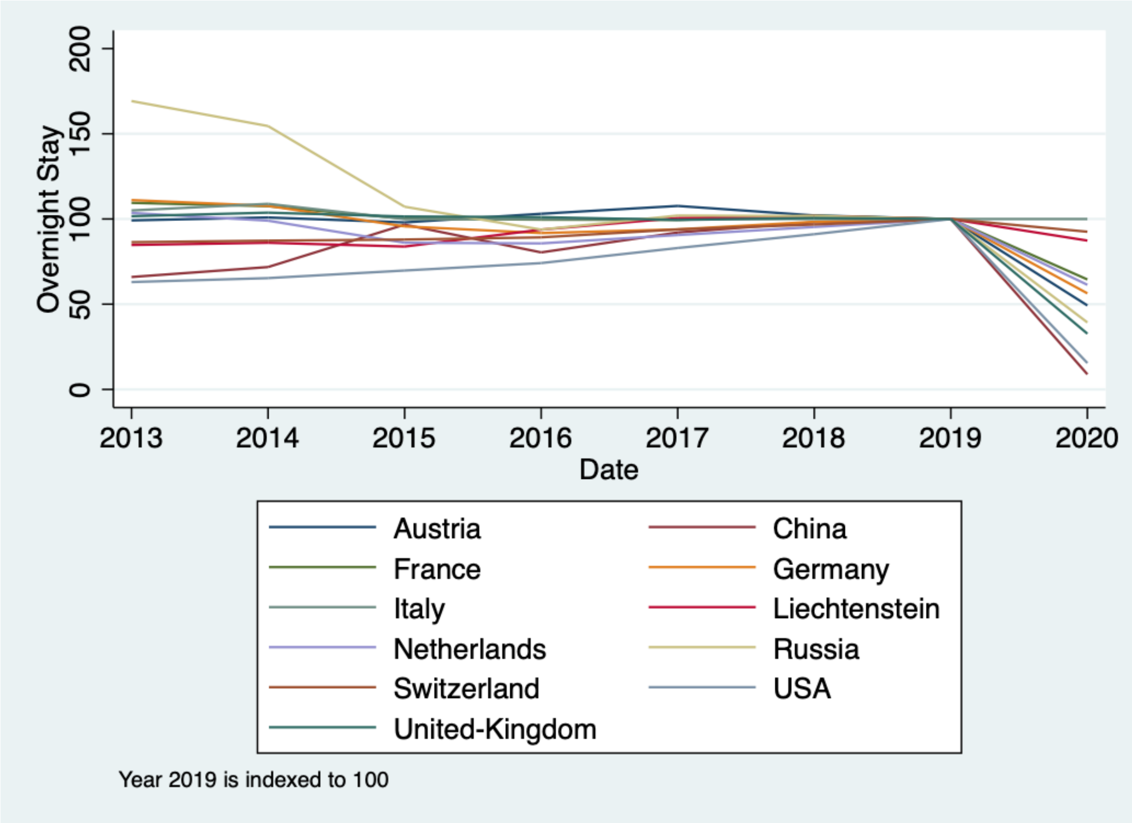

Figure 1: Change in the number of overnight stay compared to 2019
Source: Federal Statistical Office, authors' calculations

daily transactions made through debit and credit cards in Switzerland by cardholders from 10 foreign countries. We obtain a daily panel of these 10 countries between January 2019 and March 2021. Because we cannot distinguish point-of-sale transactions from online transactions on a country-by-country basis, we first perform a time series analysis with local projections [18] using point-of-sale transactions of all foreign credit card holders. We then perform simple fixed-effect regressions, as well as local projections [18], using our panel. While the time series is more representative of the quantitative effect of travel restrictions on spending by foreigners on Swiss soil, the panel data allows to control for unobservable country- and time-dependent variables through fixed effects. The latter control for all the global and Swiss-specific developments of the COVID-19 crisis. We are thus able to identify the effect of travel restrictions through country-specific changes in the measures.

Our results show that travel restrictions substantially affected foreign expenses in Switzerland. Both inbound and outbound mattered, but especially inbound measures (i.e. measured imposed by Switzerland on travellers from abroad coming to Switzerland), which had a stronger and more lasting effect. Other important insights are the following. First, the impact of measures are non-linear. Namely, inbound (respectively outbound) measures have a negligible effect when strong outbound (respectively inbound) measures are already in place, like a quarantine or a total ban. On the opposite, inbound (respectively outbound) measures have a strong effect when outbound (respectively inbound) measures are absent or mild, like when only tests are imposed. Second, a quarantine (inbound or outbound) is about as costly as a total ban (inbound or outbound) in terms of foreign consumption. Finally, expenses from neighboring countries (Italy, France, Germany) were less affected than expenses from remote countries (like the US or the UK).

Our time series analysis provides additional policy-relevant insights. First, the severity of the COVID crisis in foreign countries affected negatively foreign spending in Switzerland. The negative effects of the pandemics in a given country thus spills over to other countries through tourism. Second, the overall stringency of Swiss measures (that aggregates measures like closing restaurants, limiting public gatherings, etc.) had a negative impact on foreign consumption. Finally, the relative number of COVID cases in Switzerland had also a negative effect on foreign spending. The relative spread of the virus in Switzerland has thus a deterring effect on tourism. This suggests that authorities face a trade-off: controlling the spread of the virus through travel restrictions measures affects tourism negatively, but, on the other hand, limiting the number of cases benefits tourism. One important avenue for future research would be to identify the effects of travel restrictions on cases. Indeed, one key part of the equation that policy-makers need to solve is whether (and under what conditions) travel restrictions help control the pandemics.

The evaluation of policy measures during the COVID-19 crisis is an active area of research. Chernozhukov et al. (2021) [6] assess the effects of different policies adopted by the United States on the growth rate of COVID-19 cases or deaths using a SIRD (Susceptible, Infected, Recovered, Deceased) epidemiological model. They highlight the importance of measures such as face masks to fight COVID-19. Moreover, due to the dynamic structure of their model, they were able to show that the US population self-adjusted its behaviour by reducing its mobility in high-affluence places when receiving information about the number of confirmed case and death due to COVID-19 in the media. Other papers focus on the impact of policy measures on the economy. Caselli et al. (2020a) [4] show, using a sample of 128 countries, that the economic crisis resulting from the COVID-19 pandemic was not only generated by lockdowns, but also by the self-adjustment behaviour of the population that voluntary applied social distance.[3]

Our study is close to these contributions but focuses on a specific type of measures (travel restrictions) and on a specific part of the economy (tourism). Our results can be read in two ways. On the one hand, they show that ravel restrictions have a clearly negative effect on the economy through the tourism sector. On the other, they imply that these measures were effective in restricting cross-border mobility. One open question that remains is whether restricting cross-mobility is an important dimension in the fight against the spread of the virus. Notably, Russell et al. (2021) [20] show, using a model, that international travel restrictions might have little impact on pandemics except in countries

[3]See also IMF (2020) [10], Deb et al. (2020) [8], Demirgüç-Kunt et al. (2021) [9] and Dave et al. (2021) [7], among others.

with low Covid-19 incidence and large numbers of arrivals from abroad. However, empirical evidence on that issue is mixed (see [3] for a survey of the literature).

The paper is organized as follows. Section 2 discusses the data. Section 3 describes the empirical strategy and presents the results. Finally, Section 4 concludes.

2 Data

To conduct this research, two variables are key: a daily measure of international tourism in Switzerland and a daily measure of travel restrictions during the COVID-19 crisis. For the former, we use the consumption of non-Swiss residents in Switzerland. For the latter, we use hand-collected data of inbound and outbound travel restrictions. We complement these variables with various controls. All in all, the daily panel that we construct is balanced and covers 10 countries from 02 January 2019 to 13 March 2021.

2.1 Foreign consumption in Switzerland

Monitoring Consumption Switzerland is an initiative which aims at collecting transaction payment data in Switzerland. Relevant data for the empirical analysis are those about the origin of the cardholder. Those data can be downloaded at https://monitoringconsumption.com/acquiring-data-by-cardholder-origin/. *Monitoring Consumption Switzerland* provides the amount spent and the number of transactions made in Switzerland through card payments by origin of the cardholder on a daily frequency. The following cardhoder origins are available: Switzerland, Austria, China, Germany, France, United-Kingdom, Italy, Liechtenstein, the Netherlands, Russia, United-States of America and Other. We focus on transactions made by foreigners.

Some features of these data will impose limitations in the analysis. In particular, it is not possible to identify transactions made by credit card from a foreign country for purchases on the internet. To limit this problem, a robustness analysis will use another dataset provided by *Monitoring Consumption Switzerland* at https://monitoringconsumption.com/data/ [4] . This data identify the transactions that are made online and those that are carried out directly in a place of purchase in Switzerland. However, information regarding the origin of cardholder is not available with this dataset. This second part of the analysis of foreign consumption in Switzerland will therefore concern data in the form of a time series.

These data may be subjects to seasonality, especially in the context of tourism. We have therefore computed and used the growth rate of consumption on an annual basis, where the baseline is 2019, so that it is equal to:

$$\frac{Consumption_{it} - Consumption_{i,t-364}}{Consumption_{i,t-364}} \tag{1}$$

The year-on-year growth rate of consumption is delayed by one day (i.e. we used 364 days instead of 365) so that each observation in the period of interest is adjusted by

[4] Select the data set called *ACQ_Transaction_Type.csv*

an observation of the same day of the week from the previous year. We adjusted this computation for observations since March 2020 as of February 2020 account for 29 days. Hence, after this date, the year-on-year is computed using the observation 365 days before.

The resulting values for each foreign country i is shown in Figure 16 in the Appendix. Since consumption data are also subject to high disturbance, we applied the `hprescott` Stata command to smooth it. The computed smoothed growth rate of consumption is displayed in Figure 2. This command aimed to implement the smoothing method developed by Robert J. Hodrick and Edward C. Prescott [17] for business cycles and is recommended for models identifying tourism (Baggio, R., and al., 2011) [1].

Figure 2: Smoothed Growth Rate of Foreign Consumption in Switzerland
Source: Monitoring Consumption Switzerland, author's calculations.

Among our sample of bank card consumption data, transactions made by foreign cardholders represent 13.8% of all transactions in 2019. These foreign electronic transactions account for 1.8% of Swiss final consumption in 2019 [5]. These ratios show the importance of foreign consumption in Switzerland and therefore potentially the large impact of international tourism on the Swiss economy.

[5]Final Consumption source: https://www.bfs.admin.ch/bfs/fr/home/statistiques/themes-transversaux/mesure-bien-etre/indicateurs/consommation-epargne.html

2.2 Travel Restrictions Indices

The *Oxford COVID-19 Government Response Tracker* data, used in many papers regarding COVID-19, provide an indicator of international travel restrictions taken by Governments. However, this indicator is aggregated and does not allow to identify against which countries Switzerland imposed restrictions and symmetrically, in which foreign countries Swiss residents face measures.

We have thus constructed 2 indices for the 10 foreign countries for which data are available in the *Monitoring Consumption Switzerland*. The first one concerns travel restrictions imposed by other countries to Switzerland (Outbound travel restrictions) and the second one travel restrictions imposed by Switzerland to other countries (Inbound travel restrictions). To do so we used the website *Internet Archive* available at https://archive.org that allows access to the past version of internet sites. Indeed, while searching for chronological entry restrictions, one obstacle was that official governments' websites do not necessarily keep archives about what has been announced a few months earlier. However, *Internet Archive* does not identify all internet sites at each update but captures screenshots depending on the affluence on the website. As a consequence, some sites do not have many archives available. Thus, other online sources were necessary. Appendix A lists all the websites consulted to construct Travel Restrictions Indices.

Moreover, accurate information for some countries such as China and Russia was not easy to find, and some entry restrictions were not completely clear. This may create a bias in the results of this analysis. This difficulty in finding and understanding restrictions concerning travel highlights the importance of communication by Governments during such a crisis.

2.2.1 Outbound travel restrictions

To construct the index of travel restrictions imposed by other countries to Switzerland, we have looked for information about entry restriction on the territory for each of the 10 countries identified by the payment transaction data in chronological order since the beginning of the COVID-19 pandemic.

The index of entry restrictions imposed for persons travelling from Switzerland to a foreign country, which we call $Travel^{CH}$, is coded in the following way:

- 0: No measure
- 1: Weak formalities (Self-declaration form, register before arrival, ...)
- 2: Quarantine for some regions of Switzerland
- 3: Negative COVID test or quarantine (for entire Switzerland)
- 4: Strict quarantine (even with a negative test, for all regions in Switzerland)
- 5: Complete ban of entry for individuals coming from Switzerland (tourism impossible)

Table 5 in Appendix A.1 presents the measures imposed by foreign countries on travelers coming fro Switzerland and the resulting index from January 1, 2020 to March 13, 2021.

2.2.2 Inbound travel restrictions

The second index about travel restrictions, $Travel^{For}$, concerns conditions imposed by the Swiss Federal Government to foreign residents wanting to enter Switzerland since January 1, 2020 to March 13, 2021. Most information about the Swiss list of risky countries and areas can be found on the different *COVID-19 Ordinances* [15].

The index of entry restrictions for persons coming to Switzerland from another country is coded in the same way as outbound restrictions.

Table 6 in Appendix A.3 presents the measures imposed by Switzerland on travelers coming from foreign countries and the resulting index from January 1, 2020 to March 13, 2021.

All countries on the Swiss list of risky countries or area face the same restrictions or conditions of entry. In other words, there is no special treatment for any country on the list. Nevertheless, restrictions for risky countries have changed over time, and the list of risky countries have also evolved. At first, the entry in Switzerland was refused to all individuals coming from a risky country or area. This condition applied during the period from 13.03.20 to 05.07.20. From 06.07.20 to 13.03.2021, individuals coming from a risky country or area had to self-quarantine for 10 days at their arrival in Switzerland.

Figure 3 displays inbound ($Travel^{For}$) and outbound ($Travel^{CH}$) travel restrictions indices over time and by countries.

This Figure shows the heterogeneity of measures across countries. In addition, and contrary to what one might think, the restrictions imposed by Switzerland on other countries, and vice versa, are not necessarily a reciprocal response but really seem to depend on criteria based on the spread of the virus. Indeed, apart from the restrictions imposed during the first wave of COVID-19 during which almost all countries imposed very strong measures at the same time, the measures imposed by and against Switzerland often seem to follow different trends during the last two quarters of 2020 and early 2021.

2.3 Controls

2.3.1 Health

The Federal Office of Public Health collects and provides daily data about health variables related to the COVID-19 situation. A particularly useful variable for this research is the number of daily confirmed cases of COVID-19 in Switzerland and also in foreign countries. The FOPH data related to COVID-19 is available and can be downloaded at https://www.covid19.admin.ch/fr/overview.

Figure 17 in the Appendix shows the new confirmed cases of COVID-19 per million inhabitants over time. The left-hand side panel displays numbers for Switzerland while

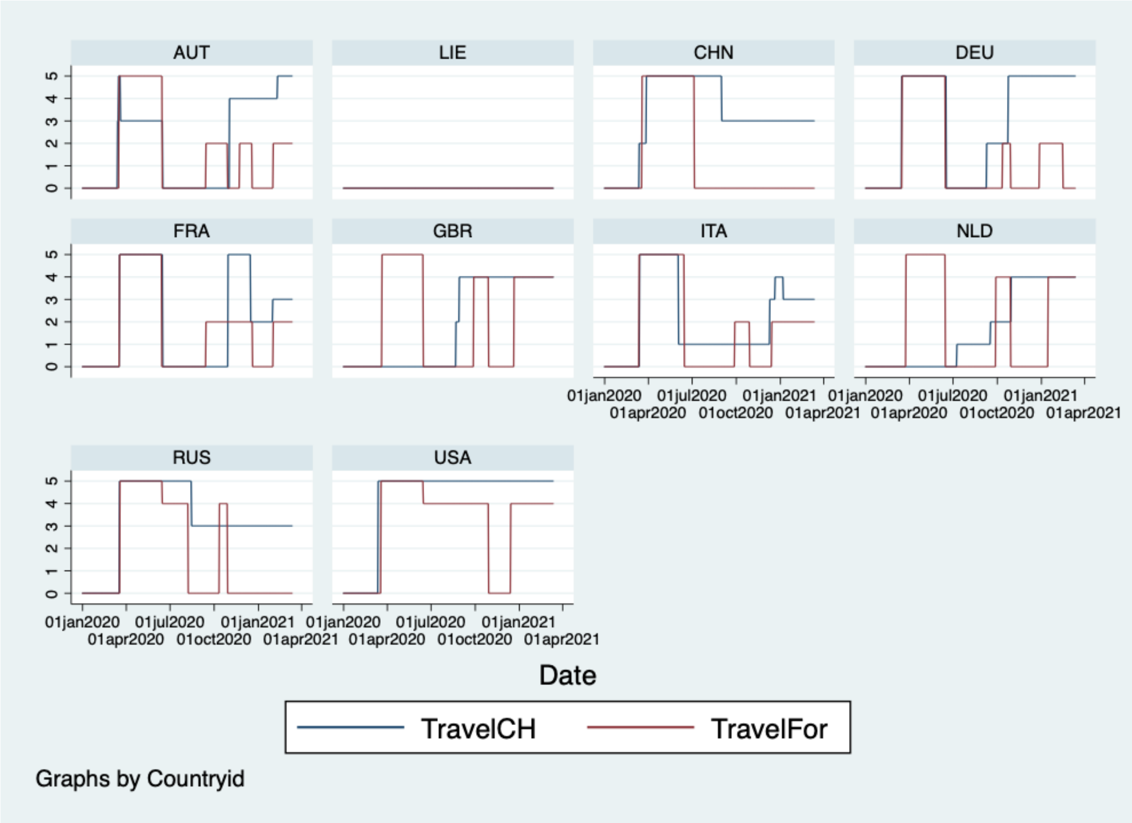

Figure 3: Travel Restrictions Indices
Source: Authors' calculations.

the right-hand side displays numbers for the 10 foreign countries that are identified by the *Monitoring Consumption* dataset.

Some issues appear in this figure. First, the FOPH data about foreign cases contain negative values. The date and countries for which such negative measures are reported are listed in Table 7 in Appendix B. Since no detailed explanations are provided by the FOPH regarding this inconsistency and that it mostly concerns France, we made the assumptions that those negative values could be corrections for past misreported measures.

The second issue of those data is that confirmed cases are subject to daily disturbance. To correct for this high volatility, we used a smoothed value of $Cases_{it}$ by applying the `hprescott` [2] command in Stata.

Note that, to interpret properly the results of the analysis, we have constructed a variable that reports the log-difference between the number of cases per million inhabitants in Switzerland and the number of cases per million inhabitants in foreign countries:

$$log(Relative\_Cases)_{it} = \log(CasesPerInhabitant_t^{CH} + 1) - \log(CasesPerInhabitant_{it}^{FOR} + 1)$$

where

$$CasesPerInhabitant_{it}^{FOR} = \frac{Cases_{it}^{FOR}}{Population_t^{FOR}},$$

$$CasesPerInhabitant_t^{CH} = \frac{Cases_t^{CH}}{Population_t^{CH}},$$

with CH indicating Switzerland's data and FOR foreign countries' one.

Hence, if this variable is negative, then there are relatively more cases in foreign country i than in Switzerland. On the opposite, if it is positive, there are relatively more COVID-19 cases in Switzerland than in foreign country i. Figure 4 represents this variable for our sample.

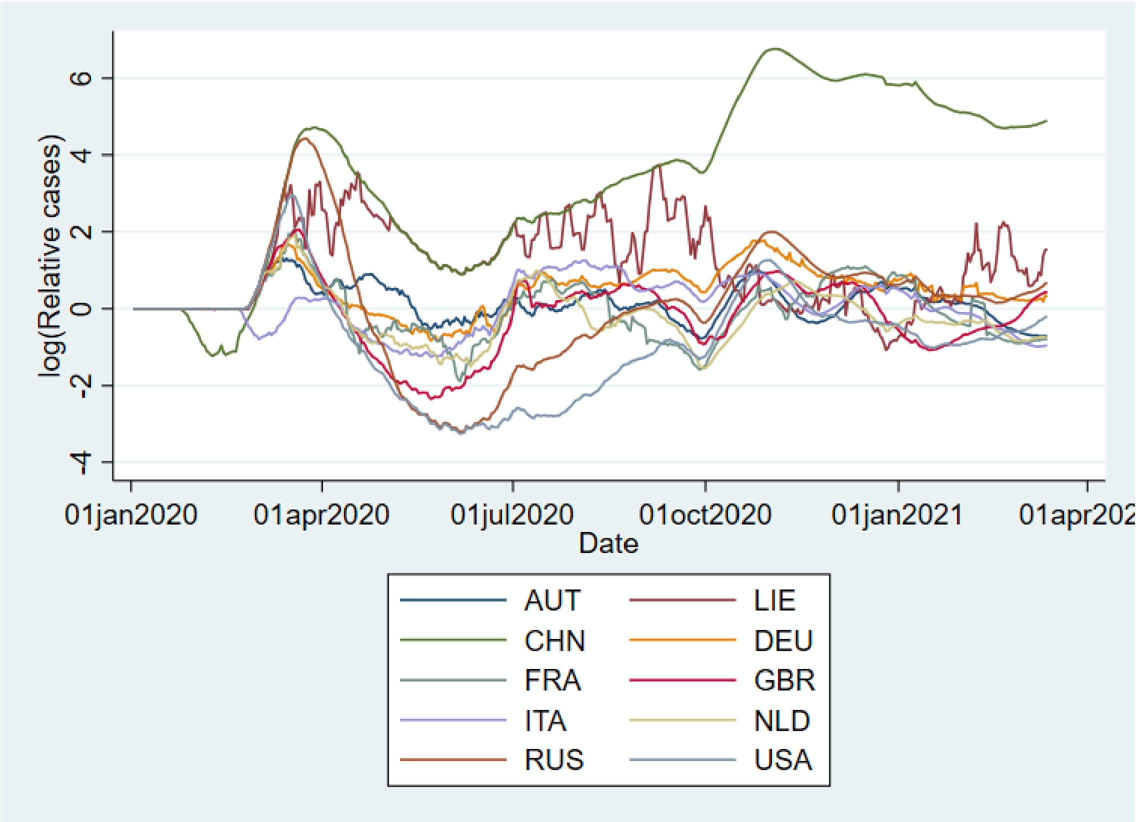

Figure 4: Smoothed Swiss cases relative to foreign cases
Source: Federal Office of Public Health and authors' calculations.

Including the relative cases as an independent variable makes it possible to control for the spread of the virus in Switzerland in comparison with the spread abroad. Our hypothesis is that individuals coming from countries with a more sensitive epidemiological situation will be less reluctant to go on vacation to a country where there are fewer cases per inhabitant (Cevik, S. , 2021) [5] . On the other hand, and symmetrically, tourists will have fewer incentives to go on a trip to Switzerland if there are more cases than in their country of residence because this would increase their chance of being contaminated by COVID-19.

2.3.2 Economic activity

Individuals from countries with a better economic situation may be more likely to have resources to go on holidays abroad (Eugenio-Martin, J. L., al., 2014) [12]. The empirical analysis thus controls for economic activity by using the daily Google mobility index, which is now commonly used as a high-frequency proxy for economic activity. Indeed, since mid-February 2020 Google published reports [6] about mobility initially collected by Google Maps for example. Those data are anonymized and aggregated. They are constituted of the percentage change from the baseline mobility in Retail and Recreation places, Grocery and Pharmacy, Parks, Transit stations, Workplaces and Residential places. We take the first principal component of these indices as our Google mobility index. This variable may also reflect the population's self-adjustment behaviour due to the risk of contamination and the policies adopted by the government to restrict the general mobility of the population.

Since Google's data starts on February 15, 2020, we have assumed that missing values before this date corresponds to zero percentage change from the baseline mobility. Figure 5 shows the evolution of the estimated first component of Google Mobility Index over time. The graph shows a large drop in mobility during the first wave of COVID-19 for all countries. This decrease seems to be correcting in mid-2020 but mobility is still declining at the end of 2020 - beginning of 2021 for many countries.

Unfortunately, we do not have Google Mobility data for Russia and China. Therefore, as an robustness, we use the growth rate of foreign GDP on a quarterly basis. This variable is more directly related to economic activity, but is available only at a quarterly frequency. The data about the quarterly growth rate of GDP [7] are provided by the OECD [19]. The OECD does not provide data for Liechtenstein. Given the structure and the governance of Liechtenstein, we assumed that its GDP's growth rate follows the same trend as the Swiss one. Moreover, at the time of doing the analysis, the data do not include the fourth quarter of 2020 for Russia and the first quarter of 2021 for all countries that are in the panel. Hence we used GDP's forecast computed by the IMF [8] to complete this missing quarter. The IMF's publication [13] indicates quarterly GDP for China, Advanced Economies and Developing Economies. Thus, we consider all countries in the sample as Advanced Economies except China which has its own individual forecast, and Russia, that is classified as a Developing Economy by the IMF [9].

[6] Google's mobility data can be downloaded directly at https://www.google.com/covid19/mobility/ and are also available through the website www.ourworldindata.org on the page https://ourworldindata.org/COVID-google-mobility-trends

[7] Those data can be downloaded at https://stats.oecd.org/index.aspx?queryid=350 OECD (2021), Quarterly GDP (indicator). doi: 10.1787/b86d1fc8-en (Accessed on 29 April 2021)

[8] The forecast is available at https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update

[9] https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/groups.htm#ae

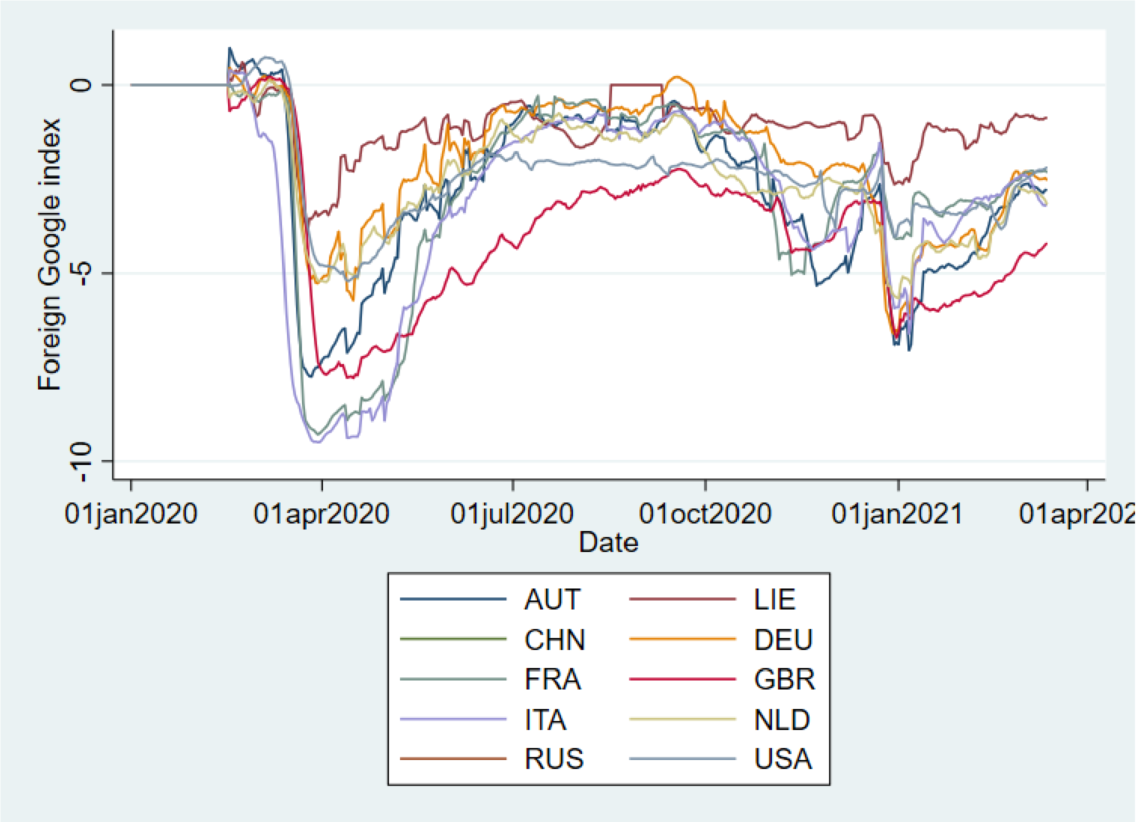

Figure 5: Google Mobility Index
Source: Google and authors' calculations.

2.3.3 Policies

To control for policies taken by governments, we use the Stringency index from the Oxford COVID-19 Government Response Tracker data. The Oxford COVID-19 Government Response Tracker is a research project created jointly by the Blavatnik School of Government and the University of Oxford. This project aims at collecting all national measures taken by countries to fight the spread of COVID-19 so that measures can be compared. Concretely, the OxCGRT regroups data about 20 indicators that represent measures or policies taken by governments around the world. Indicators are coded from 0, which represents no measures, to 5. Those indicators are used to create four indices: *government response index, containment and health index, economic support index, stringency index.*[10] The general index ranges from 0 to 100. In some version of the analysis presented below, the Oxford Stringency Index will be used as a variable to control for the tightening of the government's policies aimed at controling the spread of COVID-19.

Note that this index contains an indicator for international travel restrictions. However, this indicator is aggregated with a large number of other indicators and therefore represents only a very small percentage of the value of the stringency index. In the empirical analysis,

[10]The data are available at https://covidtracker.bsg.ox.ac.uk or at https://ourworldindata.org/grapher/COVID-stringency-index

this indicator should therefore not conflict with indices of travel restrictions presented in Subsection 2.2. We compute the relative stringency index as the difference between the Swiss index and country i's index:

$$Relative\_Stringency_{it} = Stringency_{CH,t} - Stringency_{i,t}$$

The relative stringency Index for panel's countries are displayed in Figure 6.

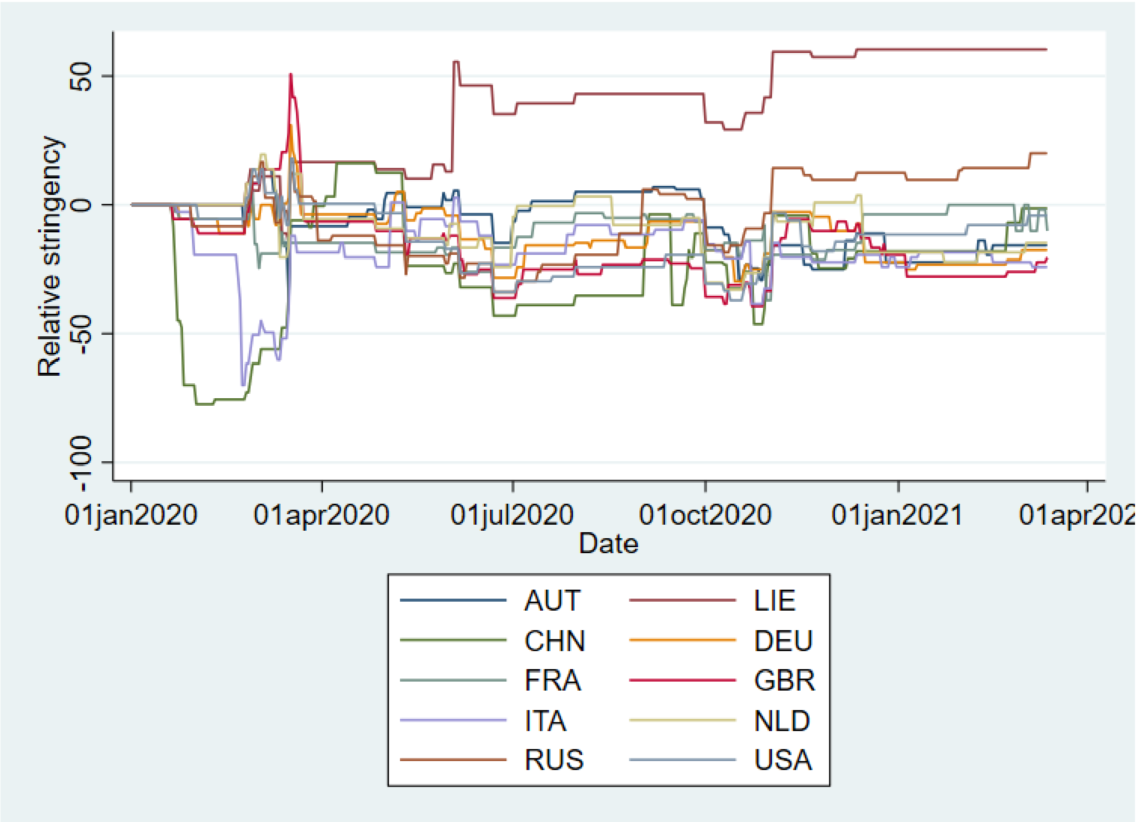

Figure 6: Relative stringency Index
Source: Oxford Covid-19 Government Response Tracker and authors' calculations.

2.3.4 Geography

To discuss the role of geography, we include in some regressions a dummy variable *Border* to assess whether a country shares a border with Switzerland or not. The dummy variable then takes the value 1 for France, Germany, Italy, Liechtenstein and Austria, and 0 for the other countries. The inclusion of the dummy variable *Border* relies on the assumption that tourists from Swiss' neighbouring countries may have a higher incentive to visit Switzerland than countries that are geographically further away (Durbarry, 2008) [11]. Hence neighbouring tourist' spending in Switzerland may be greater.

2.4 Descriptive Statistics

Table 2.4 displays some descriptive statistics about variables used in the panel data analysis. Especially, it shows that the mean yearly growth rate of foreign consumption in Switzerland is -32%.

The average level of the outbound index denoting travel restrictions imposed by foreign countries to Switzerland was 2.3. The inbound index's mean is 1.6, which reflects relatively milder measures imposed by Switzerland on our sample of countries.

The relative cases variable indicates that there were more cases on average in Switzerland than in the countries of the panel since its mean is 41%. This indicates that on average, the number of cases in Switzerland was 41% higher than the number of cases in foreign countries during the period covered by the sample. The *Border* variable's mean points out that 5 out of the 10 countries in the sample are neighbours to Switzerland.

The average of the Google Mobility Index is -2.43 and the average of the relative stringency Index which is around -8, which means that Switzerland imposed milder restrictions on average as compared to the countries in the sample.

Table 1: Desciptive Statistics

	N	Mean	St.Dev.	Min	Max
Cons.	4380	-.32	.48	-.93	2.29
TravelCH	4380	2.28	2.12	0	5
TravelFor	4380	1.58	2.09	0	5
log(Rel. cases)	4370	.41	1.58	-3.26	6.75
Border	4380	.50	.50	0	1
Google	3504	-2.43	2.12	-9.49	.97
Rel. string.	4380	-7.85	20.78	-77.31	60.19

Table 1 displays correlations. Few insights for analysis are that both travel restrictions imposed by foreign countries *against* Switzerland and travel restrictions imposed *by* Switzerland against foreign countries are negatively correlated with the growth rate of foreign consumption in Switzerland by respectively, and positively correlated with cases. Moreover, all other correlations have the expected signs. Especially, the growth rate of GDP is positively correlated with foreign consumption in Switzerland which is itself a proxy for tourism. A positive correlation between tourism and border is coherent with the hypothesis that neighbouring countries have more incentives to consume in Switzerland than those how are further away. Finally, consumption is positively correlated with relative cases.

Table 2: Correlations

	Cons.	TravelCH	TravelFor	log(rel. cases)	Border	Google	Rel. string.
Cons.	1						
TravelCH	-0.629***	1					
TravelFor	-0.656***	0.543***	1				
log(Rel. cases)	0.413***	-0.280***	-0.483***	1			
Border	0.390***	-0.168***	-0.248***	0.354***	1		
Google	0.629***	-0.573***	-0.641***	0.219***	0.119***	1	
Rel. string.	0.692***	-0.423***	-0.311***	0.394***	0.248***	0.334***	1

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3 The Effect of Travel Restrictions on Foreign Consumption

This section presents the empirical analysis. We first present evidence using a time series analysis on aggregate data. The advantage of aggregate data is that they enable us to identify spending by foreigners on Swiss soil (payments by credit or debit card in stores), while in the panel data we cannot distinguish spending by foreigners on Swiss soil from online spending. Only part of the latter can be related to touristic expenses (hotel costs for instance). While the time series analysis will enable us to assess the quantitative impact of travel restrictions on touristic spending more precisely, the panel data analysis will enable to explore their relative effects across several dimensions. Depending on the purpose and on the structure of the datasets, we will rely on local projection methods (Jordà, 2005) [18], and on static and dynamic panel regressions.

3.1 Time-Series analysis

The foreign consumption data used in the panel data analysis allow to identify the origin country of the cardholder but unfortunately does not permit to identify the payments made by credit or debit cards at a point of sale from payments made online. To go around this issue, we use another dataset provided by *Monitoring Consumption* where the payment method can be identified. This dataset contains daily observations of transactions made by foreigners and differentiates between payments done online and at a point of sale, but does not distinguish foreigners by country of origin. We are thus able to perform a time-series analysis on transactions made by foreign cardholders by credit or debit cards directly in

Swiss buying places. Note that, an important part of tourism expenses may not be taken into account here, namely accommodation spending.

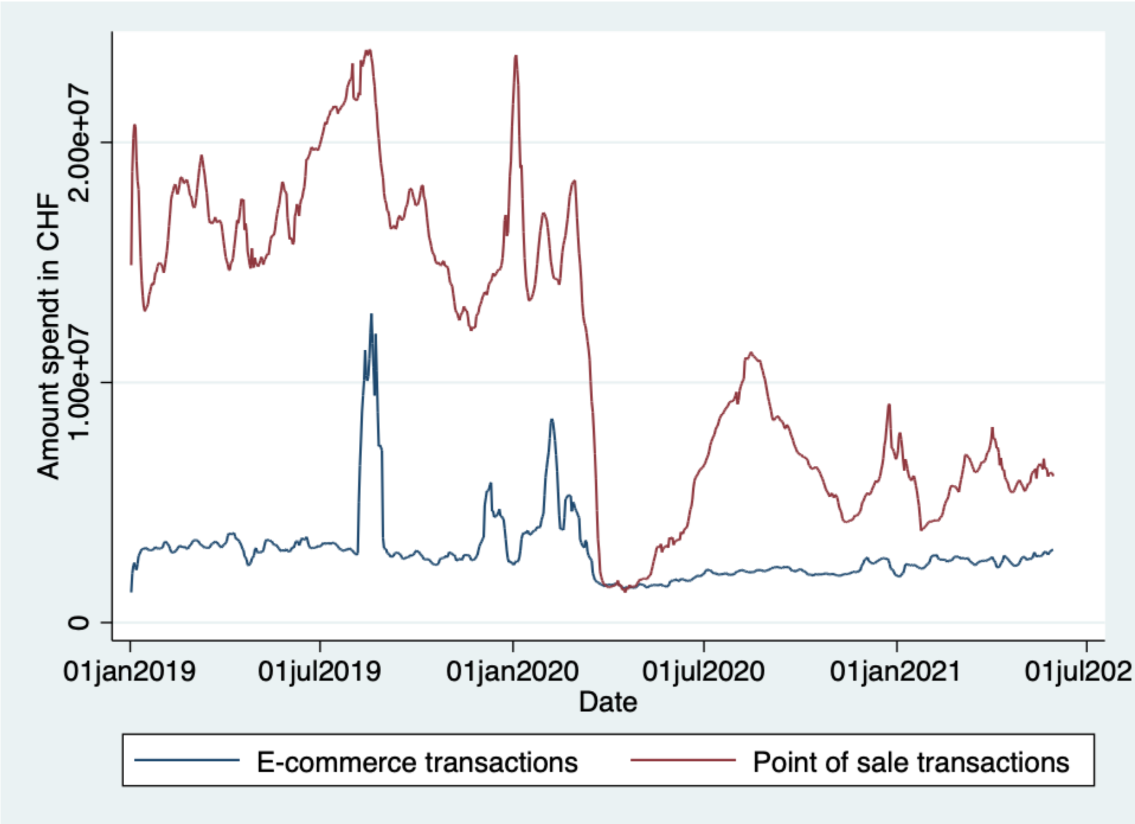

Figure 7: E-commerce and Point of sale Transactions
Source: Monitoring Consumption Switzerland.

Figure 7 shows the evolution of transactions amounts made by foreigners on e-commerce (blue line) and directly in points of sale in Switzerland (red line). The figure clearly displays a large drop in consumption in March 2020 during the first wave of COVID-19. Among transactions made by foreigners on e-commerce and in points of sale, the former represents a mean share of 16,75% in 2019 while the mean became 28,55% during the COVID-19 crisis covered by our sample. The share of transactions made by foreigners directly in points of sale represents on average 83,24% of transactions in 2019 and 71,44% during the crisis.

Importantly for the remainder of the analysis, point-of-sale transactions represent the bulk of credit-card transactions by foreigners. Besides, these transactions have dropped less during the COVID crisis than point-of-sale transactions. Estimating the effect of travel restrictions on total foreign credit-card transactions must therefore underestimate their effect on point-of-sale transactions.

Since those data do not identify the origin's country of cardholders, we use time-series data. We thus aggregate all other panel data variables by computing a weighted average where the weights of each country are their share of consumption of 2019 in the data used for the panel analysis. We also collapse $TravelFor$ and $TravelCH$ to a single travel restriction index in order to limit multicolinearity issues: $Travel_t = (TravelFor_t + TravelCH_t)/2$.

To analyse this time series, we computed impulse-response functions by using the Local Projection method as developed by Òscar Jordà (2005) [18]. The empirical specification of our local projections' regressions corresponds to

$$\begin{aligned}\log(Cons^{For}_{t+h}) - \log(Cons^{For}_{t-1}) = &\sum_{p=0}^{P} \beta^h_{1,p} Travel_{t-p} \\ &+ \sum_{p=0}^{P} \beta^h_{2,p} log(Relative\_Cases)_{t-p} + \sum_{p=0}^{P} \beta^h_{3,p} Relative\_Stringency_{t-p} \\ &+ \sum_{p=0}^{P} \beta^h_{4,p} Stringency^{CH}_{t-p} + \sum_{p=0}^{P} \beta^h_{5,p} Google_{t-p} + \sum_{p=1}^{P} \beta^h_{6,p} \log(Cons_{t-p}) \\ &+ \mathbb{1} DOW_t + \epsilon_{t+h}\end{aligned} \quad (2)$$

where $Cons$ is the aggregated foreign consumption through credit and debit card transactions at points of sale, DOW is a set of dummy variables to control for the day of the week, $log(Relative_Cases)$ is the aggregated relative cases, $Relative\_Stringency$ is the aggregated relative stringency, and $Google$ is the aggregated foreign Google index. We add $Stringency^{CH}$, the Oxford stringency index for Switzerland, in other to control for other Swiss measures.[11] We set $P = 7$. The specification follows the methodology presented by Caselli and al. (2020) [4]. The impulse-response functions of $Travel_t$ is computed using the estimated coefficients $\beta^h_{1,0}$ at different horizons. The confidence intervals are computed using newey-West standard errors.

The IRF of foreign consumption to $Travel$ is presented in Figure 8. It represents the cumulated change in foreign consumption in Switzerland of a one-notch increase in $Travel$, relative to its initial level. The grey shaded areas display 95% confidence intervals. A one-notch increase in the bilateral index of travel restrictions reduces tourism expenses in Switzerland by -40 percentage point after 10 days. This is an extremely large effect. Besides, this negative effect persists over time.

We can compare this effect to the effect of the control variables: relative COVID Cases, relative stringency index, absolute stringency and mobility index, all represented in Figure 9. Interestingly, the relative number of Swiss cases matters substancially to foreigners. The IRF in the top right panel suggests that a doubling of cases decreases spending by 60% at a 30-day horizon. Domestic economic activity also affects positively and significantly foreign spending. An independent decline in the index by 1 unit would lead to a 20% decline in foreign consumption after one week. This is quantitatively large, since the standard deviation of this index is 2. Finally, the stringency of domestic measures

[11] In another version of these regressions, we have added the Swiss Google index as well. However, the results were not affected.

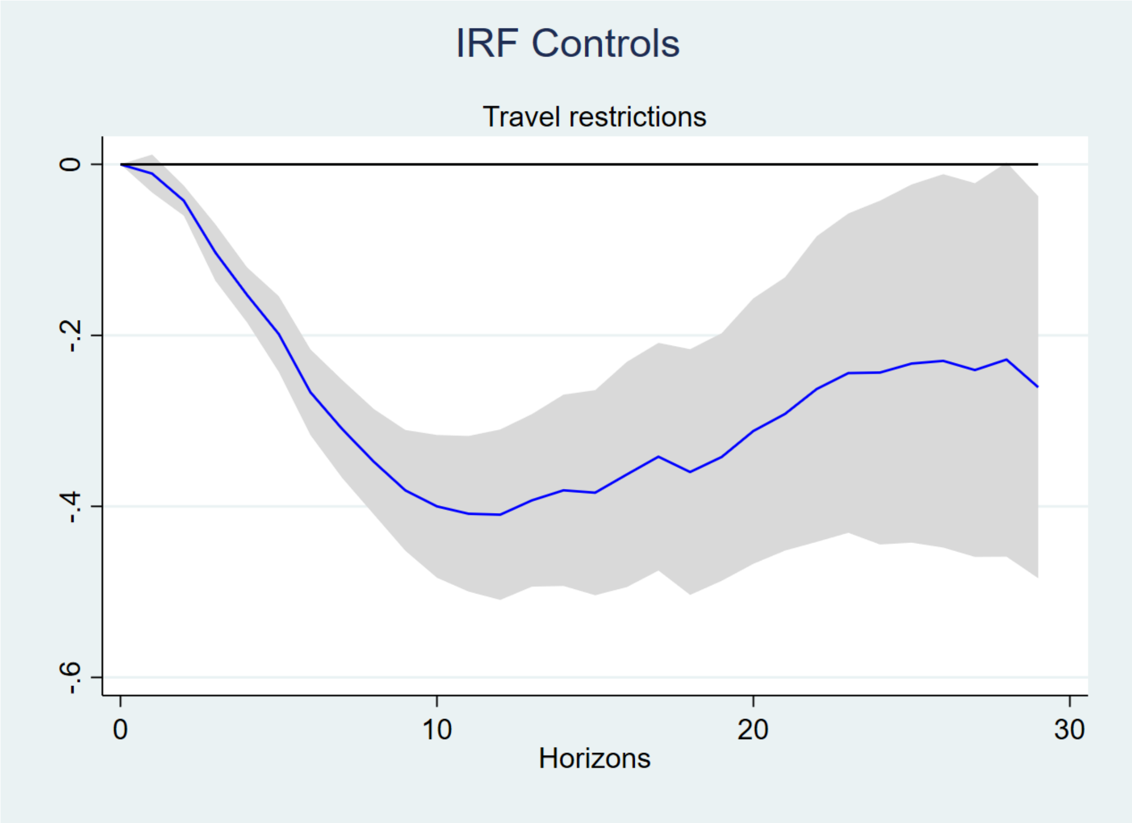

Figure 8: Time series: IRFs of foreign cons. to Travel restrictions
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on Newey-West standard errors.

has also a detrimental effect on foreign consumption on Swiss soil. An increase in the index by one notch leads to a -2% decline in foreign consumption after one week. After 30 days, the decline reaches almost -4%. This is also large given that the index goes from zero (no measure) to 100 (full lockdown). In contrast, the relative stringency has no significant effect.

3.2 Static panel data analysis

We now implement a fixed-effect panel data analysis by estimating the following baseline equation:

$$\frac{Cons_{i,t} - Cons_{i,t-364}}{Cons_{i,t-364}} = \alpha_i + \delta_t + \beta_1 Travel_{it}^{For} + \beta_2 Travel_{it}^{CH} + \beta_3 Google_{it} + \beta_4 log(Relative\_Cases_{it}) + u_{it} \tag{3}$$

where i represents the foreign country and t the date. α_i is the term for individual's fixed-effects and δ_t represents time fixed-effects. $Cons_{it}$ is the consumption of foreign cardholders in Switzerland; $Travel_t^{CH}$ are the travel restrictions imposed by country i against Switzerland (outbound restrictions); $Travel_{it}^{For}$ are the travel restrictions imposed

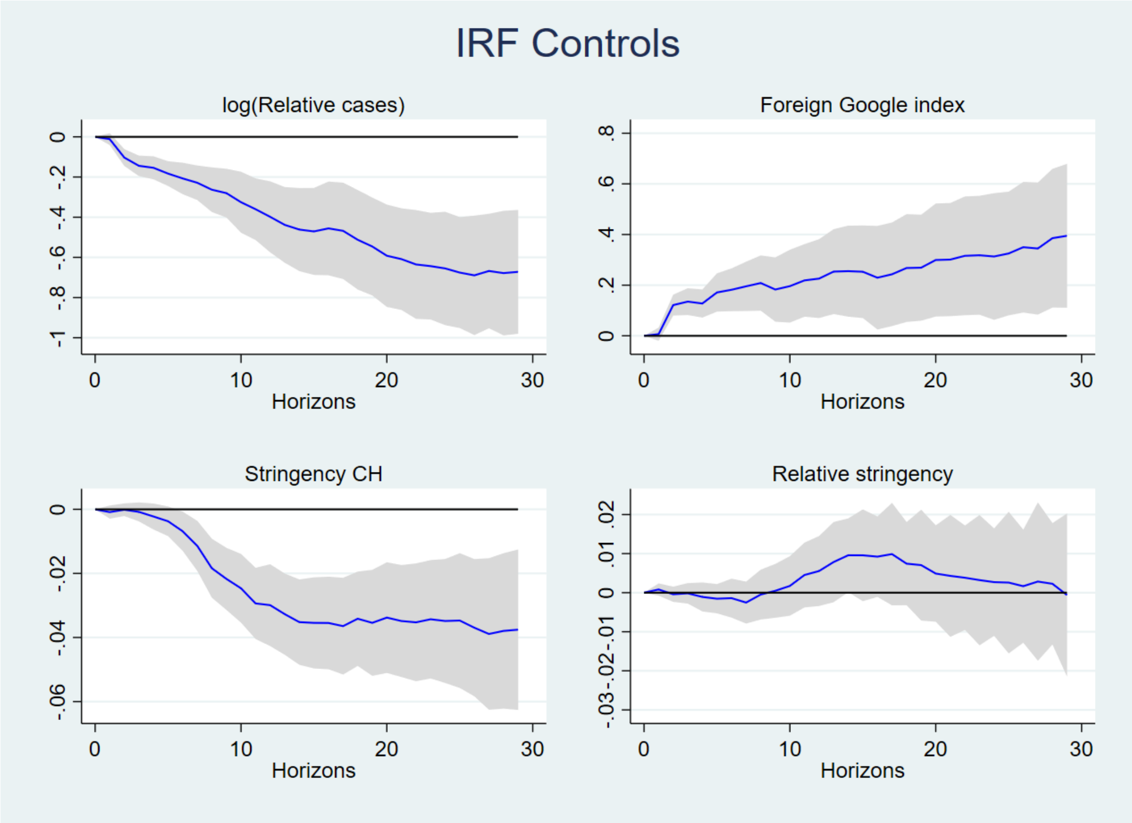

Figure 9: Time series: IRFs of foreign cons. to Controls
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on Newey-West standard errors.

by Switzerland against country i (inbound restrictions); $Google_{it}$ is the Google mobility index for country i and $Cases_{it}$ is the log-difference between cases in Switzerland and cases in country i. We compute robust standard errors.

The panel data analysis provides more degrees of freedom and hence enables us to include our two travel restriction indices and to use a richer set of foreign variables. We can also introduce country fixed effects and time fixed effects that control for time- and country-invariant factors.

Table 3: Panel: Fixed-effect regressions

	Cons	Cons	Cons	Cons	Cons
TravelFor	-0.0580***	-0.0479***	-0.0561***	-0.0567***	-0.0970***
	(-26.83)	(-11.72)	(-14.17)	(-13.02)	(-15.68)
TravelCH	-0.0335***	-0.0377***	-0.0203***	-0.0577***	-0.0861***
	(-17.40)	(-14.50)	(-9.70)	(-17.05)	(-17.32)
log(Rel. Cases)	-0.0202***	0.0272***	0.0174**	0.0169*	0.0310***

	(-3.57)	(3.60)	(2.66)	(2.21)	(4.24)
Google	0.0556***	0.0199***	-0.0107**	0.0295***	0.0138***
	(21.01)	(4.68)	(-2.82)	(6.70)	(3.29)
Rel. String.			0.00731***		
			(13.89)		
TravelFor×Border				0.0320***	
				(8.95)	
TravelCH×Border				0.0204***	
				(6.25)	
TravelFor×TravelCH					0.0178***
					(14.42)
Country FE	Yes	Yes	Yes	Yes	Yes
Date FE	No	Yes	Yes	Yes	Yes
DOW FE	Yes	No	No	No	No
N	3496	3496	3496	3496	3496
R^2	0.801	0.849	0.875	0.854	0.860
Adj. R^2	0.800	0.826	0.856	0.833	0.840

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The estimation results of Equation 3 are presented in Table 3.2. The first column presents results of the individual fixed-effects regression while the second one includes time fixed effects. Column (1) of Table 3.2 shows the results of the individual fixed-effect regression. This specification does not account for time fixed-effects (Date FE), which is the reason why we includes fixed effects for the days of the week, represented by DOW FE. It contains individual fixed-effects (Country FE). The estimates indicate that increasing the inbound travel restriction index by one notch reduces foreign consumption growth in Switzerland by -5.8 percentage points while increasing the outbound index leads to a decrease in foreign consumption of -3.3 percentage points. Both coefficients are significant. Column (2) includes time fixed-effects (Date FE). The coefficients of both travel restriction indices remain stable at -4.8 and -3.8 percentage points. Interestingly, the two coefficients are of the same order of magnitude, which means that travellers consider both inbound and outbound restrictions as important, but the coefficient of inbound restrictions is higher, which implies that travellers consider first the inbound restrictions when deciding to travel.

Note that the coefficients are smaller than the ones estimated in the time series analysis, where local foreign spending by credit/debit cards are better identified. This is because here the strong effect on local spending is diluted.

The second specification is the one that explains more of the variance in the dependent variable with an adjusted R^2 of $0,826$ against $0,80$ for the first column. Moreover, a test on the time fixed-effects parameter indicates that individuals time-fixed effects are not jointly equalled to zero. Therefore, the inclusion of time fixed-effect in the empirical specification is relevant.

We can also examine the effect of the control variables in this specification. The foreign Google index coefficient is equal to 2 percentage points, which confirms that the reduction in mobility, and more generally the slowdown in economic activity, contributes to the decline in foreign consumption. It is quantitatively large. An independent decline in the index by 4 units (which corresponds to the decline observed in Germany in the first quarter of 2020 for instance) would lead to a 8% decline in foreign consumption. The sign of the coefficient of relative cases is significantly positive. This is not the sign we expected. It is however small in magnitude, as it represents the effect of a doubling in Swiss cases relative to the foreign country. This positive sign could be explained by a tendency to switch to contactless payments as cases become relatively more frequent in Switzerland. It could also be due to an omitted variable bias. For instance, a more relaxed behavior (due to "COVID fatigue" for instance) leads to both an increase in cases and more travel. Finally, it could be that foreigners consider total cases in Switzerland as more relevant than relative cases. Here, the effect of total cases in Switzerland is absorbed by the time fixed effects. Consistently, in the absence of time fixed effects, the coefficient of relative cases has the expected sign (see column (1)).

It is instructive to compare the effect of travel restrictions to the effect of relative overall restrictions. In column (3), we add the relative stringency index. The estimated coefficient implies that an increase in the foreign restriction index relaive to the wiss index by one notch decreases foreign consumption in Switzerland by 0.73%. Increasing the stringency index by one standard deviation (i.e. 21 notches) would then decrease foreign consumption by 15%. In column (3), the coefficients of inbound and outbound travel restrictions are 5.6% and 2.0% respectively. Increasing these two indices by one standard deviation (i.e. 2 notches) would decrease foreign consumption by respectively 11.2% and 4%. The quantitative effect of overall restrictions and of travel restrictions are thus of a similar order of magnitude. However, the effect of travel restrictions is relatively large if we note that they constitute only one dimension of restrictions.

The last two columns of Table 3.2 extend the baseline specification of column (2) by adding interaction terms. Column (4) includes the interactions of travel restriction indices with the *Border* dummy. These interaction terms have positive coefficients. This implies that consumers from neighboring countries decrease less their expenses than consumers from other countries when restrictions are tightened. This could be explained either by the fact that essential frontier workers were not affected by restrictions, or by a tendency to travel closer to home during the pandemics. Finally, Column (5) includes the interaction between inbound and outbound travel restriction indices. The coefficient is significantly positive. This means that the marginal effect of inbound measures is smaller when outbound measures are already in place (and reciprocally). This nonlinear effect is strong. In this specification, if either inbound or outbound restriction indices are increased unilaterally by 4 notches (for instance, from no restrictions to quarantine), then consumption decreases by -35-40% as compared to the previous year. If the indices are increased by 4 notch at the same time, then consumption will decrease by an amount of -45%, which is only slightly higher than the effect of unilateral quarantine.

Table 4: Panel: Fixed-effects regressions - Categorical variables

	Cons
2.TravelFor	-0.0704***
	(-5.23)
4.TravelFor	-0.196***
	(-16.03)
5.TravelFor	-0.227***
	(-4.83)
1.TravelCH	0.0373*
	(2.01)
2.TravelCH	-0.0514**
	(-2.65)
3.TravelCH	-0.139***
	(-9.82)
4.TravelCH	-0.203***
	(-12.33)
5.TravelCH	-0.149***
	(-10.67)
Cases	0.0282***
	(3.78)
Google	0.0197***
	(4.44)
_cons	-0.0767***

	(-5.06)
Country FE	Yes
Date FE	Yes
N	3496
R^2	0.852
Adj. R^2	0.830

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 presents a modified version of Equation 3 by looking into more details at the different types of restrictions. We thus replace the linear indices by categorical variables. The results in column (1) suggest that when Switzerland imposed Travel Restrictions only to some regions of foreign countries, then foreign consumption was negatively affected (as compared to imposing no restriction). However, stronger restrictions, i.e. quarantines and total bans, appear to have a quantitatively larger effect: a quarantine decreased foreign consumption by 20% and total bans by 23%. Surprisingly, when foreign countries imposed some weak measures of entry from Switzerland, then the growth rate of foreign consumption in Switzerland increases by 3.7 percentage points compared to a situation when there is not restrictions. This results could reflect the fact that during the COVID-19 crisis, individuals may have chosen to go on holidays to countries where restrictions were low both at the arrival and at the return journey. This could have led to more tourism during low restrictions period compared to a non-crisis situation. When outbound travel restrictions are more stringent, the estimates then turn negative with -14 percentage points when people coming from Switzerland have to perform a test to enter a foreign country, -20 for a quarantine and -15 when there is a ban of entry compared to when there is no restrictions.

Figure 10 presents the effects of inbound restrictions ($Travel^{For}$) for different levels of outbound restrictions ($Travel^{CH}$). This figure is obtained by adding to Equation 3 the interactions of $TRavel^{For}$ and $Travel^{CH}$ across all categories. First, it appears that when Switzerland imposed either a quarantine or a ban on foreign visitors, foreign consumption in Switzerland was hit very hard (-40% to -60%), regardless of foreign restrictions. This is reflected in the fact that the yellow and green lines are flat. This confirms the insights from the interaction term in column (5) of Table 3.2. On the opposite, when Switzerland imposes no or mild restrictions (a quarantine on a subset of regions), stronger foreign restrictions affect foreign consumption more strongly. For instance, in the absence of restrictions, foreign consumption drops by -40% if the foreign country switches from no restriction to a quarantine. Finally, a quarantine (inbound or outbound) is about as costly as a total ban (inbound or outbound) in terms of foreign consumption.

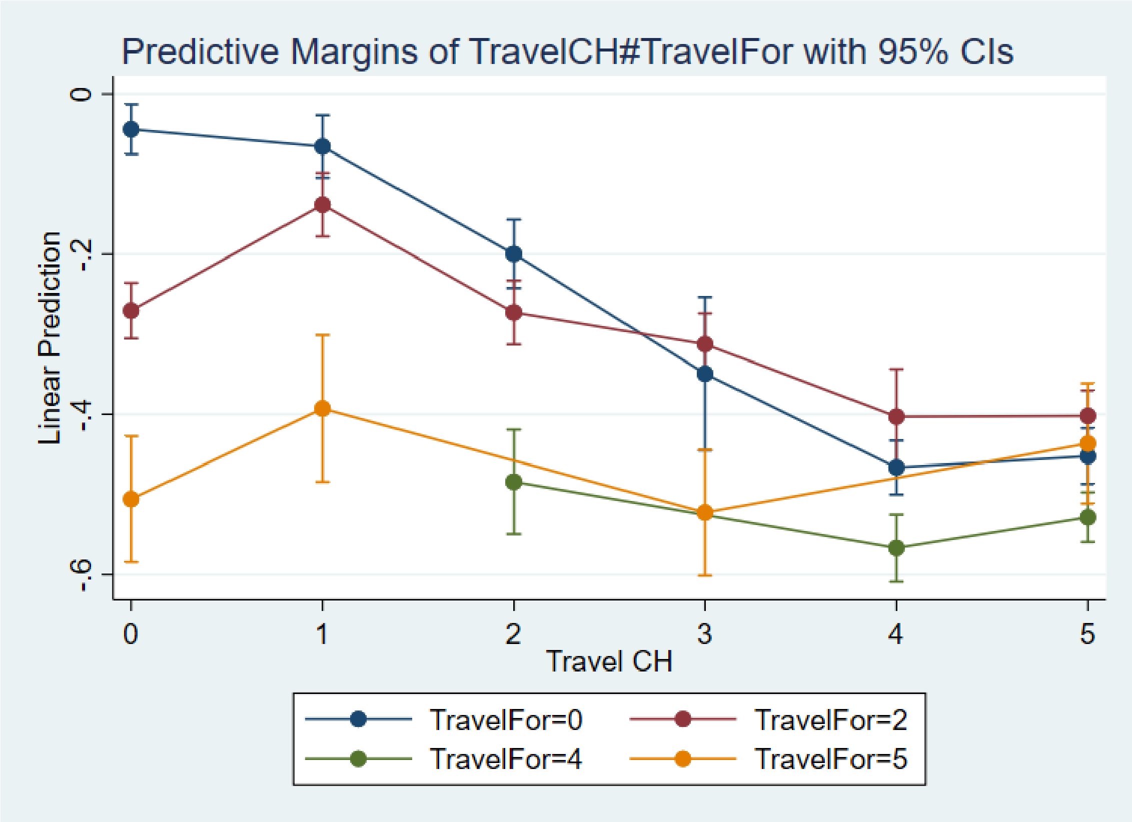

Figure 10: Panel: Marginal effects

Note: We represent here the point estimates and the 95% confidence interval based on robust standard errors.

3.3 Dynamic panel data analysis

In addition, the panel data structure also allow for the computation of Impulse-Response Functions by using Local Projections methods developed by Òscar Jordà (2005) [18]. The specification of each regression used to compute the impulse-response function is

$$\begin{aligned}\log(Cons^{For}_{i,t+h}) - \log(Cons^{For}_{i,t-1}) = \alpha^h_i + \delta^h_t + \sum_{p=1}^{P} \beta^h_{5,p} \log(Cons^{For}_{i,t-p}) \\ + \sum_{p=0}^{P} \beta^h_{1,p} TravelFor_{i,t-p} + \sum_{p=0}^{P} \beta^h_{2,p} TravelCH_{i,t-p} \quad (4) \\ + \sum_{p=0}^{P} \beta^h_{3,p} Cases_{i,t-p} + \sum_{p=0}^{P} \beta^h_{4,p} Google_{i,t-p} + \epsilon_{i,t+h}\end{aligned}$$

$p = (0, ..., 7)$ represents the number of lags accounted for in the regressions. We follows Caselli and al., (2020) [4] and set the lag length to $P = 7$. The Impulse-Response Function will then be given by $IRF = \{\beta^h_{1,0}\}_{h=0,...,H}$ for an increase in the level of $TravelFor$ by one notch and by $IRF = \{\beta^h_{2,0}\}_{h=0,...,H}$ for an increase in the level of $TravelCH$ by one notch. The confidence intervals are computed using robust standard errors.

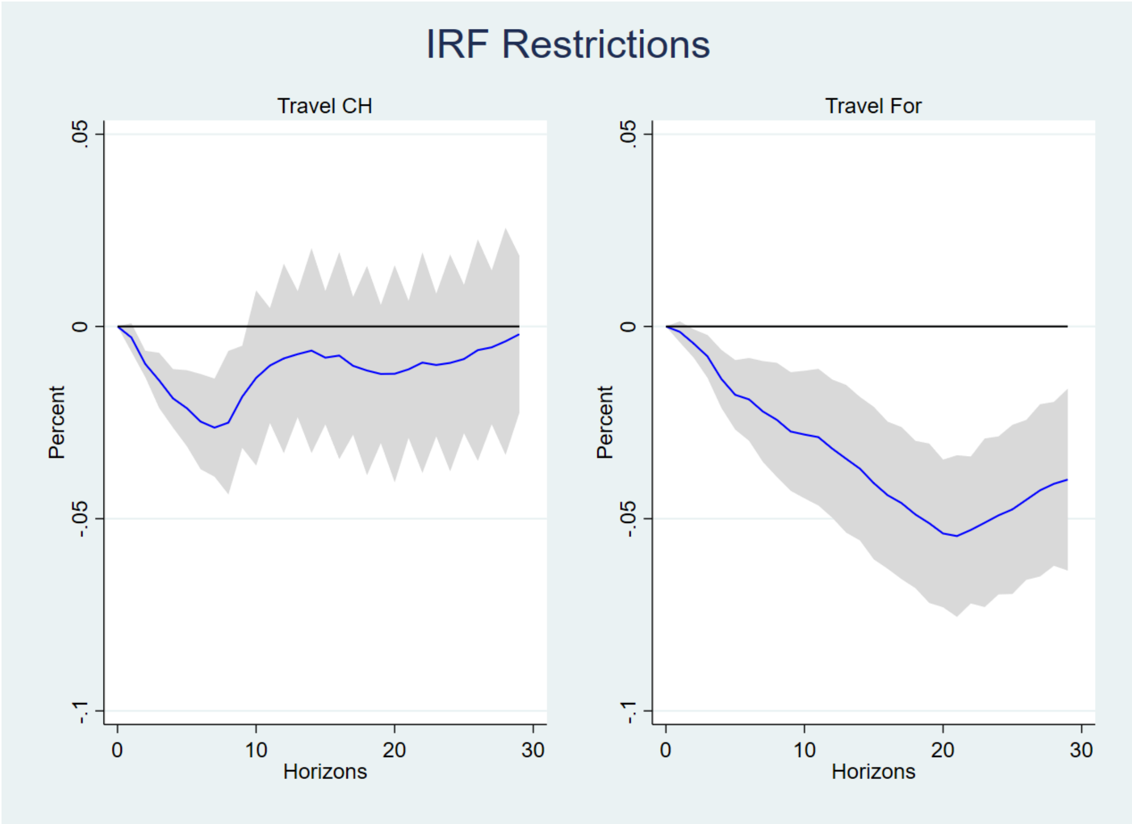

Figure 11: Panel: IRF Consumption of foreigners in Switzerland
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.

Figure 11 shows the resulting IRFs. It indicates that when $TravelCH$ increases by one notch, then the growth rate of foreign consumption in Switzerland decreases by -2 percentage points after at an horizon of 7 days. However, the effect is not significantly negative after 10 days. On the other hand, when $TravelFor$ increases by one notch, then the consumption's growth rate of foreigners in Switzerland decreases by $-5,5$ percentage points after 20 days. Compared to the Impulse-Response function for a shock on $TravelCH$, the response of consumption for a shock on $TravelFor$ is significantly negative beyond the 30-days horizon of estimation.

This heterogeneity could be explained by the significantly positive effect of $TravelCH = 1$ presented in Table 4. This positive effect is also displayed by Figure 12 which presents disaggregated Impulse-Response functions for each level of $TravelCH$. On the opposite, stricter measures have more negative effects, with the decrease in consumption reaching -15% for $TravelCH = 4$ and $TravelCH = 5$ after 7 days. We obtain these IRFs by estimating the following equations for $h = 0, .., 30$:

$$\begin{aligned}\log(Cons^{For}_{i,t+h}) - \log(Cons^{For}_{i,t-1}) = \alpha^h_i + \delta^h_t + \sum_{p=1}^{P} \beta^h_{5,p} \log(Cons^{For}_{i,t-p}) \\ + \sum_{k=2,4,5}^{P} \beta^h_{1,k} \mathbb{1}(TravelFor_{i,t} = k) + \sum_{k=1,..,5}^{P} \beta^h_{2,k} \mathbb{1}(TravelCH_{i,t} = k) \\ + \sum_{p=1}^{P} \beta^h_{1,p} TravelFor_{i,t-p} + \sum_{p=1}^{P} \beta^h_{2,p} TravelCH_{i,t-p} \\ + \sum_{p=0}^{P} \beta^h_{3,p} Cases_{i,t-p} + \sum_{p=0}^{P} \beta^h_{4,p} Google_{i,t-p} + \epsilon_{i,t+h}\end{aligned} \tag{5}$$

Here, the Impulse-Response Function for restriction category k will then be given by $IRF = \{\beta^h_{1,k}\}_{h=0,\ldots,H}$ and $IRF = \{\beta^h_{2,k}\}_{h=0,\ldots,H}$.

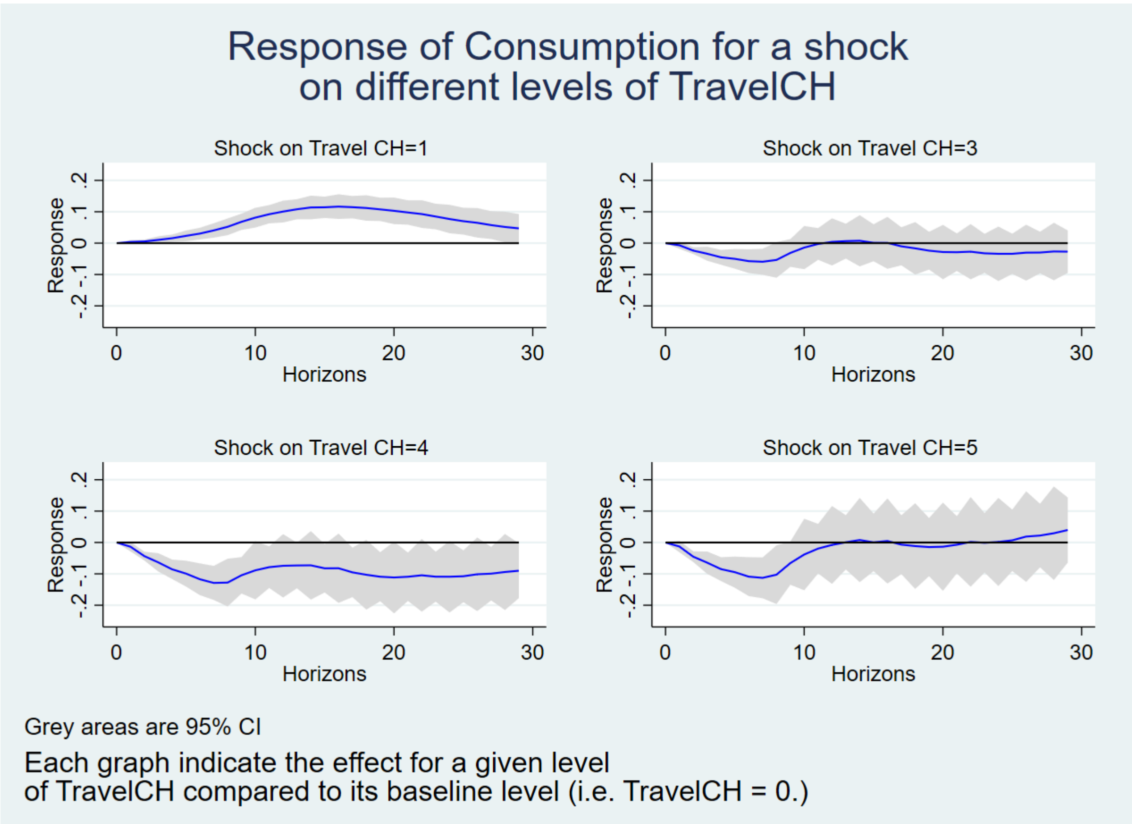

Figure 12: Panel: IRF Consumption of foreigners in Switzerland by levels of TravelCH
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.

Figure 13 presents the response of consumption for each levels of $TravelFor$ compared to the baseline situation where Switzerland do not imposed any restrictions against foreign countries. The figure indicates a significant negative response of consumption when

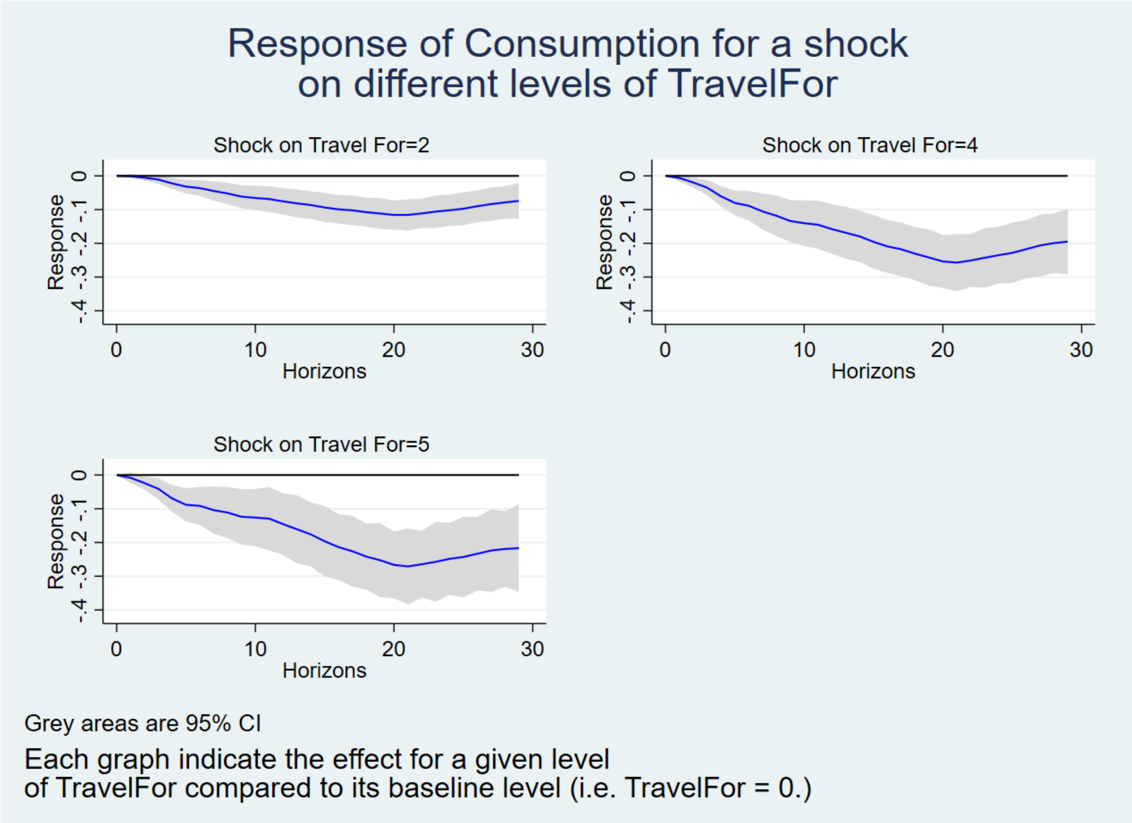

Figure 13: Panel: IRF Consumption of foreigners in Switzerland by levels of TravelFor
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.

$TravelFor = 4$ and $TravelFor = 5$ of -30% after 20 days.

We investigate the implications of reciprocity in restrictions by estimating the following equations for $h = 0, .., 30$ and $j = For, CH$:

$$\begin{aligned}\log(Cons^{For}_{i,t+h}) - \log(Cons^{For}_{i,t-1}) &= \alpha^h_i + \delta^h_t + \sum_{p=1}^{P} \beta^h_{5,p} \log(Cons^{For}_{i,t-p}) \\ +Travel^j_{it} \times [\beta^h_{j,0}\mathbb{1}(Travel^{-j}_{i,t} = 0, 1, 2) &+ \beta^h_{j,1}\mathbb{1}(Travel^{-j}_{i,t} = 3, 4, 5)] \\ &+\beta^h_j \mathbb{1}(Travel^{-j}_{i,t} = 0, 1, 2) \\ &+ \sum_{p=1}^{P} \beta^h_{1,p} TravelFor_{i,t-p} + \sum_{p=1}^{P} \beta^h_{2,p} TravelCH_{i,t-p} \\ &+ \sum_{p=0}^{P} \beta^h_{3,p} Cases_{i,t-p} + \sum_{p=0}^{P} \beta^h_{4,p} Google_{i,t-p} + \epsilon_{i,t+h}\end{aligned} \tag{6}$$

Here, the Impulse-Response Function will then be given by $IRF = \{\beta^h_{j,0}\}_{h=0,...,H}$ and $IRF = \{\beta^h_{j,1}\}_{h=0,...,H}$ for $j = For, CH$. The travel restriction variables and the corresponding dummy variables are highly correlated, so here we run one regression per travel restriction index (one for inbound restrictions $TravelFor$ and one for outbound restric-

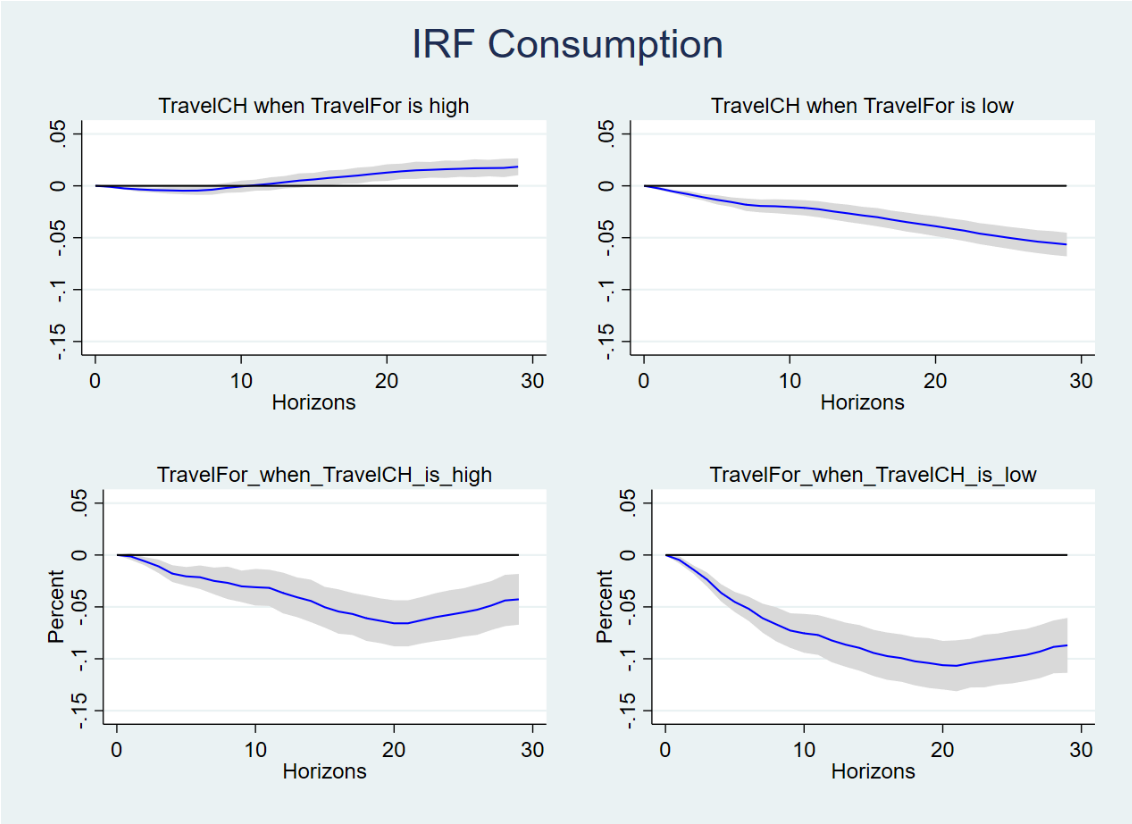

Figure 14: Panel: IRF Consumption of foreigners by low and high values of the other index

Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.

tions $TravelCH$).

Figure 14 shows the Impulse-Response functions of both travel restriction indices depending on the values taken by the other index. The top row presents the response of the growth rate of foreign consumption in Switzerland to a shock on $TravelCHr$ for low and high values of $TravelFor$. Symmetrically, the bottom row shows the response of consumption to a shock on $TravelFor$ for low and high values of $TravelCh$. For both indices low values correspond to index levels from 0 to 2 and high values correspond to index levels from 3 to 5. Results indicate that consumption declines faster after an increase in $TravelFor$ when there are low restrictions imposed against Switzerland than when those restrictions are high. Similarly, for low values of $TravelFor$, the response of consumption following an increase in $TraveCH$ is clearly negative, while consumption barely responds if $TravelFor$ is high.

Finally, we investigate the extent to which the effect of travel restrictions depends on geographical proximity by estimating the following equations for $h = 0, .., 30$:

$$\begin{aligned}\log(Cons^{For}_{i,t+h}) - \log(Cons^{For}_{i,t-1}) = \alpha^h_i + \delta^h_t + \sum_{p=1}^{P} \beta^h_{5,p} \log(Cons^{For}_{i,t-p}) \\ + TravelFor_{it} \times [\beta^h_{1,0} \mathbb{1}(Border) + \beta^h_{1,1} \mathbb{1}(NoBorder)] \\ + TravelCH_{it} \times [\beta^h_{2,0} \mathbb{1}(Border) + \beta^h_{2,1} \mathbb{1}(NoBorder)] \\ + \sum_{p=1}^{P} \beta^h_{1,p} TravelFor_{i,t-p} + \sum_{p=1}^{P} \beta^h_{2,p} TravelCH_{i,t-p} \\ + \sum_{p=0}^{P} \beta^h_{3,p} Cases_{i,t-p} + \sum_{p=0}^{P} \beta^h_{4,p} Google_{i,t-p} + \epsilon_{i,t+h}\end{aligned} \tag{7}$$

Here, the Impulse-Response Function will then be given by $IRF = \{\beta^h_{1,i}\}_{h=0,...,H}$ and $IRF = \{\beta^h_{2,i}\}_{h=0,...,H}$ for $j = 0, 1$.

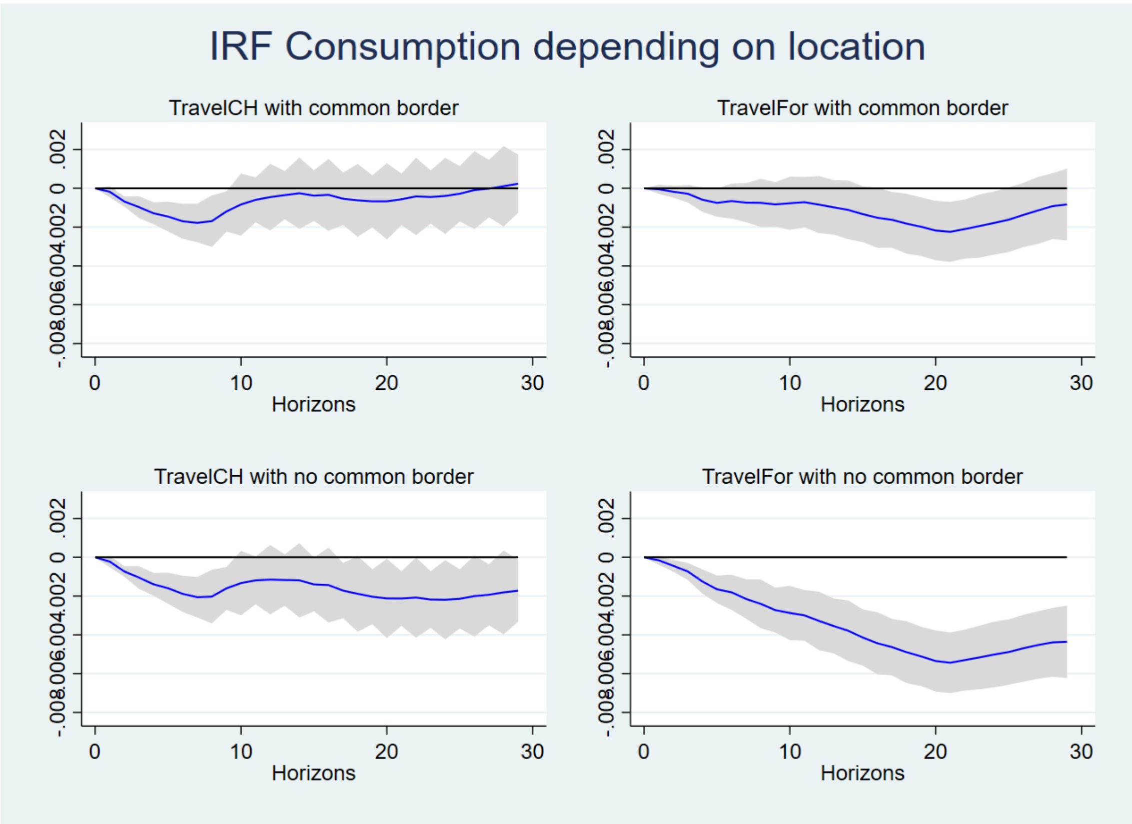

Figure 15: Panel: IRF Consumption of foreigners in Switzerland by location
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.

Figure 15 displays the IRFs of foreign consumption in Switzerland for both Travel Restrictions indices depending on whether the foreign country shares a border with Switzerland. The responses of foreign consumption to inbound and outbound restrictions when there is a common border are displayed on the top row while the responses in the absence of common border are displayed on the bottom row. Whether we consider outbound (right panels) or outbound (left panels) restrictions, the effect of restrictions are significantly stronger and more persistent for remote countries.

3.4 Robustness

As mentioned in the data section, the Google mobility index does not provide values for Russia and China. We therefore use GDP growth as an alternative measure of economic activity. We thus perform the same analysis, where we only replaced *Google* with *GDP*. Because this measure is quarterly, we do not include lags in our daily local projection analyses. The results are provided in Tables C and 8 and Figures 18, 19, 21 and 20 in the Appendix. The results remain similar to the baseline.

4 Conclusion

In this project, we studied the effect of travel restrictions taken by governments in the context of the fight against the spread of COVID-19 on tourism in Switzerland and on consumption of Swiss citizen abroad. For this purpose, we created two indices that reflect the measures taken by governments in terms of entry into the territory for travellers. The first index measures the entry restrictions into Switzerland for travellers from 10 foreign countries (Inbound travel restrictions) and the second, the restrictions taken by these ten countries for the entry into their territory of people coming from Switzerland (Outbound travel restrictions). These indices were then used to run different analysis.

The first analysis used a time-series data set which identifies foreign consumption in Swiss point of sale and use it as a proxy for tourism in Switzerland. Our results indicate a strong negative and persistent response of foreign consumption in Switzerland following a one-notch increase in bilateral travel restrictions index. The response of consumption is about -40 percentage points 10 days after the shock.

In a second time we conducted a fixed-effect panel data analysis. The consumption data used for the second analysis include all non-cash transactions made by foreigners to merchants in Switzerland. Hence it accounts for both point-of-sell and online transactions. Indeed, the results indicate a significantly negative impact of travel restrictions on consumption. However, these effects are weaker than in the analysis on the time series since certain transactions made online have not necessarily been impacted in the same way by travel restrictions as transactions made in a point of sale. However, this analysis allowed us to investigate the effect of different levels of travel restriction indices. We have found that imposing a strict quarantine for all travelers entering a territory (inbound or outbound) is as costly as a total entry ban (inbound or outbound) regarding foreign consumption in Switzerland. In addition, using local projection method on our panel data allowed us to show that spending by tourists from countries bordering Switzerland are less affected by an increase in the severity of travel restrictions than those from geographically more distant countries. The effect of the severity of inbound (respectively outbound) measures also depends on the one of outbound restrictions (respectively inbound). Thus when travel restrictions are already high in a way or another, then the reciprocal measures have only a small effect. On the other hand, imposing very stringent restriction (inbound or outbound) have a strong effect on foreign consumption when the reciprocal one is either absent, weak, only for some some regions or need a test.

Through this project, we were therefore able to determine that the travel restrictions imposed during the first 15 months of the COVID-19 crisis had a negative impact on the tourism sector in Switzerland and in which extend. More precisely, the structure of our data allowed us to break down the different effects of these restrictions according to their severity, the countries to which they were imposed and their simultaneous effects. In order to serve as a decision-making tool for policy makers, an important extension of this research would be to estimate the effect of travel restrictions on the number of COVID-19 cases. Therefore, the results could be used as part of a cost-benefit analysis.

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[15] Conseil fédéral suisse. *Ordonnance 3 sur les mesures destinées à lutter contre le coronavirus (COVID-19).* 2020.

[16] Conseil fédéral suisse. *Ordonnance sur les mesures destinées à lutter contre le coronavirus (COVID-19) dans le domaine du transport international de voyageurs.* 2020.

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A Travel Restrictions Indices

A.1 Travel Restrictions imposed by other countries to Switzerland

Table 5 presents travel restrictions imposed by foreign countries to Switzerland during the period of the analysis presented in this project. Moreover, the table specified the way the related travel index is coded.

Table 5: Travel Restrictions Index: From Switzerland to a Foreign Country

Country	Period	Condition to enter on the foreign country	Index
France	13.03.20 - 17.03.20	No measure	0
	18.03.20 - 15.06.20	Closure of intra-European borders	5
	16.06.20 - 2910.20	No measure	0
	30.10.20 - 15.12.20	Entry in France only possible for essential reasons with proof of it	5
	16.12.20 - 30.01.21	Following Cantons needs a negative COVID-test to go in Corsica: • Grisons • Jura • Neuchâtel • Uri • Valais • Vaud	2
	31.01.21 - 13.03.21	Negative COVID-test	3
Austria	13.03.20 - 13.03.20	No measure	0
	14.03.20 - 15.03.20	Medical certificate or 2 weeks of quarantine	3
	16.03.20 - 19.03.20	No flights and trains between Austria and Switzerland	5
	20.03.20 - 15.06.20	Medical certificate or 2 weeks of quarantine	3
	16.06.20 - 01.11.20	No measure	0
	02.11.20 - 09.02.21	No measure but hotels and restaurants are closed. The government specified that tourism in general is impossible	4

	10.02.21 - 13.03.21	Negative COVID-test, 10 days quarantine, register before the arrival but hotels and restaurants are still closed. The government specified that tourism in general is impossible	5
China	13.03.20 - 27.03.20	No measure but impossible to enter on some provinces of China that are under a shutdown	2
	28.03.20 - 31.08.20	No foreigner can enter in China	5
	01.09.20 - 13.03.21	Negative COVID-test	3
Germany	13.03.20 - 15.03.20	No measure	0
	16.03.20 - 16.06.20	Entry possible only if for essential reason	5
	17.06.20 - 08.09.20	No measure	0
	09.09.20 - 23.10.20	Following Cantons needs a negative COVID-test or 10 day quarantine: • Genève • Vaud	2
	16.09.20 - 30.09.20	Following Canton needs a negative COVID-test or 10 day quarantine: • Fribourg	2

	17.10.20 - 23.10.20	Following Cantons needs a negative COVID-test or 10 day quarantine: • Fribourg • Jura • Neuchâtel • Nidwald • Schwyz • Uri • Zûrich • Zug	2
	24.10.20 - 13.03.21	Register before the arrival in Germany, 10 day quarantine that can be ended after 5 day by a negative COVID-test	5
United-Kingdom	13.03.20 - 21.08.20	No measure	0
	22.08.20 - 29.08.20	10 days quarantine if going to Scotland	2
	29.08.20 - 17.01.21	10 days quarantine	4
	18.01.21 - 13.03.21	Register before the arrival, negative COVID-test, 10 days quarantine if going to Scotland	4
Italy	13.03.20 - 13.03.20	No measure	0
	14.03.20 - 02.06.20	Entry in Italy only possible for essential reasons	5
	03.06.20 - 09.12.20	Complete the form *Self-Certification for travel to Italy from abroad*	1
	10.12.20 - 20.12.20	Register before the arrival, complete the Self-Certification form, negative COVID-test or quarantine	4
	21.12.20 - 06.01.21	Complete the self-Certification form, quarantine if the purpose of the travel is not essential	4

	07.01.21 - 13.03.21	Complete the Self-Certification form, negative COVID test or quarantine	3
Liechtenstein[12]	13.03.20 - 13.03.21	No measure	0
Netherlands	13.03.20 - 08.07.20	No measure	0
	09.07.20 - 16.09.20	Complete self-declaration form, the accommodation should be booked before the arrival in Netherlands	1
	17.09.20 - 23.10.20	Following Cantons have to quarantine for 10 day: • Genève • Vaud • Fribourg , Other Cantons still have to complete the self-declaration form and booked the accommodation before the arrival in Netherlands	2
	17.09.20 - 23.10.20	Following Cantons have to quarantine for 10 day: • Genève • Vaud • Schwyz • Valais • Neuchâtel • Zug • Fribourg , Other Cantons still have to complete the self-declaration form and booked the accommodation before the arrival in Netherlands	2

	30.10.20 - 13.03.21	Complete self-declaration form, quarantine 10 days, the accommodation should be booked before the arrival in Netherlands	4
Russia	13.03.20 - 17.03.20 18.03.20 - 14-08.20 15.08.20 - 13.03.21	No measure Entry impossible for foreigners Complete self-declaration form, Negative COVID-test	0 5 3
United-States	13.03.20 - 13.03.21	Entry impossible for Schengen countries	5

A.2 Source Travel restrictions imposed by other countries to Switzerland

The sources that allow to create and compute the travel index regarding travel restrictions imposed on Switzerland are presented below and listed by countries.

France:

- https://geneve.consulfrance.org/COVID-19-vos-questions-nos-reponses
- https://www.diplomatie.gouv.fr/fr/conseils-aux-voyageurs/informations-pratiques/article/coronavirus-COVID-19-31-janvier-2021

Austria:

- https://www.austria.info/fr/informations-pratiques/coronavirus-en-autriche/entree-autriche
- https://metropole.at/coronavirus-in-austria-march/
- https://wiki.unece.org/display/CTRBSBC/Austria
- https://www.lorientlejour.com/article/1239001/lautriche-se-reconfine-ferme-restaurants-et-hotels.html

China:

- https://hr.cs.mfa.gov.cn/help_two/help-two/gj.html
- http://ch.china-embassy.org/ger/zytz/t1843039.htm
- http://ch.china-embassy.org/ger/zytz/t1846938.htm
- https://www.lemonde.fr/international/article/2020/03/27/la-chine-ferme-ses-frontieres-aux-etrangers_6034638_3210.html

[12]The border between Switzerland and Liechtenstein had never been closed. Both countries shares agreements about measures to fight COVID

- https://www.lemonde.fr/international/article/2020/03/31/coronavirus-si-les-hopitaux-de-pekin-ou-de-shanghai-avaient-ete-debordes-cela-se-serait-su_6035056_3210.html

Germany:

- https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Risikogebiete_neu.html
- https://www.letemps.ch/suisse/zones-risque-une-jungle-europeenne
- https://www.lemonde.fr/international/article/2020/03/16/coronavirus-en-se-barricadant-l-allemagne-effectue-un-revirement-majeur_6033203_3210.html
- https://wiki.unece.org/display/CTRBSBC/Germany

United-Kingdom:

- https://www.gov.uk/guidance/transport-measures-to-protect-the-uk-from-variant-strains-of-COVID-19
- https://ourworldindata.org/grapher/international-travel-COVID?stackMode=absolute&time=2020-05-29&region=World

Italy:

- https://www.eui.eu/ServicesAndAdmin/CommunicationsService/Travelling-to-Italy-from-abroad-COVID19
- https://wiki.unece.org/display/CTRBSBC/Italy
- https://www.ejpd.admin.ch/ejpd/fr/home/actualite/mm.msg-id-79314.html

Liechtenstein:

- http://www.liechtensteinusa.org/article/measures-taken-in-liechtenstein-in-response-to-the-coronavirus-pandemic

Netherlands:

- https://www.government.nl/topics/coronavirus-COVID-19/visiting-the-netherlands-from-abroad/self-quarantine
- https://www.government.nl/topics/coronavirus-COVID-19/visiting-the-netherlands-from-abroad/eu-list-of-safe-countries
- https://www.government.nl/topics/coronavirus-COVID-19/tackling-new-coronavirus-in-the-netherlands/travel-and-holidays/self-quarantine

- https://www.government.nl/topics/coronavirus-COVID-19/visiting-the-netherlands-from-abroad/self-quarantine

Russia:

- https://tourism.gov.ru/en/contents/turistam/restriction-of-entry-to-the-territory-of-the-russian-federation-until-may-01-2020/
- https://www.eda.admin.ch/countries/russia/fr/home/representations/ambassade-moscow.html
- http://static.government.ru/media/files/wwGGarWzAuGcDRw4OFHBfkInXcpDOZPu.pdf
- https://wiki.unece.org/display/CTRBSBC/Russian+Federation

United-States of America:

- https://wiki.unece.org/display/CTRBSBC/United+States+of+America
- https://www.liberation.fr/planete/2020/03/12/trump-suspend-tous-les-voyages-depuis-l-europe-vers-les-etats-unis-pour-trente-jours_1781395/
- https://ch.usembassy.gov/visas/
- https://washington.consulfrance.org/IMG/pdf/21-0616-1-_proclamation_on_the_suspension_of_entry_as_immigrants_and_non.pdf
- https://www.skyscanner.fr/restrictions-voyage

A.3 Travel Restrictions imposed by Switzerland to other countries

Table 6 presents travel restrictions imposed by Switzerland to other countries during the period of the analysis presented in this project. Moreover, the table specified the way the related travel index is coded.

Table 6: Travel Restrictions Index: From a Foreign Country to Switzerland

Country	Period of being on the red list of Switzerland	Index
France	17.03.20 - 14.06.20	5
	14.09.20 - 19.12.20	2
	01.02.21 - 13.03.21	2
Austria	17.03.20 - 14.06.20	5
	14.09.20 - 28.10.20	2
	23.11.20 - 18.12.20	2
	01.02.21 - 13.03.21	2
China	19.03.20 - 05.07.20	5
Germany	17.03.20 - 14.06.20	5
	12.10.20 - 28.10.20	2
	28.12.20 - 14.02.21	2
UK	21.03.20 - 14.06.20	5
	28.09.20 - 28.10.20	4
	21.12.20 - 13.03.21	4
Italy	13.03.20 - 14.06.20	5
	28.09.20 - 28.10.20	2
	14.12.20 - 13.03.21	2
Liechtenstein	-	-
Netherlands	25.03.20 - 14.06.20	5
	28.09.20 - 28.10.20	4
	15.01.21 - 13.03.21	4
Russia	19.03.20 - 14.06.20	5
	15.06.20 - 07.08.20	4
	12.10.20 - 28.10.20	4
USA	19.03.20 - 14.06.20	5
	15.06.20 - 28.10.20	4
	14.12.20 - 13.03.20	4

A.4 Sources Travel restrictions imposed by Switzerland to other countries

The sources that allow to create and compute the travel index regarding travel restrictions imposed by Switzerland are presented below and listed by countries.

- *Ordonnance du 2 juillet 2020 sur les mesures destinées à lutter contre le coronavirus (COVID-19) dans le domaine du transport international de voyageurs (Ordonnance COVID-19 mesures dans le domaine du transport international de voyageurs)* [16] and all its versions consultable at https://www.fedlex.admin.ch/eli/cc/2020/

496/fr

- *Ordonnance 2 sur les mesures destinées à lutter contre le coronavirus (COVID-19)* [14] and all its versions consultable at https://www.fedlex.admin.ch/eli/cc/2020/141/fr
- https://www.bag.admin.ch/bag/fr/home/krankheiten/ausbrueche-epidemien-pandemien/aktuelle-ausbrueche-epidemien/novel-cov/empfehlungen-fuer-reisende/liste.html

B Negative number of COVID-19 cases reported

Table 7 shows the countries and dates for which negative number of cases were reported, as described in Section 2.2.2.

Table 7: List of Negative Cases by Countries

Country	Date
China	03jun2020
France	02jun2020
France	29apr2020
France	07apr2020
France	23apr2020
France	28jun2020
France	24may2020
France	04apr2020
France	03jun2020
France	04nov2020
Italy	19jun2020

C Additional Tables

Table 8: Panel: Fixed-effect regressions

	Cons	Cons	Cons	Cons	Cons
TravelFor	-0.0601***	-0.0418***	-0.0448***	-0.0425***	-0.101***
	(-24.83)	(-11.65)	(-12.48)	(-11.32)	(-17.64)
TravelCH	-0.0807***	-0.0560***	-0.0330***	-0.0769***	-0.101***
	(-38.11)	(-20.07)	(-15.34)	(-19.97)	(-22.70)
log(Rel. Cases)	-0.0627***	-0.0133*	-0.0353***	-0.0196**	-0.0106
	(-11.20)	(-2.14)	(-5.60)	(-3.02)	(-1.74)
GDP	0.0130***	0.00773***	0.00348	0.0121***	0.00452*
	(10.90)	(3.80)	(1.77)	(6.06)	(2.16)
Rel. string.			0.00685***		
			(13.64)		
TravelFor×Border				0.0125***	
				(3.90)	
TravelCH×Border				0.0336***	
				(9.63)	
TravelFor×TravelCH					0.0197***
					(17.35)
Country FE	Yes	Yes	Yes	Yes	Yes
Date FE	No	Yes	Yes	Yes	Yes
DOW FE	Yes	No	No	No	No
N	4390	4390	4390	4390	4390
R^2	0.724	0.790	0.816	0.795	0.804
Adj. R^2	0.723	0.766	0.795	0.771	0.782

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9: Panel: Fixed-effect regressions - Categorical variables - Robustness

	Cons
2.TravelFor	-0.0443***
	(-3.69)
4.TravelFor	-0.166***
	(-15.85)
5.TravelFor	-0.205***
	(-5.29)
1.TravelCH	0.0723***
	(3.73)
2.TravelCH	-0.0495**
	(-2.71)
3.TravelCH	-0.291***
	(-16.79)
4.TravelCH	-0.235***
	(-14.41)
5.TravelCH	-0.274***
	(-17.26)
log(Rel. Cases)	0.00161
	(0.27)
GDP	0.00815***
	(3.98)
Country FE	Yes
Date FE	Yes
N	4370
R^2	0.805
Adj. R^2	0.782

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

D Additional figures

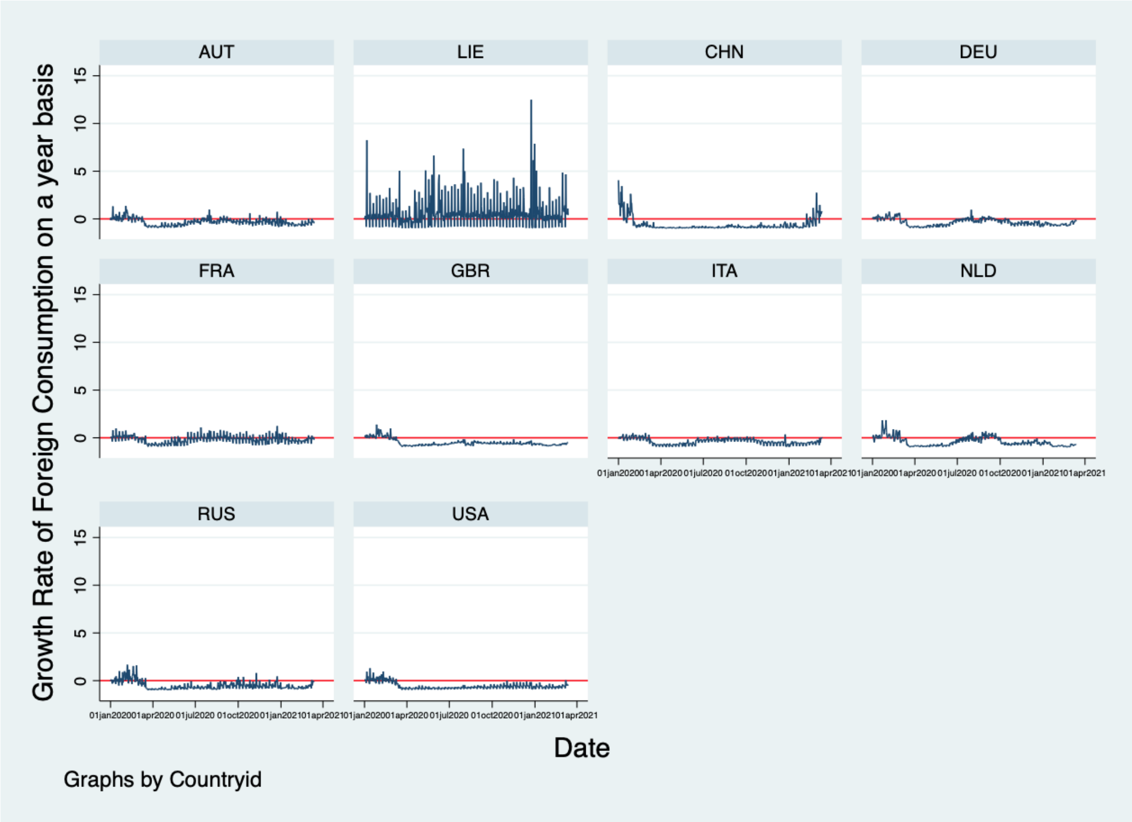

Figure 16: Growth Rate of Foreign Consumption in Switzerland
Source: Monitoring Consumption Switzerland and authors' calculations.

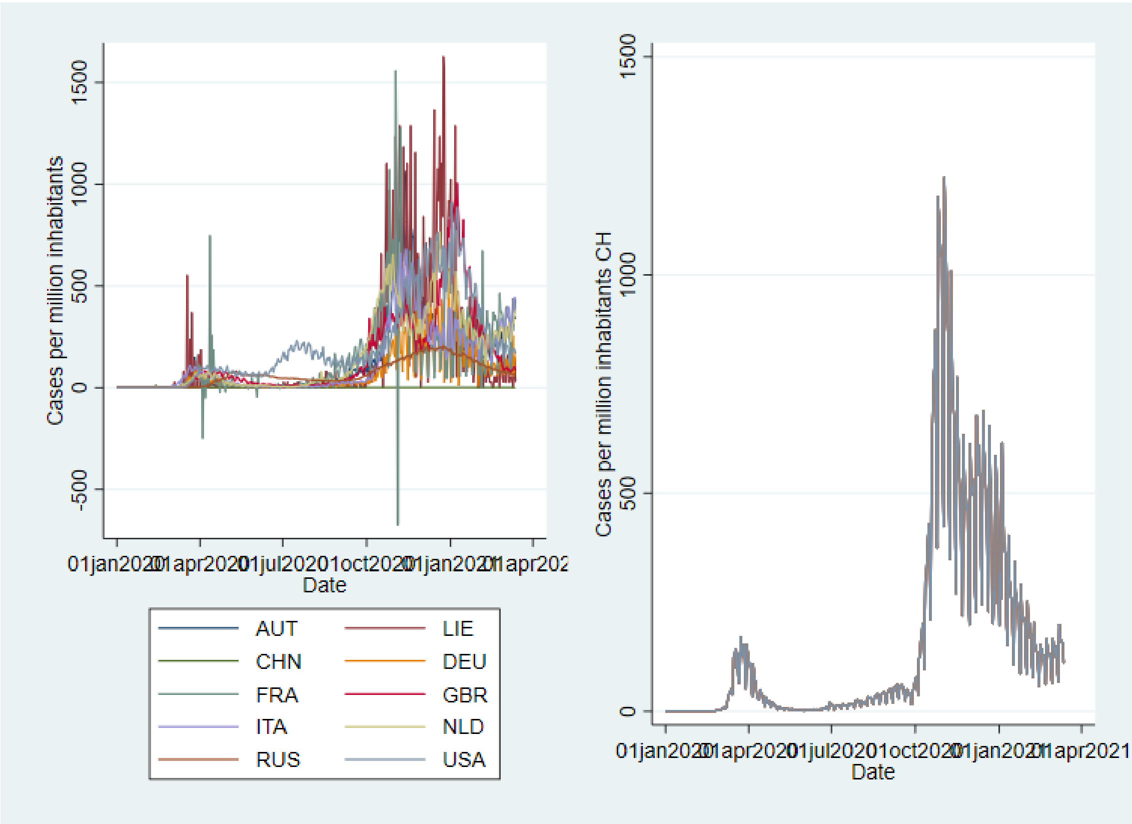

Figure 17: Number of new confirmed cases per million inhabitants in Switzerland and in 10 Foreign Countries

Source: Federal Office of Public Health and authors' calculations

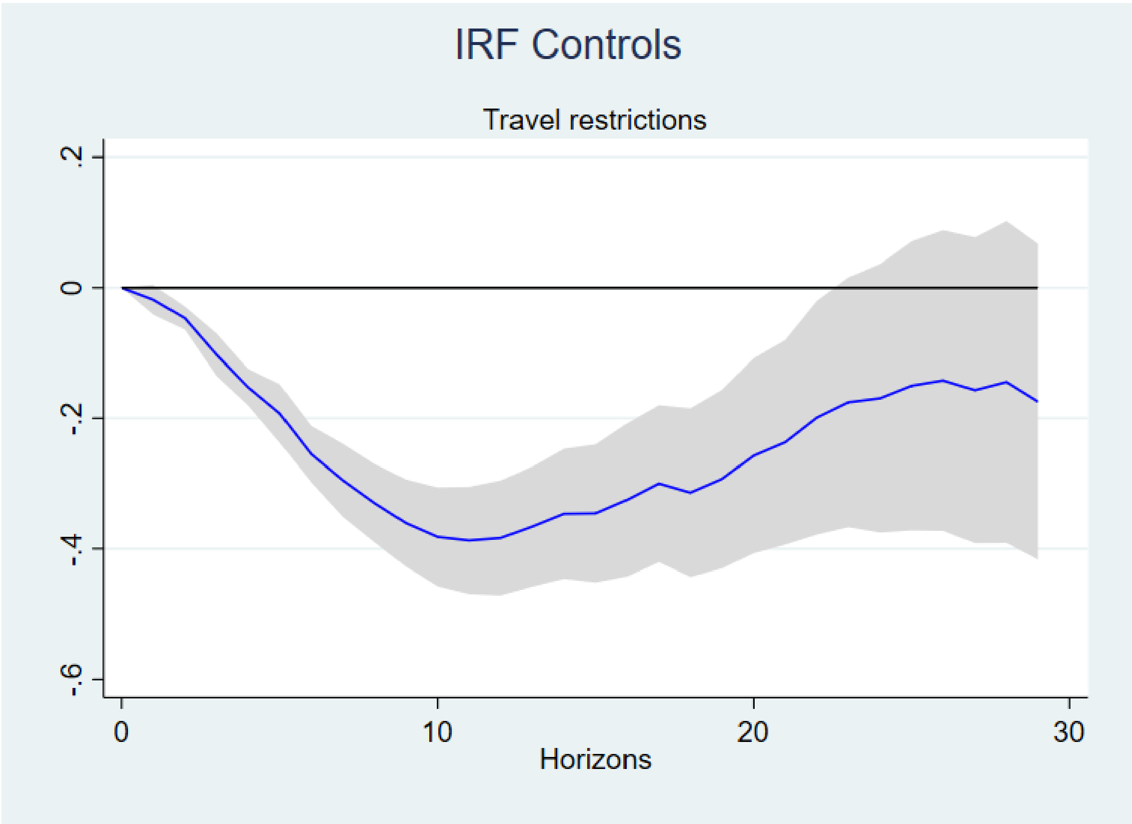

Figure 18: Time series: IRFs of foreign cons. to Travel restrictions - Robustness
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on Newey-West standard errors.

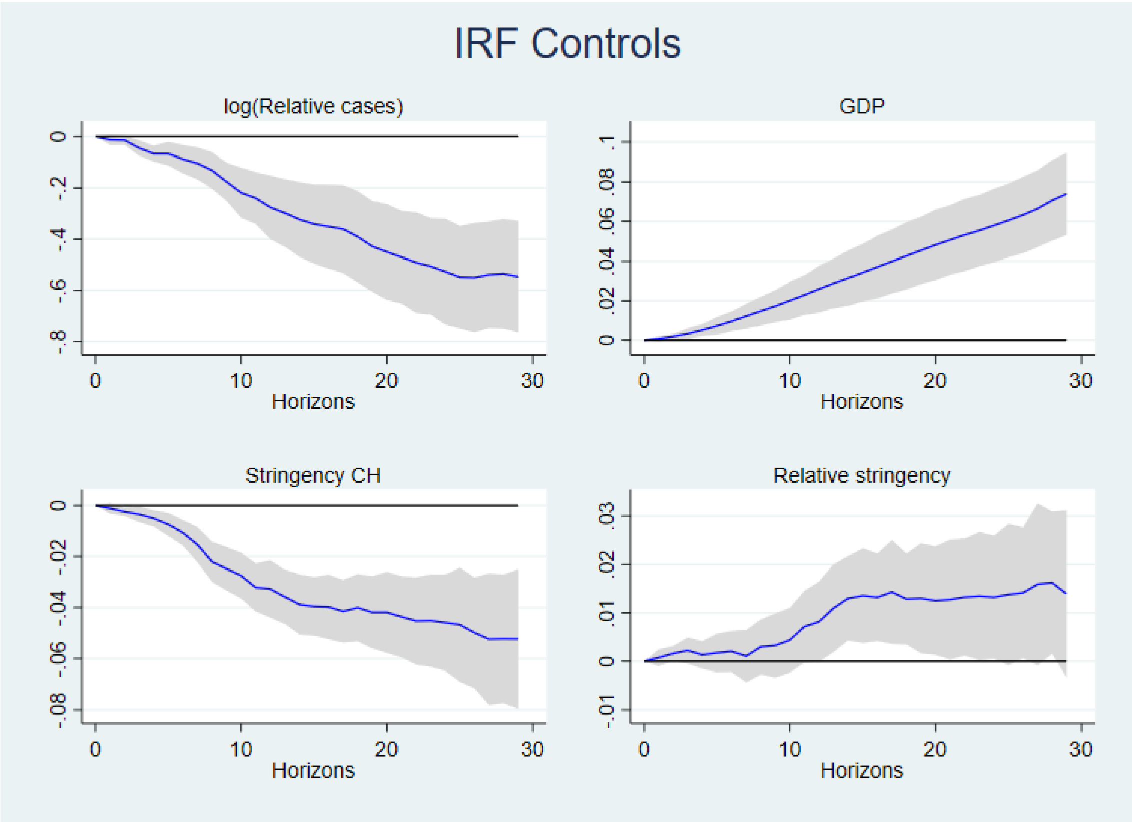

Figure 19: Time series: IRFs of foreign cons. to Travel restrictions - Robustness
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on Newey-West standard errors.

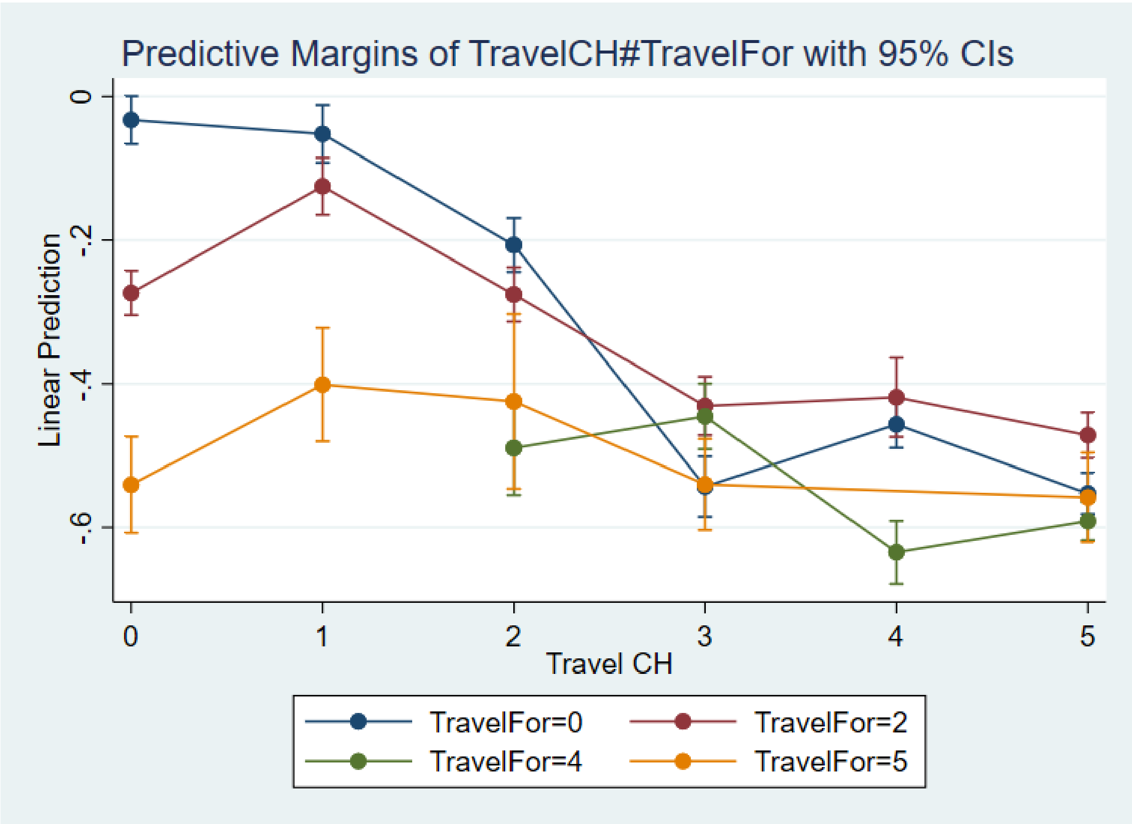

Figure 20: Panel: Marginal effects - Robustness

Note: We represent the point estimates and the 95% confidence interval based on robust standard errors.

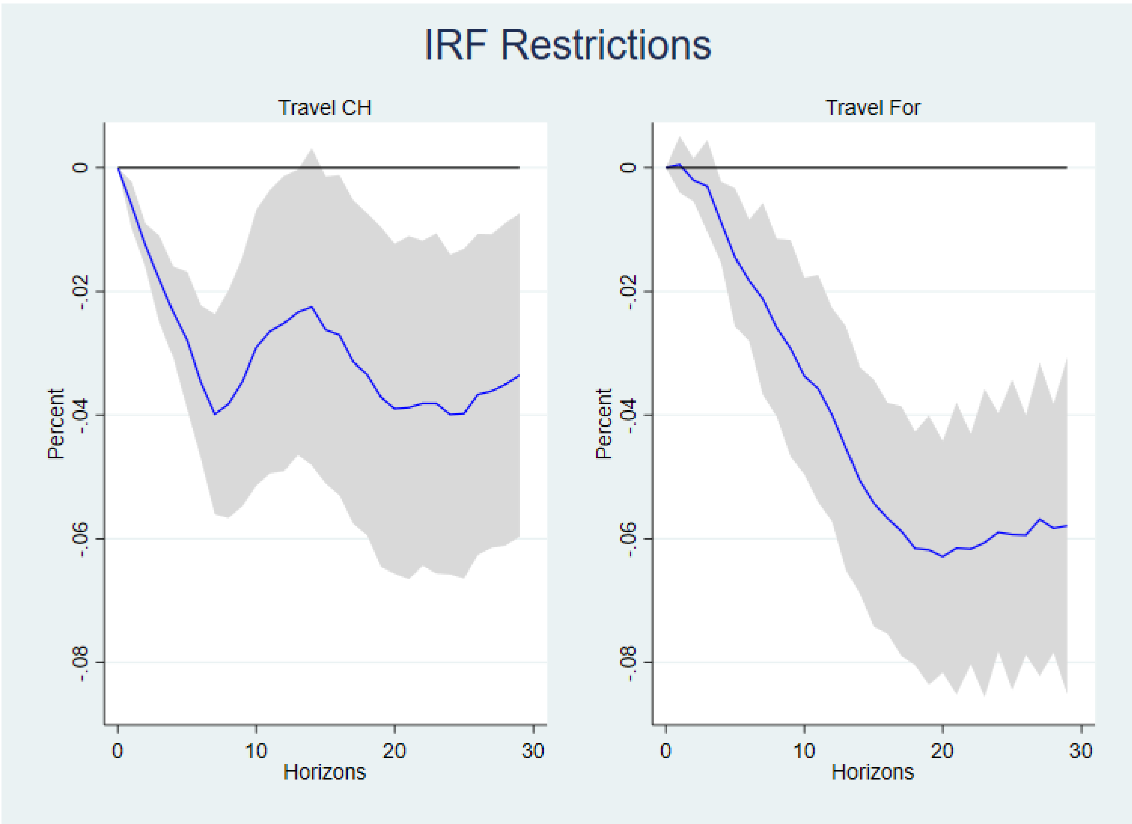

Figure 21: Panel: IRF Consumption of foreigners in Switzerland - Robustness
Note: The solid line represents the point estimates and the gray area represent the 95% confidence interval based on robust standard errors.