

Introduction

As Covid-19 began to spread, in a response to “flatten the curve” governments have imposed national lockdowns, so all the non-essential businesses were closed, people were required to limit trips outside border, shutdowns were enforced, travel restrictions and quarantine shelter-in-place. The measures to contain the pandemic and protect public health appeared to be at odds with those that promoted economic activity and aimed at supporting employment and income, thus upsetting family dynamics, and undermining out economic stability. Consequently, economic contagion spread as fast as the coronavirus itself. Since then, people around the globe were faced with drastic changes in many aspects of their lives, also modifying their consumption behaviour. In fact, empirical evidence suggests that during the outbreak of Covid-19 around the developed countries, there was an unusual increase in the propensity to save. According to Eurostat, in the second quarter of 2020, the EU household saving rate recorded its highest year-over-year increase since 2000.

This sudden increase in the household saving rate, which translated into a sharp decrease in consumer spending, may be related to different explanations. Firstly, the precautionary saving could have modified spending plans in the presence of uncertainty about the future and a higher risk of unemployment. Second, restrictions imposed by the governments such as lockdown may have actually constrained purchases of goods that are sold in stores, thus driving an unintentional increase in savings (Baker et al. (2020), Chronopoulos et al. (2020), Chen et al. (2020), Andersen et al. (2020), Chetty et al. (2020), Cox et al. (2020)). However, there is another, less explored, possible explanation for this increase in savings: the fear of contracting the virus. According Goolsbee and Syverson (2021), Immordino et al. (2021) individuals may voluntarily diminish their shopping activity based on their personal health concerns, in order to abate the infection’s risk. Indeed, the Coronavirus pandemic was not only an epidemiological and economic crisis, but was also psychological, and it has provoked a state of vulnerability that has caused remarkable shifts in people's perceptions and behaviours.

The thesis aims to contribute to this debate, in particular for what concerns the importance of health for preserving the consumption levels and sustaining the macroeconomic stability. We try to shed some light on this topic by focusing on how fear of Covid-19 may influence households’ consumption decisions and providing some useful suggestions for economic and health policy to introduce appropriate interventions to sustain the process of the economic recovery.

In addition, this project contributes to the growing body of research that uses subjective expectations data in order to understand economic facts. Despite the central role economic analysis allocates to agents' expectations in their decision making, the standard practice of economists has been to infer decision processes from data on observed choices often making non verifiable assumptions on expectations. The advantage to use expectations data is to be able to examine unconstrained potential behaviour and manage problems related to the fact that observed choices may be consistent with many combinations of expectations and preferences, and especially in the presence of imposed lockdowns, these may be forced by impediments imposed by law, as a consequence it becomes difficult to understand the decision-making of households during a pandemic. Recently, a growing body of research uses subjective expectations data of spending, income, employment, retirement, inflation, stock value, marriage, longevity, moving, crime, etc. in order to understand economic facts (Wilbert van der Klaauw, 2022). This practice is generated by the awareness of the potential value of expectations data for the purposes of predicting choice behaviour and understating how expectations are formed. In addition, the first two chapters are related to a small but growing literature that applies a novel identification strategy that is based on an Instrumental Variables approach in a Conditional Mixed Process model to address the potential endogeneity problem in a non-linear model with a non-continuous endogenous variable.

In the first chapter, using data from the second wave of the Special Survey of Italian Households, (SSIH), conducted by the Bank of Italy we examine the causal effect of the fear of Covid-19 on consumption expectations during the pandemic. Until now, existing literature has just provided descriptive analysis on the interrelationships between these variables. Instead, we provide evidence on the causal effect of the fear of Covid-19 on expected consumption using an identification strategy that overcomes endogeneity problems, since that the fear of contagion may depend on unobservable characteristics, and those related to the presence of government restrictions. In order to address these issues, we implement a *Fuzzy Regression Discontinuity Design*, using an exogenous variation in the fear of contagion related to belonging to a specific age group. The age threshold is exogenously determined by official statements that in Italy informed individuals that the fatalities caused by Covid-19 for those aged 60-69 are nearly four times higher compared to those aged 50-59. Therefore, it seems plausible to suppose that the perceived fear of Covid-19 increases with age and that a cut-off arises between the two age-groups highlighted above. In addition, our estimates are quite robust to a different identification strategy, as the *Instrumental Variable* approach in a *Conditional Mixed Process* model, which allows us to control for unobservable time-varying factors leading to endogeneity problems.

In the second chapter, we use data from the second and third wave of the SSIH to examine through which channel -economic or health- the pandemic most impacts Italian households' expectations on future spending. The panel structure of our data allows us to control for time-invariant individual heterogeneity, which could lead to an endogeneity problem, by implementing a sophisticated new identification strategy, as an *Instrumental variable* approach in a *Conditional Mixed Process* combined with the *Correlated Random Effect* method. This analysis is extremely relevant in order to single out policy measures useful to recover after a recession caused by infectious diseases. Overall, findings highlight that the pandemic creates new challenges for public policy on the need to find functional strategies to stimulate aggregate demand because health concerns could not be fully overcome by traditional macroeconomic policies.

The recent outbreak of Covid-19 was an unprecedented event, and it created an environment of uncertainty that prompted a collective sense of anxiety, and fear with consequences for the global economy. Governments around the world were faced sudden simultaneous health, economic and social challenges that have put a strain them in identifying policy measures capable to protect public health but at the same time to promote the economic recovery. Vaccines against Covid-19 appeared to be a key complimentary intervention because vaccinations not only keep people healthier, but they also lower health care costs, make it easier for people to return to the normal daily routine, to work, and increase overall economic activity. Therefore, given the importance of vaccination for the epidemic dynamics and faster economic recovery, it is necessary to improve understanding how a vaccination campaign needs to deliver information necessary to encourage people to decide to vaccinate.

In this perspective, in the last chapter, we investigate on the effect of information about severity of the Covid-19 on willingness to get the vaccine against the disease, using data from a special survey questionnaire of the Survey of Health, Ageing and Retirement in Europe, (SHARE), that was designed and conducted in all 28 European countries to examine the impact of pandemic on the health and living situation of the 50+ population. We exclude Italy from this analysis since at the time of the survey vaccination was compulsory. Nevertheless, we conduct the analysis for France and Spain, as these two countries share similar epidemiological profiles and vaccination strategies. We take advantage of the different age stratification used to disseminate information on the severity of the disease by the National Health Authorities of these countries, the "*Santé Publique France*" and the "*Centro de Coordinación de Alertas y Emergencias Sanitarias*", which are the French and Spanish National Health authorities respectively. We implement a *Regression Discontinuity Design* approach (RDD) to verify if any discontinuity in the willingness to get the vaccine against Covid-19 arises at two different cut-offs according to the age stratification used in national communication of Case

Fatality Rate (CFR). Results suggest that individuals respond “proactively” to the systematic exposure to news on risk of death from Covid-19, which may have produced an intensification of fear of contagion and anxiety according to the belonging to a specific age group, transforming individuals’ behaviour, and encouraging the decision to get the vaccine. In addition, this evidence confirms the sensitivity of individual behaviour to the communication strategy used for official statements and may be considered in support of our identification strategy used in the first chapter for Italy.

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Chapter I

Chapter I

Health Concerns and Consumption Expectations During Covid-19: Evidence from a Fuzzy Regression Discontinuity Design

Abstract:

Using novel microdata from the Bank of Italy's Special Survey of Italian Households, we study the determinants of consumption expectations during the Covid-19 pandemic. The dataset spans the period of August-September 2020 and contains quarterly observations of about 2,000 households. We apply a Fuzzy Regression Discontinuity Design to study the causal effects of fear of Covid-19 on consumption expectations exploiting the discontinuous relationship between age and level of perceived fear to contract the virus. Results highlight that the impact of the pandemic outbreak on consumption expectations operates through health concerns related to households' fear of contagion. This evidence provides a powerful tool to public policy in order to find functional strategies to stimulate aggregate demand during recessions generated by a pandemic. Appropriate policy instruments should be aimed at restoring consumer confidence and reducing the fear of contagion, strengthening the National Health Care System in order to provide effective and timely health services to enhance people's mental health and well-being.

1. Introduction

The new coronavirus outbreak emerged in Wuhan, China, and spread to the rest of the world with a dramatic human and social impact, prompted the governments of many countries to impose measures capable to contain the pandemic and protect public health. At the same time, these interventions have led to huge disruptions of labour markets, causing major income losses and sparking uncertainty about the future and fears of an impending economic crisis. Consequently, consumers' behaviour changed during the pandemic. Empirical evidence suggests that in the whole world, propensity to save reached a twenty-year-high, while consumption decreased much more than gross disposable income. This occurrence is depicted in Fig. 1.1 in the Appendix for Italy, as well as for other EU countries and the UK.

[Fig. 1.1]

This evidence is in conflict with standard economic models of consumption smoothing which suggest that since households prefer to maintain a stable level of spending, during recessions income falls more than consumption. This sudden increase in the saving rate in response to the pandemic may be related to different explanations. First, government restrictions such as lockdowns severely reduced consumption opportunities, thus driving an involuntary increase in savings. Secondly, as uncertainty about the future has increased, people are expected to increase their precautionary savings. Additionally, it is well documented that infectious diseases are associated with fear, anxiety, and other psychological disorders and Covid-19, as an infectious disease, could have caused psychological distress leading to changes in consumption behaviour. Thus, another explanation could be that the outbreak of the pandemic may have operated through the fear of contagion generated a reduction in consumption since individuals may voluntarily decide to limit their shopping activities in order to abate the infection's risk. Investigating determinants of spending decisions at the micro level during epidemics plays a key role in setting appropriate policy instrument to curb its recessive effects. Therefore, understanding to what extent consumption is constrained by health concerns is extremely relevant in order to single out measures useful in order to shape the dynamics out of the downturn. If consumer spending is constrained by health concerns government should restore consumers' confidence by addressing health care, while traditional macroeconomic tools that stimulate aggregate demand might have a reduced capacity to boost consumption and promote economic recovery. The

difficulties in finding the right policy to exit from the economic recession generated by a pandemic are highlighted in the most recent literature.

In order to shed some light on this topic we analyse the spending plans of Italian households during the pandemic period August-September 2020. The novelty of our study consists in evaluating consumption expectations rather than actual choices since this allows us to examine unconstrained potential behaviour and manage problems related to the occurrence of government restrictions such as lockdowns. Despite the central role economic analysis allocates to agents' expectations in their decision making, the standard practice of economists has been to infer decision processes from data on observed choices often making non verifiable assumptions on expectations. Indeed, most of previous empirical studies on how the current pandemic impacts household spending, use transactional data (Baker et al. (2020), Chronopoulos et al. (2020), Chen et al. (2020), Andersen et al. (2020a)) or retrospective survey on consumption (Coibion et al. (2020)). Generally, a basic difficulty with data measuring actual consumption is that observed choices may be consistent with many combinations of expectations and preferences, and especially in the presence of imposed lockdowns, actual choices may be forced by impediments imposed by law. Recently, a growing body of research that uses subjective expectations data of spending, income, employment, retirement, inflation, stock value, marriage, longevity, moving, crime, etc. in order to understand economic facts (Wilbert van der Klaauw, 2022). This practice is generated by the awareness of the potential value of expectations data for the purposes of predicting choice behaviour and understating how expectations are formed. The expectation data used in our study have been collected by a strategic survey, which is an experimental method that enables causal identification by generating controlled within-person exogenous variation in economic environment.¹ Respondents participate to a survey where they are asked to indicate their behaviour in hypothetical scenarios that may be observed in practice. These survey responses are used to identify cleanly the phenomenon of interest. Hence, for our analysis we decide to use data on consumers respondents and to exploit answers on expected consumption frequency in hypothetical pandemic scenarios in terms of daily Covid-19 cases. We use the second wave of the Bank of Italy's Special Survey of Italian Households (SSIH) a survey that interviews, since April 2020, about 2,000 households. The survey is designed to fill the information gap and gather timely information on the economic situation of households during the Covid-19 crisis in Italy, asking questions on the way that households perceive the economic consequences of the pandemic, including data on consumption and saving decisions.

¹ A valuable reference is Ameriks et al. (2011).

In terms of methodology, we investigate the causal effect of fear of contagion on households' expectation on consumption changes via an identification strategy that is based on a Fuzzy Regression Discontinuity Design (FRDD), which addresses the potential endogeneity which arises when one or more explanatory variables are correlated with unobservable variables. In order to build our experimental design, we consider that in Italy according to data from the Covid-19 integrated surveillance reports coordinated by the "*Istituto Superiore di Sanità*" (ISS), the disease severity, as measured by the Case Fatality Rate (CFR) increases steeply in individuals aged 60-69, namely it rises from 2,7% for those aged 50-59 to 10,8% in those in the 60-69 age group.² Crucially, the statistics on the severity of the consequences of the disease were daily conveyed by mass media considering these age groups. Therefore, it seems plausible to suppose that the perceived fear of Covid-19 infection increases with age and that a cutoff arises between the two age-groups highlighted above. Our FRDD relies on the fact that a higher level of perceived fear is defined as a discontinuous function of the respondent's age, considering that at the threshold we observe similar individuals who have a different perception of infection's risks since they have been informed by official sources that they have a different resistance to it.³ Using this identification strategy, we show that the effect of fear of contagion on spending decisions is significant, leading to a reduction in future spending.

The paper proceeds as follows. The next section is a review of the existing literature. In Section 3, the dataset is described, and the variables used in the analysis are defined. Section 4 presents the identification strategy. Section 5 summarizes the main results. Section 6 presents a robustness check. Section 7 concludes.

2. Previous Literature

As the pandemic runs, studies on the economic consequences of Covid-19 also started to become more numerous since investigation on how household spending reacts in a global pandemic is relevant to devise policies that stimulate recovery. Initially, the exploration of the impact of Covid-19 on consumers' decisions was made possible by advances in information technology that have enabled the real-time collection of transaction-level data and allowed researchers to analyse consumer expectations and spending patterns as they occur, whereas official statistics are often produced with a significant time delay. Early empirical studies, such as Baker et al. (2020), Chronopoulos et al.

² Task force COVID-19 del Dipartimento Malattie Infettive e Servizio di Informatica, Istituto Superiore di Sanità. Epidemia COVID-19, national update: 28 August 2020

³ See Lee and Lemieux 2010; Angrist and Pischke 2009.

(2020), are mainly concerned with the timing of the heterogeneity of the response of different expenditure categories during the outbreak. Baker et al. (2020) use transactional data for the US and observe that at the start of the pandemic spending increased sharply, but this initial increase was followed by a decrease of about 25-30% in the middle of March. Other studies explore the consumer spending behaviour outside the US, using high-frequency data. Chronopoulos et al. (2020) find that consumer spending in UK remained relatively stable in the early stages of the Covid-19 pandemic, while in the latter stage, when the government imposed lockdown, it declined quite significantly. Spending reduction vary across product categories, so that non-essential items such as dining, travels, entertainment were the most severely hit, whereas in an initial phase, groceries consumption increased as households stockpiled essential goods. This evidence is consistent with other studies, such as Chen et al. (2020), Andersen et al. (2020a) study the response of household spending in China and Denmark, respectively. Other authors explore the stay-at-home effects on consumer behaviour. Coibion et al. (2020) analyse how the differential timing of local lockdowns due to Covid-19 causally affects households' spending and macroeconomic expectations finding that local economic conditions and households' expectations about the economy are significantly affected by government restrictions. Alexander and Karger (2021) find that the stay-at-home orders cause a large reduction in spending in sectors that require mobility and in-person physical interaction. These results are consistent with those Chetty et al. (2020) and Cox et al. (2020) who report that high-income households reduced spending mainly because of concerns about the risk of infection rather than for the fear of a reduction in income or wealth. They show that roughly two-thirds of the reduction in spending came from reduced spending on goods or services that require in-person contact and thereby carry out a risk of Covid-19 infection. In addition, they find that spending in services that require personal contacts remained depressed even during gradual reopening order.

In line with these results, Andersen et al. (2020b) exploit a natural experiment to investigate the effects of the virus considering the orders aiming to contain it comparing Denmark and Sweden, which were countries similarly exposed to the pandemic but implemented different restrictions on social and economic activities. They find that the vast majority of the fall in economic activity during the pandemic crisis can be attributed to perceived disease risks rather than to government restrictions. The causal effect of government policy on the economy during the initial spread of Covid-19 is also examined by Goolsbee and Syverson (2021). Their findings suggest that the largest decrease in commercial activity is due to individuals' voluntary decisions to disengage from commerce rather than government-imposed restrictions on activity, reflecting people's concerns that commerce may expose them to the virus. Eichenbaum et al. (2021) highlight how the pandemic has both a supply and a demand effect, since people cut back on consumption and work in order to reduce the chances

of being infected. These effects interact exacerbating the size of the recession caused by the epidemic. Hence, according to the authors, the answer to the question “what policies should the government pursue to deal with infection externalities?” points toward containment measures which saved roughly half million lives in the US. These findings are consistent with the results of Correia et al. (2020), who study the economic effects of the largest influenza pandemic in U.S. history, the 1918 Flu Pandemic. They find that in a pandemic, economic activity slows down in the absence of non-pharmaceutical interventions (NPIs) such as social distancing, since households reduce consumption and labor supply in order to decrease their risk of becoming infected. Fear of contagion leads households to be prudent and keeps people away from activities that expose them to a higher risk of being infected, becoming the main reducer of economic activity.

Immordino et al. (2021) build on this literature providing new evidence for Italy, based on data from an ad hoc designed household Survey on Covid-19 and Consumption (SCC) and questions about perceived risk of contracting Covid-19 in various hypothetical situations. Relying on information on consumers’ concerns about the risk of contagion during in-person shopping and services requiring in-person contacts, they find a positive correlation between consumption drops and the fear of contagion. These conclusions are partially shared by Guglielmetti and Rondinelli (2021), using data from the Special Survey of Italian Households (SSIH, Bank of Italy), who find a strong impact of the fear of contagion on consumption choices, independently of government orders restrictions. However, these papers provide just a descriptive analysis of the phenomenon so that their main drawback is that it is not possible to claim causality from the mere association of the fear of contagion to the expected consumption drop.

The novelty of our approach is that we apply a solid identification strategy that allows us to provide evidence on the existence and on the direction of causality between these two variables by implementing a Fuzzy RDD which relies on an exogenous threshold in the fear of contagion generated by the perceived increasing risk of infection after the age of sixty.

3. Data

The empirical analysis in the present study is based on data from the Special Survey on Italian Households (SSIH) conducted by the Bank of Italy, every three months, starting from April/May 2020. We use data from the second edition of the SSIH, conducted in the summer (between August

and September 2020) and covering over 2,300 individuals⁴. Apart from basic socio-demographic variables (age, gender, education and occupational status), the survey includes questions on economic and labour market prospects, financial situation, saving and consumption choices. In particular, considering expected consumption the survey reports answers to the question “*Consider the expenditure for food, clothing and footwear, home goods and services. How will your household change total expenditure for these items in the next 3 months?*” recording if consumption is expected to increase, stay the same or decrease.⁵

Tables 1.1–1.2, in the Appendix, provide some descriptive statistics on the household’s head and define the control variables. We use sample weights to make the statistics population-representative.

As regards the construction of the fear of contagion indicator we exploit some relevant information arising from the interview. Indeed, this dataset may be thought of as a strategic survey which asks to the head of households: “*Compared to ordinary times, how frequently would you do the following activities [...] if the daily Covid-19 cases in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.*” And the answers are categorized according to the following indicators: 1 = *I would stop doing it/rarely*; 2 = *less often*; 3 = *with the same frequency*; 4 = *a little more often*; 5 = *I would do it more frequently*.

Starting from this survey question, that indicates how spending on different categories of goods and services (i.e., essential goods, clothing, furniture, bars-restaurants-hotels and personal services) would vary depending on the number of contagions per day in the region of residence, we construct our measure of fear of infection, *Fear*. We consider activities of purchasing non-essential goods and services that require social interactions or the non-use of the face mask, like purchases in physical stores selling clothing and footwear, personal services, and restaurants, coffee bars and hotels, because during these activities Covid-19 can spread more easily.⁶ Moreover, in order to check for the robustness of our results and to be confident that expected lockdowns of certain activities do not determine the expected behaviour of respondents, we also decide to consider the activity of purchasing essential goods because it was defined by government as a non-suspended activity, in any

⁴ The main results of the survey and the methodological aspects are described in the paper: “*The main results of the second wave of the special survey of Italian households in 2020*”(Covid-19 Notes, November 2020,) and in the box “Italian households during the epidemic: the Bank of Italy’s survey”, in *Economic Bulletin*, 4, 2020.

⁵ The specific wording of questions is reported in the Appendix.

⁶ According to WHO, the transmission of the Covid-19 virus spreads more easily in: Crowded places; Close-contact settings, especially where people have conversations very near each other; Confined and enclosed spaces with poor ventilation. Consequently, the risk of Covid-19 spreading is especially high in places where these “3Cs” overlap; “Coronavirus disease (COVID-19): How is it transmitted?” *World Health Organization*, 23 Dec 2021, www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted. Accessed: 27 December 2021.

epidemiological scenario assumed. For each of these activities, we construct an increasing ordered categorical variable, which assumes value from 0 (no fear) if individuals perform with the same frequency or more the activity considered in each assumed epidemiological scenario; to 4 (greater fear) when they declare to eliminate or drastically reduce these activities that expose them to infection, whatever the assumed epidemiological scenario.⁷

The construction of the variable *Fear* is illustrated in Fig. 1.2, in the Appendix.

4. Identification Strategy

In order to assess to what extent, the fear of contagion is relevant in determining spending decisions of Italian households we need to take into account endogeneity and reverse causality problems due to the simultaneous relationship between these two variables. The issue is related to the fact that households which consume less might think they are at a lower risk of infection, because they have fewer social interactions. In order to deal with endogeneity issues, we implement a Fuzzy Regression Discontinuity Design, using an exogenous variation in the fear of contagion related to belonging to a specific age group.

The general idea underlying an RDD is that it is possible to assign all units who have received a specific treatment, “treated”, on one side of a prefixed threshold and all other units who have not received the treatment, “control group”, on the other side. The variable used to assign units to the intervention is the running or forcing variable. The advantage of this analysis is that it makes possible to compare units with very similar values of the running variable, but different levels of treatment, to draw causal inference on the effect of treatment at the threshold. In the fuzzy design, the realized value of the forcing variable does not determine the receipt of the treatment in a deterministic way. This methodology is based on the assumption that a value of the forcing variable, falling above or below the threshold, acts as an incentive to participate in the treatment. The design implemented in this study exploits variation in the perception of health risks in different age groups. It has been well documented that age appears to be a crucial factor in Covid-19 health outcomes. In all European regions, fatalities caused by Covid-19 are mostly concentrated in older age groups. National media outlets provided daily reports and updates concerning the Coronavirus pandemic, reporting on the number of infected, quarantined, hospitalized and deaths, and emphasising that advanced age is a risk factor for Covid-19 mortality. One of the terms we see most often is Case Fatality Rate, or CFR which

⁷ The value assumed by the variable increases as the threshold of assumed Covid-19 cases above which respondents decide to eliminate or drastically reduce frequency with which they perform the activity considered decreases.

is a recognized measure of severity among detected cases.⁸ We argue that systematic exposure to news on CFR related to the Covid-19 pandemic may have produced an intensification of fear of contagion and anxiety according to the belonging to a specific age group, transforming individuals' behaviour, and boosting preventive conducts. In Italy official statistics reported that individuals aged 60-69 had significant higher health risks with respect to other groups, and daily official statements informed population of this risk.⁹ Therefore, it seems plausible to suppose that the perceived fear of Covid-19 infection increases with increasing age. Remarkably, all mass media communications focused on stacked age groups separating individuals in the 50-59 age group from those in the 60-69 one. Consequently, we could observe similar individuals who have just few months of age difference, who have a different perception of the risk of the disease simply because they classify themselves in different, *a priori* defined, age groups. Thus, to study the causal effect of fear of Covid-19 on consumption expectations, we use a Fuzzy Regression Discontinuity Design relying on the fact that a higher level of perceived fear is defined as a discontinuous function of the respondent's age. In our dataset individual's age in years at the time of the survey is reported. However, we have to consider that age is a sociodemographic variable, and the accuracy of actual age perception depends on numerous factors such as literacy, occupation, socioeconomic status, and so on. Indeed, misstatement of age is a common example of content error in surveys. We therefore set our cut-off at 62 age, to make sure that the respondent is of an age that makes him to identify in the 60-69 age group and therefore to perceive the risk of a higher CFR. We employ a fuzzy discontinuity approach since the respondent's age will not perfectly predict fear of Covid-19. Indeed, some respondents will not be afraid of contracting the virus, even if they are older, these individuals are labelled as "never-takers" while others could have higher levels of fear of contracting the virus even if they are younger, "always-takers". A fuzzy discontinuity design explicitly allows for the presence of "never-takers" and "always-takers" by utilising the age to predict a jump in the fear of contracting the virus at the cut-off (Imbens and Lemieux, 2008). We can use such discontinuities to produce instrumental variable estimators of the effect of the treatment on expected consumption.

The advantage of our identification strategy consists also in the fact that it allows us to get rid of problems arising from the presence of government restrictions, such as lockdowns, which constraint individual behaviour. Indeed, even if it is true that we use expectations on consumption, it may be that individual forecasting takes into account expected lockdowns, according to the hypothetical

⁸"Estimating mortality from Covid-19" *World Health Organization*, 4 August 2020, <https://www.who.int/news-room/commentaries/detail/estimating-mortality-from-covid-19>, Accessed: 27 December 2021.

⁹ Task force COVID-19 del Dipartimento Malattie Infettive e Servizio di Informatica, Istituto Superiore di Sanità. Epidemia COVID-19, national update: 28 August 2020

contagion scenario. However, as far as at the threshold we compare similar units, this effect should be uninfluential for our inference.

5. Results

5.1. Naïve Method: Ordered Probit

Before showing the results of the RDD analysis, we provide some evidence on the correlation between consumption expectations and socio-economic variables as well as the fear of contagion. Therefore, if we are prepared to assume that all variables are exogenous, we can employ an Ordered Probit to estimate the following equation:

$$Exp_{C_changes_i} = \alpha + \beta_1'X_i + \beta_2'L_i + \beta_3'EXP_i + \beta_4'Fear_i + u_i \quad (1.1)$$

where the dependent variable $Exp_{C_changes_i}$ indicates the expectations on consumption changes and it is an ordered discrete outcome variable. The outcome variable was recoded so that the higher value corresponds to the expectation of an increase in consumption expenditure in the next three months. Therefore, it takes the value of 0 for households that expect a decrease in their total spending for food, clothing and footwear, home goods and services in the next three months; 1 if their total spending will remain the same and 2 if they expect an increase; X_i is a vector of respondent's characteristics (age, gender, marital status, family size, qualification, education, geographical area of residence); L_i are dummies variables that approximates liquidity constraints, based on the subjective evaluation that households make about their general economic condition in making ends meet. Following the literature on how expectations about future growth affect households' consumption plans (Coibion et al. (2020)), we control for the personal macroeconomic expectation, i.e. their personal expectation on the development of the general economic situation in Italy and the labour market, EXP_i ; and we also include the expectation about their employment status in the near future, which is a variable that takes the value 1 if the self-reported probability of losing the job in the next 12 months is higher than 50% for the head of household and another employed household member; it assumes 2 if the probability of losing the job is higher than 50% for both the head of household and another employed household member, in relation to the number of income earners in the household, and 0 otherwise. Finally, we introduce the key variable that is at the heart of our analysis, $Fear_i$, for the fear of contagion, that indicates how spending in goods and services requiring social interaction would vary depending on the number of Covid-19 cases per day in the region of residence as illustrated in the previous section. In Table 1.3 in the Appendix, we present the results including the specific fear of Covid-19's indicators. These preliminary estimates demonstrate that fear of

contagion is an important determinant of spending decisions of Italian households, with significant negative effects for each spending category. Moreover, the coefficients suggest that the probability of a consumption drop is higher for younger people; the expected expenditure has a U-shape profile over the life cycle, as demonstrated by the coefficients in age and age squared. Self-employed and unemployed are more likely to expect a fall in consumption in the next three months. In addition, being subject to liquidity constraints - captured by the variable *make ends meet* - increases the possibility of cutting future expenditure compared to wealthy households. As expected, consumption expectations decrease for those foreseeing a worsening in labour market perspectives. Although interesting correlations may result from this preliminary investigation, we should be aware that the fear of contagion in Eq. (1.1) is potentially endogenous due to the simultaneous determination of fear of contagion and consumption expenditure expectations. Households which consume less might think they are at lower risk of infection because they have fewer social interactions generating a reverse causality problem. Thus, not considering endogeneity issues would likely lead to biased estimates which do not reflect the underlying causal relationship.

5.2. Fuzzy Regression Discontinuity Design

Dealing with endogeneity issues requires using an exogenous variation to identify the coefficients of interest as illustrated in Section 4. Hence, we implement our fuzzy RDD considering the *Fear* of contagion as the outcome variable, and we set the cut-off point at the age of 62. A graphical analysis of our RDD study is presented in Fig. 1.3.

[Fig. 1.3]

In Fig. 1.3 we represent with dots the sample average within each bin of indicators of fear for the different activities against the respondent's age. The continuous line predicts the values of a 4-order polynomial, estimated separately on each side of the cut-off point represented by the vertical line at the respondent's age 62 in years. In panels (a), (b), (d) of Fig. 1.3 it clearly emerges a jump in the relationship between the outcomes (Fear's indicators) and the respondents' age variable in the proximity of the threshold. The discontinuity of the outcome variable constructed considering the spending on beauty and personal care services, at the cut-off is not significant (panel (c) Fig.1.3), and this could be explained by the fact that this activity is not usual for men after their fifties, who are those representing a large share of our sample of head of households (57% of the sample is

represented by men with more than 54 years age). Hence, it is plausible that reducing this type of purchase might not actually capture the fear of being infected. Considering this, we decided to discard this spending category from our further analyses. A nonparametric RDD approach is then implemented. This approach tries to produce reliable estimates focusing on small samples to the right and to the left of the cut-off point (bandwidths), through the so-called Local Linear Regressions and Polynomial Regressions that represent a sort of Weighted Least Squares estimations of Eq. (1.1), where the weights are larger the closer the observations are to the cut-off. The Panel (a) of the Table 1.4 reports our first stage estimates, where the outcome variables are *Fear_essentialg*, *Fear_clothing*, *Fear_restaurants* (in columns (1), (2), (3), respectively). The cut-off is equal to 62 years old. On the other hand, in Panel (b) of the Table 1.4 we can see the results from the second stages estimates, which the dependent variable is the expectation on consumption changes, *Exp_C_changes*. We use a Triangular Kernel, a linear polynomial and a data driven bandwidth selection, that selects different bandwidths for different outcome variables. We have also carried out the estimates including our covariates that we used in the naïve method. The results show that the effect of fear of contagion on spending decisions in the next three months is negative and statistically different from zero.¹⁰ In other words, the fear of being infected increases the probability that Italian households will reduce future spending on essential goods.

5.3. Check the validity of RDD

In this section, we check the validity of the RDD. There are two key identification assumptions in the context of RDD: there is no “manipulation” of the forcing variable and so the cut-off provides exogenous variations in the treatment; and “continuity”, respondents just above and below the cutoff point should be similar, it means that observable and unobservable characteristics do not vary discontinuously at the cut-off. In our case manipulation of the forcing variable is unreasonable, respondents cannot decide their age. However, we decide to plot a histogram of the density of the forcing variable (respondent’s age) around the cut-off as suggested by McCrary (2008) to test for the existence of manipulation.

[Fig. 1.4]

The graph does not show any evidence of jumps. Since there is no discontinuity in the distribution of the respondent’s age at the cut-off point, we are reassured that this variable was not manipulated by

¹⁰ We also conduct the analysis on the previous age range 40-49, to check the robustness of our results. As expected, we do not obtain any statistically significant results.

the respondents. However, we decide to carry out the formal McCrary test, using local polynomial density estimation and find a coefficient of 0.478, which, with a p -value= 0.633, is far from being significant; the null hypothesis is not rejected suggesting there is no self-selection or sorting of units into the treatment around the cut-off.

To check for continuity assumption, we examined the continuity of observed covariates; we conduct a parallel RD analysis on covariates to determine whether they are continuous at the threshold at the respondent's age of 62 years.

[Fig. 1.5]

According to Fig. 1.5 in the Appendix, there seems that observable characteristics are all sufficiently continuous at the cutoff, assuring the similarity of the two groups around the cutoff, confirming that the effect estimated in our main analysis is not due to any spurious correlation between the age and other factor.

5.4.RD with discrete running variable

In what follows we take into account the problem that our running variable (age in years) is discrete, and this poses some problems in regression discontinuity design.¹¹ We decide to address these concerns by implementing honest and efficient confidence intervals in regression discontinuity designs using procedures from Armstrong and Kolesár (2020), Armstrong and Kolesár (2018) and Kolesár and Rothe (2018). These authors point out that the discreteness of the running variable causes problems if the number of support points close to the cutoff is so small that using a smaller bandwidth to make the bias of the estimator negligible relative to its standard deviation is not feasible. We implement the approach of bounding the second derivative (BSD) using Armstrong and Kolesár (2020) rule of thumb for a bound on the second derivative of the conditional mean function. Our nonparametric estimates, using BSD inference for the different indicators of fear of contagion as an outcome variable are reported in Table 1.5 in the Appendix. The results are quite similar to those obtained in the previous section. Indeed, the discontinuous relationship between the outcomes (Fear's indicators) and the respondents' age variable in the proximity of the cutoff, 62 years, with honest standard errors is always statistically significant.

¹¹ The confidence interval, based on the conventional standard error for inference, might not be appropriately centred, and thus undercover in finite samples.

In the next section to check the robustness of our findings, we use a different estimation method to address the endogeneity problem.

6. Robustness Check

6.1. Conditional Mixed Process

The endogeneity problem in nonlinear models requires careful consideration as the Standard Two Stage Least Squares (2SLS) approach may produce inconsistent estimates (Wooldridge, 2010), one alternative to 2SLS is the Control Function (CF) approach, which involves estimating the first stage using a consistent linear or non-linear estimator, then including the residual from the first stage in the second stage with the endogenous variable still included. However, the key assumption of the CF approach requires that the residuals from the first stage are continuous, which would not hold if the endogenous variable were discrete (Papke and Wooldridge, 2008). Therefore, given that in our case the endogenous regressor is an ordered variable, we cannot use the CF approach, so we need to find an alternative approach: the Conditional Mixed Process (CMP) developed by Roodman (2011). This approach can be used for the IV analysis by allowing the residuals of the first and second stage to be correlated. The fully observed recursive CMP model assumes that the underlying model is based on a general Seemingly Unrelated Regression (SUR) framework and allows that the individual equations need not be classical regressions with a continuous dependent variable;¹² the system can consist of binary, ordered, categorical or censored equations. Broadly, the CMP is appropriate for two classes of models: those in which the posited data-generating process is fully modelled; and those in which some equations are structural, while others are reduced form, providing instruments for identification of the parameters in the structural equations, as in two-stage least squares. In the first case, CMP is a full-information maximum likelihood (FIML) estimator, and all estimated parameters are structural. In the latter, it is a limited-information (LIML) estimator, and only the final stage's or stages' coefficients are structural (Roodman, 2011).

We therefore use the CMP model to estimate the following system of equations:

¹² SUR model is a system of linear equations with errors that are correlated across equations for a given individual but are uncorrelated across individuals.

$$\text{I Stage: } Fear_i^* = \varphi + \delta Over_62_i + \beta'_1 X_i + \beta'_2 L_i + \beta'_3 EXP_i + \varepsilon_i \quad (1.2)$$

$$\text{II Stage: } Exp_{C_{changes}_i} = \alpha + \beta'_1 X_i + \beta'_2 L_i + \beta'_3 EXP_i + \beta_4 Fear_i^* + u_i \quad (1.3)$$

where *Over_62* is our instrumental variable, which is equal to 1 if the respondent's age is more than 62 years old, and 0 otherwise. The choice of this instrumental variable is based on the fact that the age threshold is exogenously determined by the perception of infection risks induced by official statements that provide information for specific age groups. In the Appendix at the bottom of the Table 1.6, we can see that the *atanrho_12* statistic is significant, thus suggesting that there are unobserved factors that simultaneously influence the dependent variable, consumption expectations, and the independent variables, indicators of fear of contagion. In fact, this parameter measures the covariance between the error terms in Eq. (1.2) and Eq. (1.3). Therefore, the indicators of the fear should be considered endogenous. Overall, we find quite similar results to those obtained with the RDD analysis: the fear of Covid-19 increases the probability of reporting downward consumption expectations, suggesting that the evolution of expenditure is affected by health concerns due to the severity nature of the virus, and hence may not be fixable through traditional macroeconomic interventions.

7. Conclusions

The paper uses novel micro-data from the Bank of Italy's Special Survey of Italian Households (SSIH) to examine the causal effect of fear of Covid-19 on consumption expectations during the pandemic. This analysis is extremely relevant in order to set sound policy measures to recover after a recession caused by infectious diseases. Our findings highlight that the fear of contracting the virus induces a change in consumers' behaviour and constraints individual choices. Until now, existing literature has just provided a descriptive analysis on the interrelationships between these variables. The novelty of our analysis consists in providing a neat evidence on the causal impact of the fear of contagion on expected consumption using an identification strategy that overcomes endogeneity problems and drawbacks related to the presence of government restrictions. Moreover, the use of expectations rather than actual spending has the advantage of examining unconstrained potential behaviour and manage problems related to the fact that observed choices may be consistent with many

combinations of expectations and preferences, and especially in the presence of imposed lockdowns, these may be forced by impediments imposed by law. In the more recent literature, these considerations have generated an increasing awareness of the potential value of expectations data for policy.

Fear of contagion may depend on unobservable characteristics that lead to endogeneity problems. Thus, in order to address these issues, an exogenous variation in the fear of contagion is used in order to identify the coefficients of interest. We exploit the discontinuity in the fear of contagion observed for people above a specific age threshold to implement a fuzzy RDD. The age threshold is exogenously determined by official statements that in Italy informed individuals that the CFR for those above 60-year age is nearly four times higher compared to that of younger age groups. Our results, provide evidence that the fear of contagion has a relevant impact in determining consumption expectations.

Understanding to what extent consumption is constrained by health concerns is extremely relevant to single out measures useful to shape the dynamics out of the downturn. If consumer spending is constrained by health concerns government should restore consumers' confidence by addressing health care, while traditional macroeconomic tools that stimulate aggregate demand might have a reduced capacity to boost consumption and promote economic recovery. Taken together, our findings suggest that the evolution of expenditure is affected by health concerns due to the infectious nature of the pandemic, and hence may not be fixable through conventional macroeconomic tools. Therefore, government should find functional strategies to stimulate aggregate demand, because traditional policies aimed at stimulating consumption expenditure may have reduced stimulus capacity or may be ineffective in the long-term. In this sense, our estimates highlight that the pandemic outbreak has created new challenges for public policy, which should find functional strategies to restore economic activity considering that the infectious nature of Covid-19 impacts economies through the psychological aspect of the population. Therefore, aggregate demand stimuli require appropriate policy instruments aimed at restoring consumer confidence and reduce the fear of contagion, strengthening the National Health Care System to provide effective and timely health services to all, and investing in people's mental health and well-being.

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Appendix

Survey Questions

-a- Consider the expenditure for food, clothing and footwear, home goods and services. How will your household change total expenditure for these items in the next 3 months?

- Will increase
- Will stay the same
- Will decrease

-b- Compared to ordinary times, how frequently would do the following activities if the daily Covid-19 cases in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.

1 = I would stop doing it/rarely; 2 = less often; 3 = with the same frequency; 4 = a little more often; 5 = I would do it more frequently

	<10					between 10 to 100					between 100 to 1000					>1000				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Shop For Food And Essential Goods																				
Make Purchases In Store Of Clothing, Etc																				
Go To The Salon/Barber/Cosmetician																				
Go Out To Shop Household Goods Or Furniture																				
Visits To Hotels/ Restaurants/Bars																				

Appendix Tables and Figures

Table 1.1: Household heads Summary Statistics

	Mean	Std. Dev.	N
Age (years)	57.742	15.151	2346
18-34	0.068	0.252	2346
35-44	0.158	0.364	2346
45-54	0.208	0.406	2346
55-64	0.185	0.388	2346
Equal/more than 65 years	0.381	0.486	2346
Male	0.685	0.465	2346
Female	0.315	0.465	2346
Married	0.519	0.499	2077
Family size	2.383	1.288	2346
N. of income earners	1.346	0.795	2346
Qualification:			
None/Primary School Certificate	0.192	0.394	2346
Lower Secondary School Certificate	0.373	0.484	2346
Upper Secondary School Certificate	0.295	0.456	2346
University Degree	0.141	0.348	2346
Occupation:			
Fix-Term employee	0.042	0.201	2346
Self-employed	0.099	0.298	2346
Unemployed	0.156	0.363	2346
Retirees	0.345	0.475	2346
Resident in the North	0.491	0.500	2346
Resident in the Centre	0.201	0.401	2346
Resident in the South	0.307	0.462	2346
Note. Statistics are computed using sample weights			

Table 1.2: Summary statistics of the control variables

	DESCRIPTION	Mean	Std. Dev.	Min	Max	N
Making ends meet (very difficult)	Dummy variable equal to 1 if households report very difficult in making ends meet; and 0 otherwise;	0.230	0.421	0	1	2346
Making ends meet (difficulty)	Dummy variable equal to 1 if households report difficulty in making ends meet, and 0 otherwise;	0.338	0.473	0	1	2346
Making ends meet (easily)	Dummy variable equal to 1 if households report easily in making ends meet, and 0 otherwise;	0.295	0.456	0	1	2346
Making ends meet (very easily)	Dummy variable equal to 1 if households report very easily in making ends meet, and 0 otherwise;	0.137	0.343	0	1	2346
Exp. on economic situation (worsen)	Dummy variable equal to 1 if households expect the economic situation to worsen in the next 12 months, and 0 otherwise;	0.485	0.499	0	1	2346
Exp. on economic situation (stay the same)	Dummy variable equal to 1 if households expect the economic situation to stay the same in the next 12 months, and 0 otherwise;	0.219	0.414	0	1	2346
Exp. on economic situation (improve)	Dummy variable equal to 1 if households expect the economic situation to improve in the next 12 months, and 0 otherwise;	0.202	0.402	0	1	2346
Exp. on labour market (worsen)	Dummy variable equal to 1 if households expect the labour market to worsen in the next 12 months, and 0 otherwise;	0.525	0.499	0	1	2346
Exp. on labour market (stay the same)	Dummy variable equal to 1 if households expect the labour market to stay the same in the next 12 months, and 0 otherwise;	0.214	0.410	0	1	2346
Exp. on labour market (improve)	Dummy variable equal to 1 if households expect	0.190	0.392	0	1	2346

the labour market to improve in the next 12 months, and 0 otherwise

Exp. on consumption changes:	Answer to the question -a- (see Appendix).	0.318	0.466	0	2	2346
Will decrease	Multi-level dummy dependent variable	0.631	0.483			2346
Will stay the same	(0=will decrease; 1=will stay the same; 2=will	0.051	0.220			2346
Will increase	increase)					
Exp. on employment status	Ordered variable based on the self-reported probability of losing the job in the next 12 months for employed household members, in relation to the number of income earners	0.052	0.208	0	2	2,169

Note. Statistics are computed using sample weights

Table 1.3: Determinants of expectations on consumption changes: Ordered Probit approach

VARIABLES	(1) EXP. ON CONSUMPTION CHANGES	(2) EXP. ON CONSUMPTION CHANGES	(3) EXP. ON CONSUMPTION CHANGES	(4) EXP. ON CONSUMPTION CHANGES
Age	-0.0506** (0.0200)	-0.0500*** (0.0191)	-0.0506*** (0.0191)	-0.0491** (0.0194)
Age squared	0.000461*** (0.000171)	0.000460*** (0.000165)	0.000472*** (0.000164)	0.000456*** (0.000167)
Male	0.165 (0.101)	0.170* (0.0990)	0.194** (0.0982)	0.180* (0.0994)
Married	-0.0374 (0.0956)	-0.0365 (0.0942)	-0.0623 (0.0950)	-0.0142 (0.0938)
Family size	0.0484 (0.0373)	0.0443 (0.0355)	0.0629* (0.0366)	0.0573 (0.0359)
N. of income earners	-0.0261 (0.0491)	-0.0215 (0.0487)	-0.0302 (0.0491)	-0.0559 (0.0492)
Fix-Term employee	-0.226 (0.158)	-0.200 (0.162)	-0.170 (0.161)	-0.243 (0.154)
Self Employed	-0.375*** (0.110)	-0.350*** (0.113)	-0.321*** (0.111)	-0.388*** (0.112)
Unemployed	-0.512*** (0.187)	-0.577*** (0.184)	-0.513*** (0.178)	-0.588*** (0.182)
Making ends meet (very difficult)	-0.480*** (0.121)	-0.542*** (0.120)	-0.489*** (0.118)	-0.515*** (0.119)
Making ends meet (difficult)	-0.298*** (0.101)	-0.310*** (0.0981)	-0.300*** (0.0975)	-0.277*** (0.0978)
Making ends meet (easily)	-0.104 (0.0953)	-0.0992 (0.0918)	-0.0816 (0.0923)	-0.0570 (0.0925)

Exp. on the economic sit. (worsen)	-0.0748 (0.123)	-0.0639 (0.120)	-0.0653 (0.120)	-0.0755 (0.122)
Exp. on the economic sit. (stay the same)	-0.0222 (0.116)	-0.0553 (0.113)	-0.0448 (0.114)	-0.0201 (0.115)
Exp. on the labour market (worsen)	-0.221* (0.125)	-0.224* (0.121)	-0.208* (0.121)	-0.210* (0.124)
Exp. on the labour market (stay the same)	0.0927 (0.121)	0.115 (0.117)	0.139 (0.119)	0.0781 (0.120)
Exp. on employment status	-0.275 (0.177)	-0.337* (0.190)	-0.334* (0.187)	-0.321* (0.185)
Fear_essentialg	-0.0989*** (0.0218)			
Fear_clothing		-0.108*** (0.0218)		
Fear_personalservices			-0.103*** (0.0214)	
Fear_restaurants				-0.0931*** (0.0216)
Constant cut1	-2.600*** (0.599)	-2.636*** (0.568)	-2.533*** (0.569)	-2.557*** (0.578)
Constant cut2	-0.352 (0.590)	-0.362 (0.557)	-0.286 (0.559)	-0.284 (0.568)
Observations	1,740	1,789	1,806	1,799

Note. Table reports Ordered Probit estimates, with robust standards errors in parentheses. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. Reference category for occupational status is pensioner; reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve. The model includes three qualification dummies and two regional dummies.

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 1.4: RD Non-Parametric Estimates of the Fear of Covid-19 on Expectations on consumption changes

	(1) Fear_Essentialg	(2) Fear_Clothing	(3) Fear_Restaurants
First-stage estimates	0.648** (0.250)	0.617** (0.254)	0.507** (0.241)
Panel(a)			
	(1) EXP. ON CONSUMPTION CHANGES	(2) EXP. ON CONSUMPTION CHANGES	(4) EXP. ON CONSUMPTION CHANGES
RD Estimate	-0.378** (0.183)	-0.417* (0.218)	-0.492* (0.288)
Observations	1740	1789	1799
Covariates	Yes	Yes	Yes
Bw Type	Mserd	Mserd	Mserd
Kernel	Triangular	Triangular	Triangular
Eff. obs- Left of c	369	347	349
Eff. obs - Right of c	424	396	497
Bandwidth	10.314	9.307	9.553
Order polyn.	1	1	1

Note. Table reports in Panel (a) the first stage estimates; the outcome variables are the different fear's indicators and the running variable is the age of respondent. In parentheses Std. Err. adjusted for clusters in id. Panel (b) shows RD estimates using local polynomial regression. The estimates are implemented using the Stata program *rdrobust* by Calonico, Cattaneo, Farrell, and Titiunik. The dependent variable is the Expectation on consumption changes. The running variable: Age. Treatment Status: the above fear's indicators. Mserd indicates one common MSE-optimal bandwidth selector for the RD treatment effect estimator. Significance: *** p<0.01, ** p<0.05, * p<0.1

Panel(b)

Table 1.5: Estimates of discontinuities in Fear of Covid-19 at the age 62 with BSD inference

	(1) Fear_Essentialg	(2) Fear_Clothing	(3) Fear_Restaurants
M	0.060	0.054	0.077
Estimates	0.799*	0.759*	0.755*
BSD SE	0.376	0.351	0.395
Implied bandwidth	5.55	5.60	4.90

Note. The table reports the nonparametric RD estimates with BSD inference as discussed in Kolesár and Rothe (2018); the Implied bandwidth is the one that minimizes the length of the resulting CI for a given choice of M, which is a bound on second derivative of the conditional mean function using Armstrong and Kolesár (2020) rule of thumb. No covariates included.

Table 1.6: The causal effect of Fear of contracting the Covid-19: IV-CMP approach: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	EXP. ON CONSUMPTION CHANGES	Fear_Essentialg	EXP. ON CONSUMPTION CHANGES	Fear_Clothing	EXP. ON CONSUMPTION CHANGES	Fear_Restaurants
Fear_essentialg	-0.223* (0.262)	-	-	-	-	-
Fear_clothing	-	-	-0.511*** (0.0763)	-	-	-
Fear_restaurants	-	-	-	-	-0.448*** (0.113)	-
Over_62	-	0.509* (0.271)	-	0.442** (0.177)	-	0.338* (0.189)
Constant						
cut_1_1	-0.663 (7.261)		-11.22 (8.297)		-2.878 (6.681)	
cut_1_2	1.592 (7.282)		-9.341 (8.331)		-0.867 (6.727)	
cut_2_1	-7.000 -6.761 (7.222)		-15.61 (9.636)		-11.40 (7.378)	
cut_2_2	-6.318 (7.223)		-15.46 (9.636)		-11.24 (7.373)	
cut_2_3	(6.742)		-15.09 (9.640)		-10.90 (7.380)	
cut_2_4	-5.825 (7.224)		-14.60 (9.642)		-10.46 (7.379)	

atanrho_12

0.197*

0.826***

0.679**

(0.467)

(0.252)

(0.302)

Observations

793

793

743

743

821

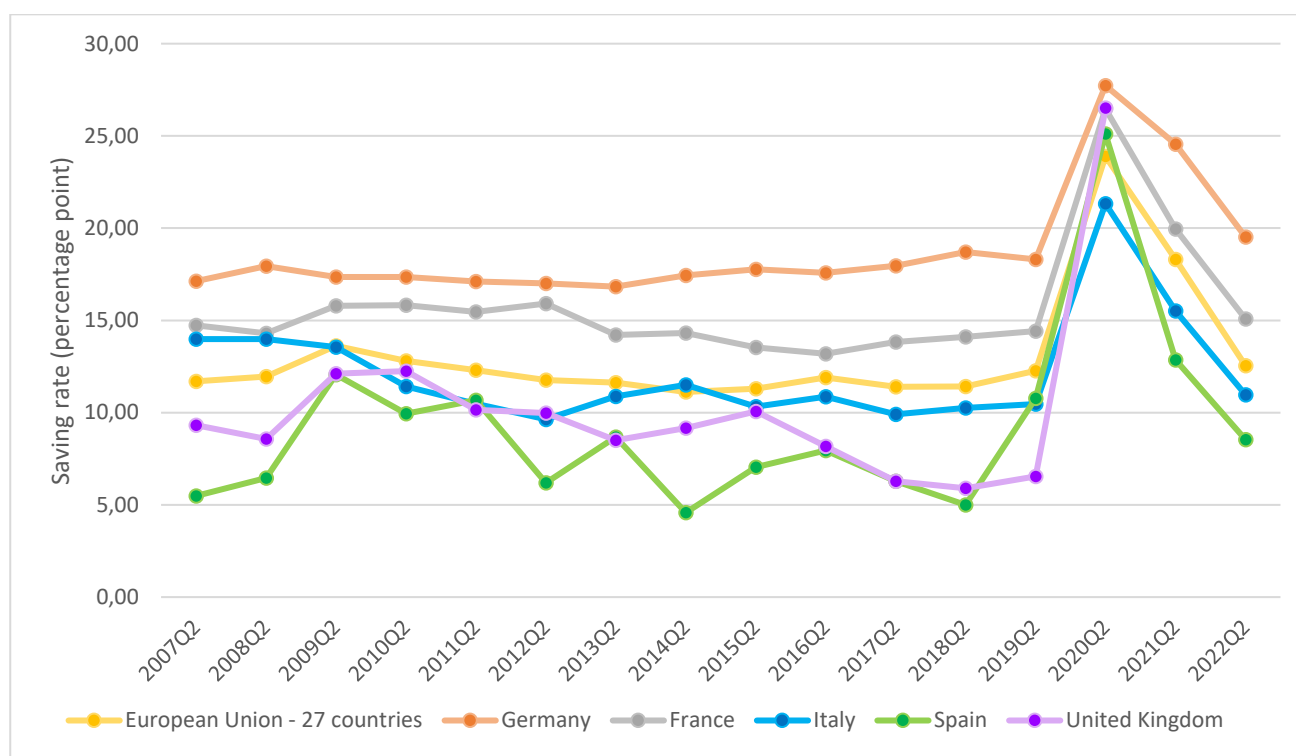
821

Note. The table reports the results of the CMP approach and robust standard errors in parentheses. EXP. ON CONSUMPTION CHANGES is an ordered discrete ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. Over_62 is the IV variable, which is equal to 1 if the respondent's age is more than 62, and 0 otherwise. The model includes age and age squared variables, a gender dummy, a marital status dummy, three qualification dummies and two regional dummies, two regional dummies, dummies for the expectations on economic situation, the labour market, and on the employment status, proxy for liquidity constraints.

cut_*_* are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Fig. 1.1: Gross households Saving rate in Q2 from 2007 to 2022
(Seasonally and calendar adjusted data)



Source: Eurostat. The gross saving rate of households is defined as gross saving divided by gross disposable income, with the latter being adjusted for the change in the net equity of households in pension funds reserves. Gross saving is the part of the gross disposable income which is not spent as final consumption expenditure. Indicator described is calculated on the basis of quarterly sector accounts data by institutional sectors. Household sector comprises all households, household firms and Non-Profit Institutions Serving Households. Data are expressed in percentage, in seasonal and calendar adjusted form. The United Kingdom left the European Union on 31 January 2020, and quarterly data from 2021 for British households are not available.

Fig. 1.2: Illustration of the answers considered to construct the fear indicators

	EPIDEMIOLOGICAL SITUATION																			
	<10					between 10 to 100					between 100 to 1000					>1000				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Shop For Food And Essential Goods (I case)			•	•	•			•	•	•			•	•	•			•	•	•
Shop For Food And Essential Goods (II case)																•	•			
Shop For Food And Essential Goods (III case)											•	•				•	•			
Shop For Food And Essential Goods (IV case)						•	•				•	•				•	•			
Shop For Food And Essential Goods (V case)	•	•				•	•				•	•				•	•			

The question is: *Compared to ordinary times, how frequently would do the following activities if the daily Covid-19 cases (Epidemiological Situation, ES) in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.*

Indicator of Frequency:

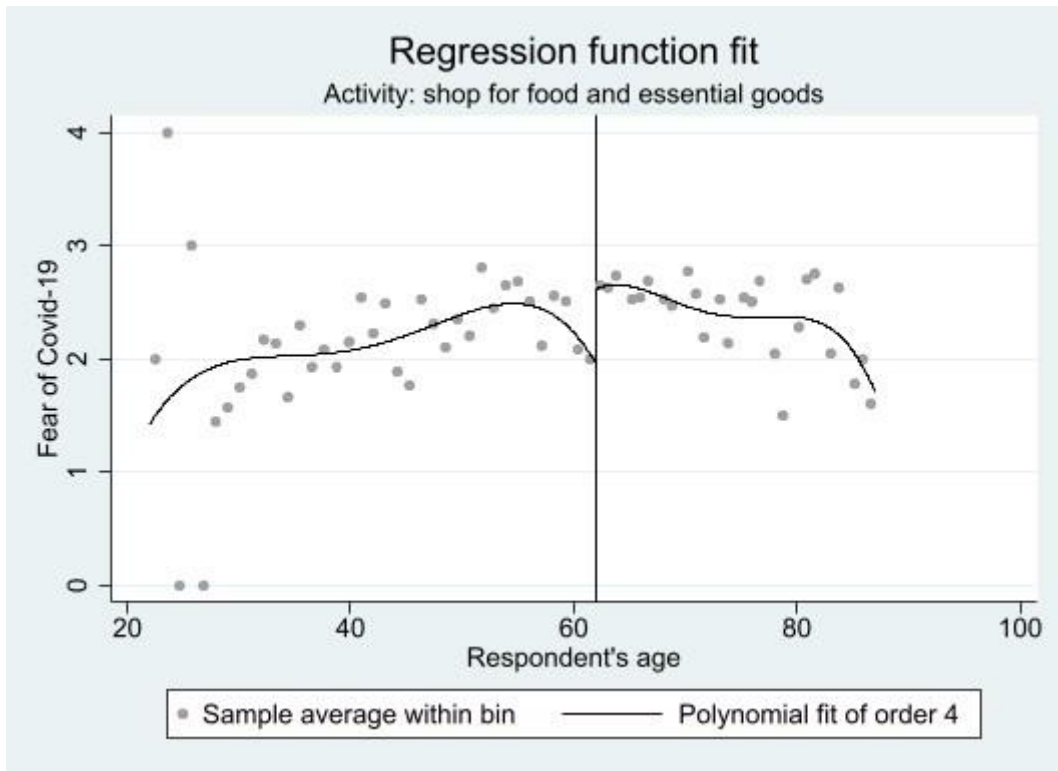
1 = I would stop doing it/rarely; 2 = less often; 3 = with the same frequency; 4 = a little more often; 5 = I would do it more frequently

We construct an indicator of the fear of Covid-19 for four activities (shop for food and essential goods, make purchases in store of clothing, etc; go to the salon/barber/cosmetician; visits to hotels/restaurants/bars). However, we only show you an example for one activity (shop for food and essential goods), since that the variables are constructed following the same reasoning.

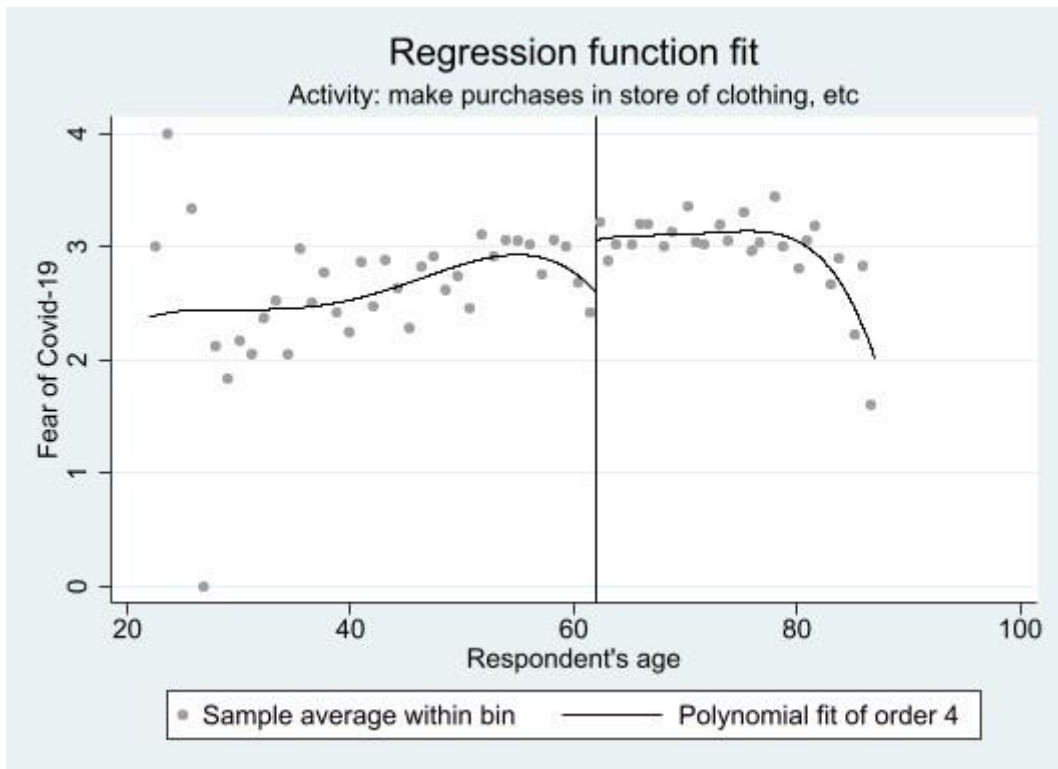
In the econometric construction, the indicator of the fear of contagion is represented by an ordered variable, which assume value from 0 to 4. The variable assumes value 0 (no fear) in the I case, if respondent perform with the same frequency or more the activity considered in each assumed epidemiological scenario; 1 in the II case, if respondent declare to eliminate or drastically reduce the activity when the Covid-19 daily cases are more than 1000; 2 in the III case, and so on up to 4 (greater fear) if he/she declares to eliminate or drastically reduce the activity, whatever the assumed epidemiological scenario.

Fig. 1.3: Graphical analysis of the relationship between the Fear's indicators and the respondents 'age

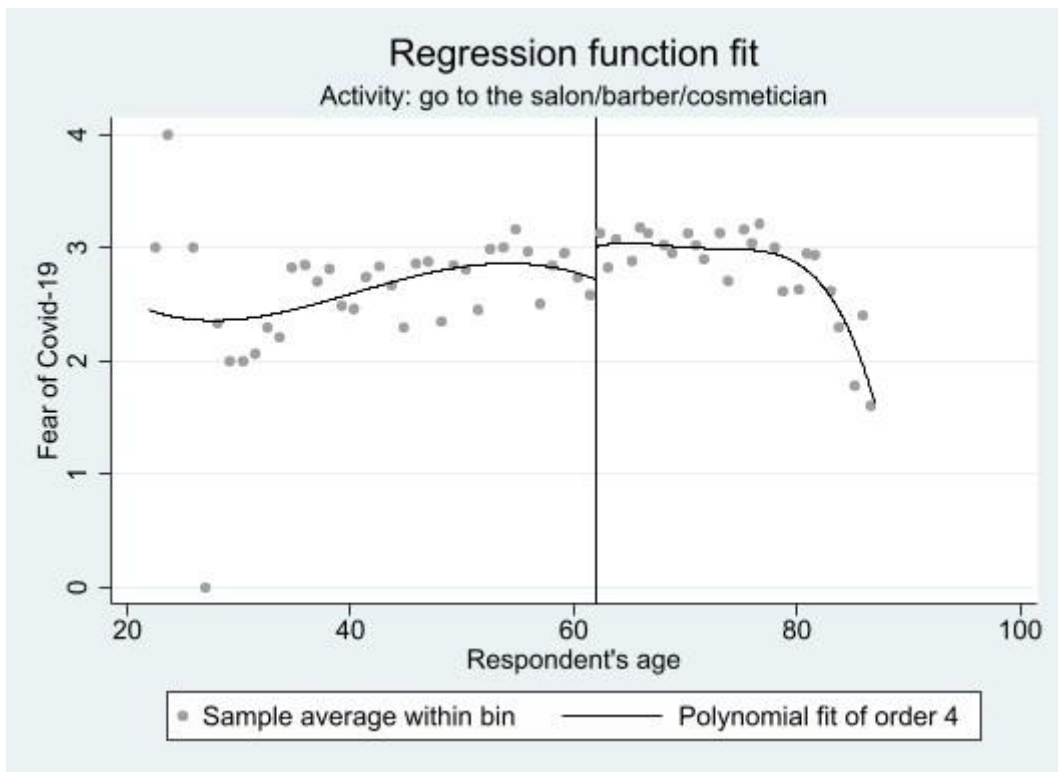
The vertical line at age 62 denotes the cut-off



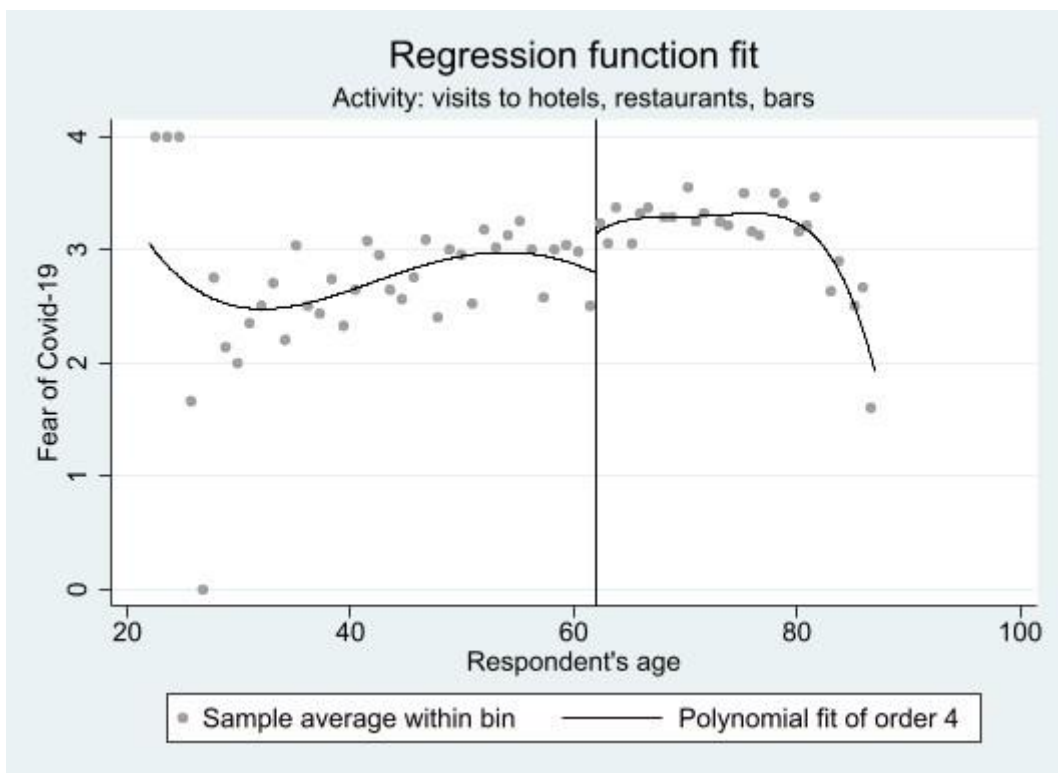
Panel (a)



Panel (b)

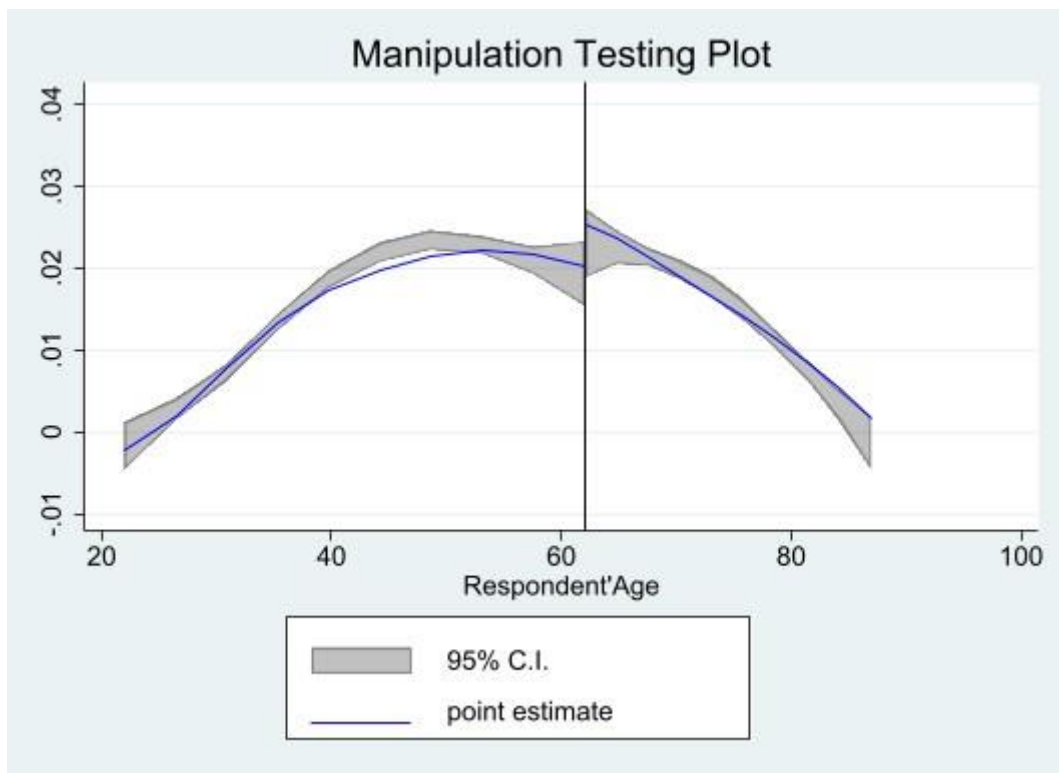


Panel (c)

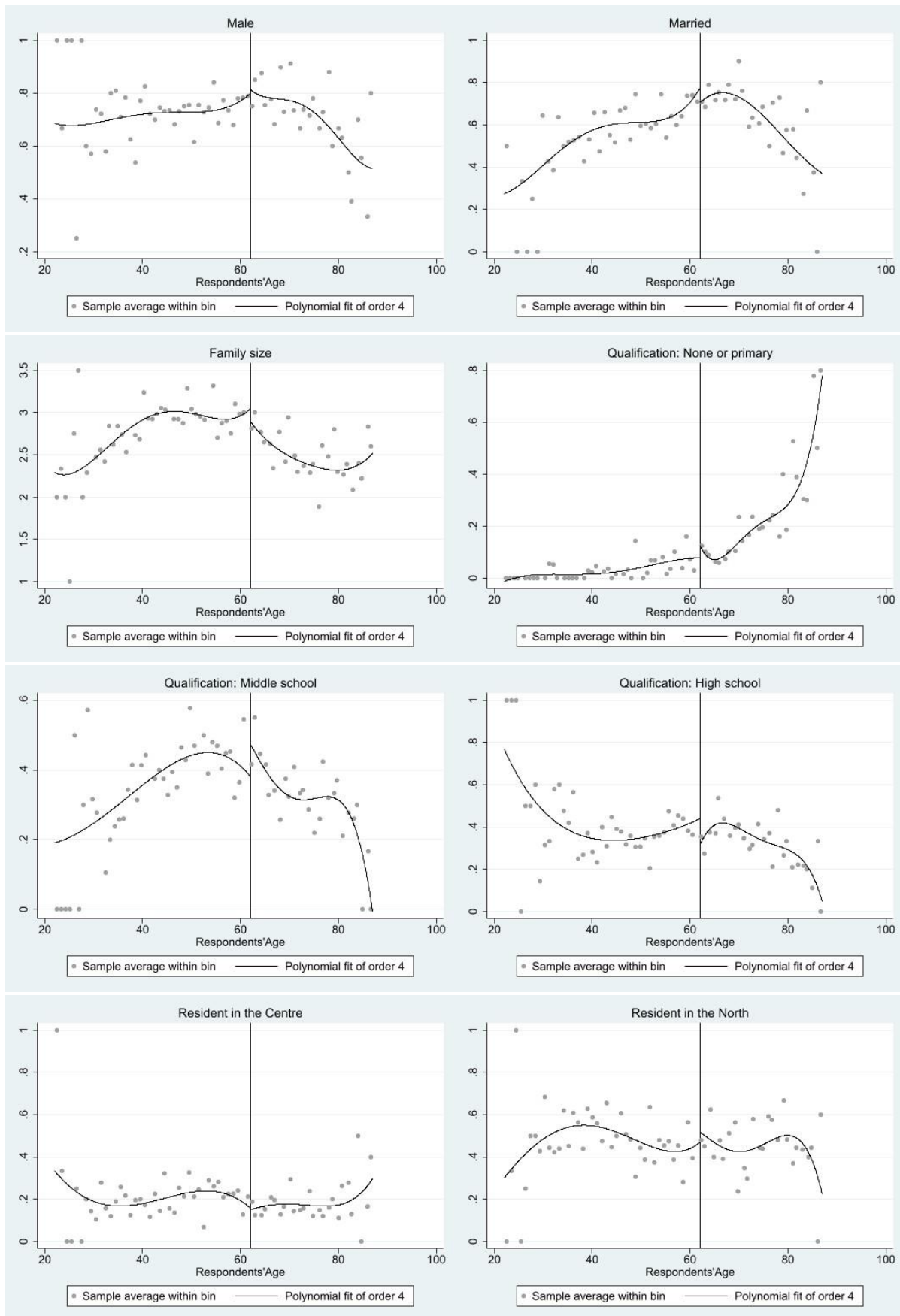


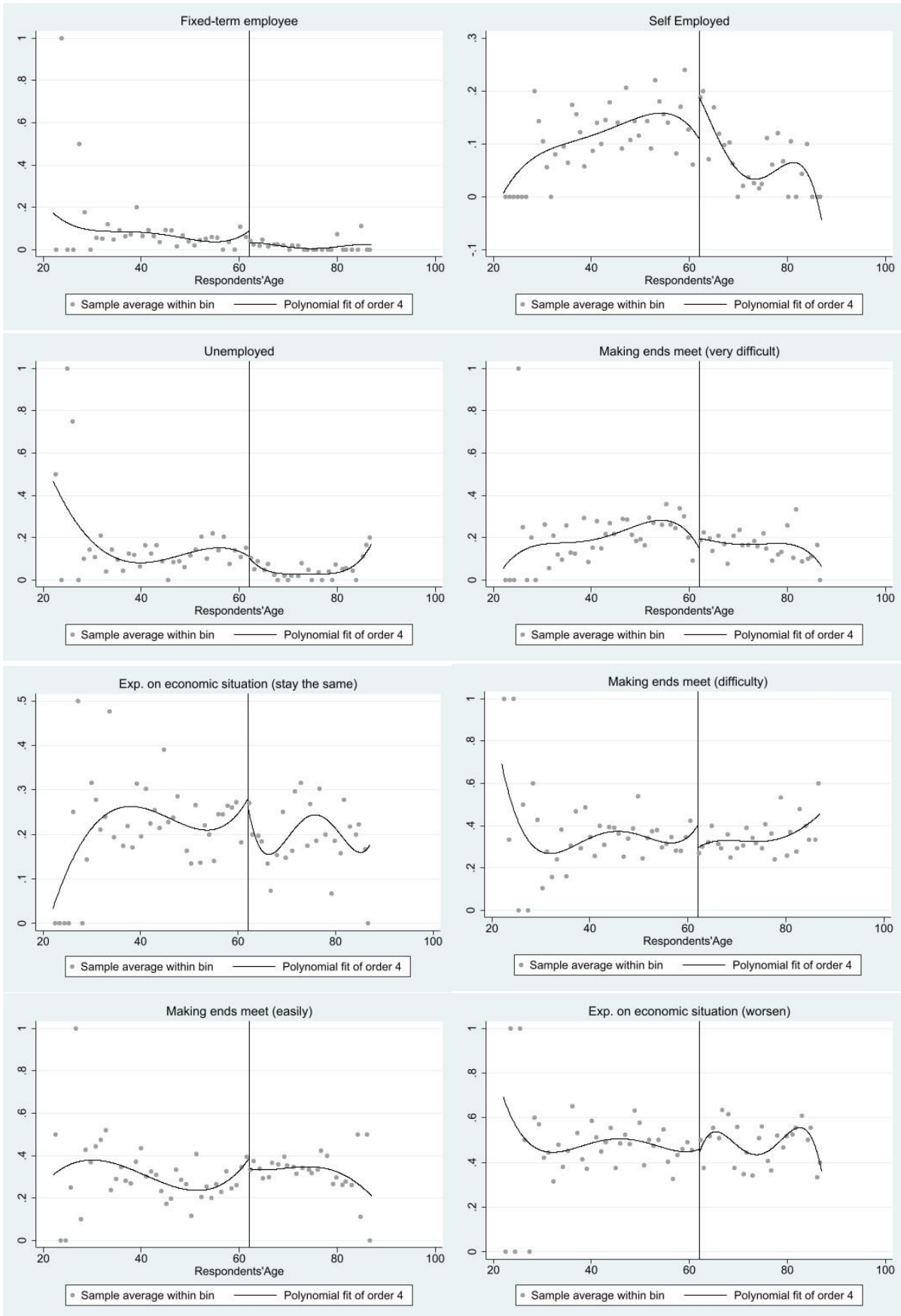
Panel (d)

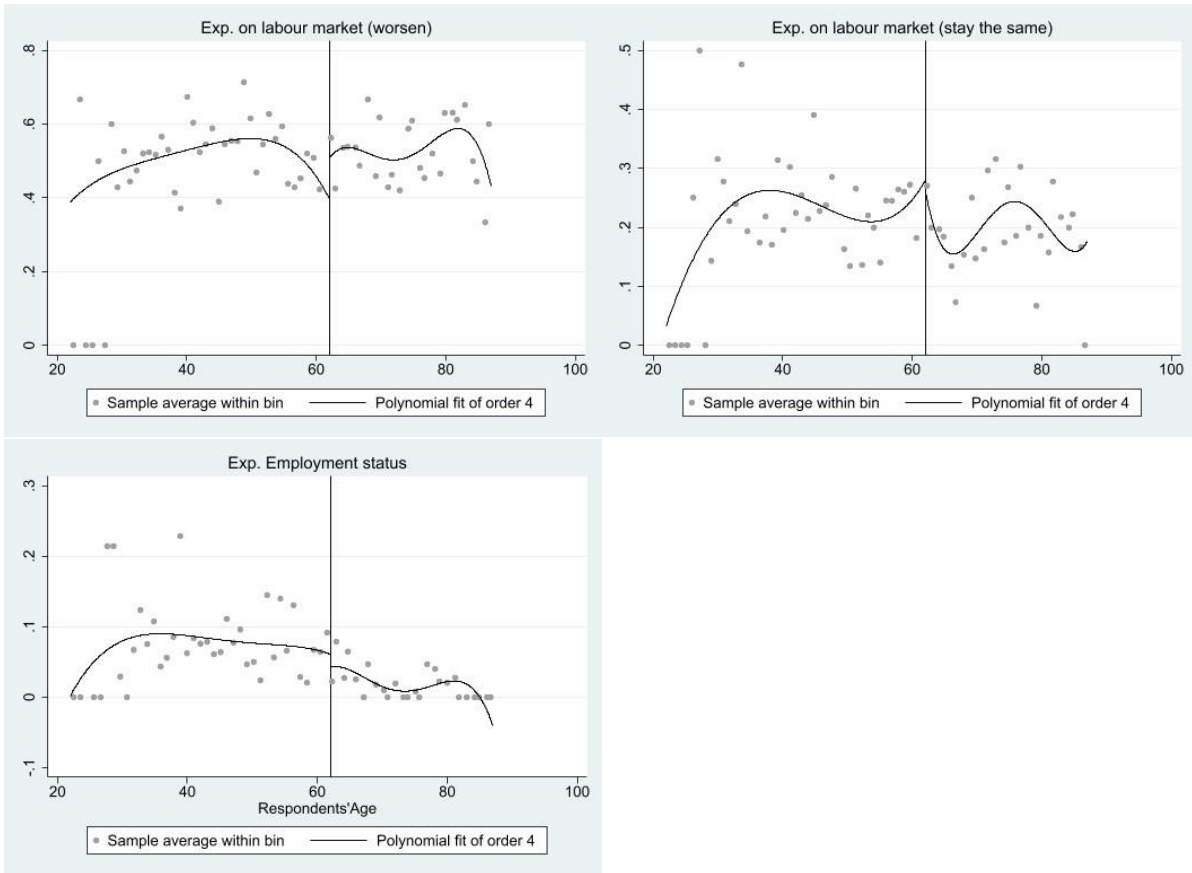
**Fig. 1.4: RD validity check I:
Density of the forcing variable (Respondent's age)**



**Fig. 1.5: RD validity check II:
Continuity of observed covariates**







Chapter II

Chapter II

How does Covid-19 most influence Consumption Expectations: Economic or Health concerns?

Abstract

This study examines the differential impact of economic and health concerns on consumption expectations using data from the second and third waves of the Special Survey of Italian Households, conducted by the Bank of Italy, between August and September and at the end of November, respectively. We find that fear of infection plays the largest role, followed by uncertainty about income in influencing future spending decisions. In this sense, our findings highlight the importance of health for preserving consumption levels and sustaining macroeconomic stability after a recession caused by an infectious disease. The results are robust to endogeneity concerns through use of new and sophisticated identification strategies, such as the Instrumental variable (IV) approach in a Conditional Mixed Process (CMP), IV-CMP with Random Effects, and IV-CMP combined with Correlated Random Effects that explicitly account for both time-varying and time-invariant unobserved factors, which lead to an endogeneity problem.

1. Introduction

The Covid-19 crisis was accompanied by a large drop in consumption in both the US and Europe. In particular, in Italy in the second quarter of 2020 households saving rate has more than doubled compared to the rate observed at the end of 2019, while household consumption dropped by 11,4%.¹³ During the pandemic households were exposed to multifaceted shocks that might have influenced their consumption decision to a different degree, depending on an array of characteristics, such as job arrangements, household composition, personal health conditions. The effects of the Covid-19 crisis were transmitted to income and employment prospects of households, which led households to modify their spending plans. In fact, in a recent paper Christelis et al. (2020) find that uncertainty about the financial consequences of the pandemic in Europe induces a significant reduction in the marginal propensity to consume. At the same time, the health crisis influenced consumers' behaviour through the infectious nature of the disease and its severity, which intensified the feeling of fear and anxiety concerning the households' possibility to contract the Covid-19 during in-person shopping activities. (Chetty et al. (2020), Eichenbaum et al (2021), Immordino et al. (2021), Goolsbee and Syverson (2021). Consequently, the pandemic was a source of a positive saving shock, with potentially long-lasting and far-reaching repercussions on the economy. However, if consumer spending is constrained by health concerns, we can argue that part of the savings piled-up in 2020 may be mobilized when the epidemic is progressively brought under control. However, health concerns could not be fully contained by traditional welfare state policies (e.g., taxes rebates, etc.) but required exceptional measures, to reduce the collective sense of anxiety concerning the households' possibility to contract the virus. On the other hand, if spending decisions are constrained by economic concerns, it is reasonable for consumers to decide to continue saving. As a consequence, structural policies are needed to preserve consumption levels.

In this paper we try to shed some light on this aspect, estimating the differential impact of economic and health concerns on consumers' expectations. In other words, the object of our work is to determine through which channel the pandemic most impacts Italian households' expectations on future consumption. In order to single out policy interventions useful to sustain the economic activity given that the largest part component of GDP is personal consumption expenditures. Therefore, for our analysis we use data from the second and third wave of the Bank of Italy's Special Survey of Italian Households and we implement novel identification strategies that are based on an Instrumental Variables (IV) approach in a Conditional Mixed Process (CMP) model which addresses the potential

¹³ "Impact of Covid-19 on household consumption and savings" *Eurostat*, 10 Nov 2020, [Impact of COVID-19 on household consumption and savings - Products Eurostat News - Eurostat \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1). Accessed: 03 March 2021

endogeneity and reverse causality problems due to the simultaneous relationship between the fear of contagion and spending decisions. In addition, exploiting the panel nature of the survey we can explicitly account for unobserved, time-invariant individual heterogeneity, implementing an IV-CMP combined with a Correlated Random Effects (CRE) specification. As a results, we demonstrate that the channel through the pandemic most influences the Italians' consumption expectations is the fear of Covid-19.

The rest of the paper is structured as follows¹⁴. In Section 2, the dataset is described, and the variables used in the analysis are defined. Section 3 outlines the econometric approach. Section 4 presents the results. In Section 5 we summarize the results obtained by conducting a panel analysis. In Section 6 we conduct a series of robustness checks. Section 7 offers some concluding remarks.

2. Data

In this study we use data from the Special Survey on Italian Households (SSIH) conducted by the Bank of Italy, every three months, starting from April/May 2020. The survey has been conducted to gather timely information on the economic situation of Italian households during the pandemic crisis¹⁵. However, in order to identify the channels through which the pandemic has altered Italian households' consumption expectations, we analyse data from the second wave of the SSIH, conducted in the summer (between August and September 2020), when restrictive measures were less stringent and covering over 2,300 individuals, and data from the third wave, conducted at the end of November 2020 after the introduction of the second lockdown. All 2,000 heads of households interviewed in the third wave had already been interviewed in the second edition of the survey. The total number of responses from the two periods is equal to 4,423 and the sample contains anonymized individual-level responses¹⁶. Apart from basic socio-demographic variables (age, gender, education and occupational status), the survey includes questions on economic and labour market prospects, financial situation, saving and consumption choices, savings and consumption changes linked to the

¹⁴ For the literature, please refer to the previous chapter.

¹⁵ The main results of the survey and the methodological aspects are described in the paper: “*The main results of the second wave of the Special Survey of Italian households in 2020*” (Covid-19 Notes, November 2020), and in the box “Italian households during the epidemic: the Bank of Italy's survey”, in *Economic Bulletin*, 4, 2020; and in the paper: “*The main results of the third wave of the Special Survey of Italian Households in 2020*” (Covid-19 Notes, March 2021) and in the box “Italian households during the epidemic: the Bank of Italy's survey” in *Economic Bulletin*, 1, 2021, respectively.

¹⁶ The head of the household once identified, provides the interviewer with all the information about the household, so in this paper we will also refer to households.

Covid-19 pandemic. Descriptive statistics of socio-economic variable and the definitions of the control variables can be found in the Appendix in Tables 2.1–2.2, respectively.

To construct a measure of the fear of contagion, we start from the following survey question: “Compared to ordinary times, how frequently would you do the following activities if the daily Covid-19 cases in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.” And the answers are categorized according to the following indicators: 1 = *I would stop doing it/rarely*; 2 = *less often*; 3 = *with the same frequency*; 4 = *a little more often*; 5 = *I would do it more frequently*.¹⁷

We consider purchases in physical stores selling clothing and footwear, personal services, restaurants, coffee bars and hotels because during these activities Covid-19 can spread more easily¹⁸. In addition, we take into account what the literature on natural disasters psychological literature suggest, namely that particular events, such as health crisis, change individuals’ behaviour, boosting preventive conducts (Ballantine et al. (2014), Forbes (2017), and Yuen et al. (2020)). For these reasons households that decided to cut spending in the above types of non-essential goods and services might be signalling a fear of contracting the virus. Therefore, the variable *Fear* is a dummy equal to 1 if individuals:

- they eliminate or drastically reduce all activities that expose them to infection, whatever the assumed epidemiological scenario¹⁹
- they perform the activities according to the risk of infection to which they are exposed during them and the epidemiological scenario.²⁰

The construction of the variable *Fear* is illustrated in more detail in the Fig. 2.1 in the Appendix.

¹⁷ Question -b-, in the Appendix.

¹⁸ According to WHO, the transmission of the Covid-19 virus spreads more easily in: Crowded places, Close-contact settings, especially where people have conversations very near each other; Confined and enclosed spaces with poor ventilation. Consequently, the risk of Covid-19 spreading is especially high in places where these “3Cs” overlap; “Coronavirus disease (Covid-19): How is it transmitted?” *World Health Organization*, 23 Dec 2021, www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted. Accessed: 27 December 2021.

¹⁹ Considering all the hypothesized epidemiological situations is advantageous for two reasons: first, it reduces the possibility that the respondents pay little attention to the survey; second, if as the number of Covid-19 cases increases, and households declare that they do not carry out the Covid-19 risk activity more frequently than in the most favourable epidemiological situation, it is another sign of their fear of contracting the virus.

²⁰ According to WHO, visiting restaurants, coffee bars and hotel are among the activities considered to expose individuals to a higher risk of infection, because most people do all those actions, such as talking, breathing through which the virus spreads via small particles of liquid without a mask for long periods of time, for this reason, households might decide to eliminate or drastically reduce these activities and only to reduce slightly the other two (make purchases in-store of clothing, etc., and personal services).

3. Econometric Approach

3.1. Conditional Mixed Process

Empirically, the estimation of the effect of the fear of Covid-19 poses several challenges. For one thing, the fear indicator might be potentially endogenous due to the simultaneous relationship between fear and expectations on consumption expenditure. For another, households which consume less might think they are at lower risk of infection, because they have fewer social interactions (i.e. reverse causality). Hence, simply regressing expectations on consumption changes on fear of contagion will therefore lead to a biased estimation due to an underlying endogeneity problem and the results might not reflect the underlying causal relationship.

Dealing with endogeneity in nonlinear models requires careful consideration as the standard two stage least squares (2SLS) approaches may produce inconsistent estimates (Wooldridge, 2010). Hence, we use an alternative approach, the Conditional Mixed Process (CMP) developed by Roodman (2011). This approach can be used for IV analysis by allowing the residuals of the first and second stages to be correlated. The fully observed recursive CMP model assumes that the underlying model is based on a general Seemingly Unrelated Regression (SUR) framework and allows that the individual equations need not be classical regressions with a continuous dependent variable; the system may consist of binary, ordered, categorical or censored equations²¹. Broadly, the CMP is appropriate for two classes of models: those in which the posited data-generating process is fully modelled; and those in which some equations are structural, while others are reduced form, providing instruments for identification of the parameters in the structural equations, as in two-stage least squares. In the first case, CMP is a full-information maximum likelihood (FIML) estimator, and all estimated parameters are structural. In the latter, it is a limited-information (LIML) estimator, and only the final stage's or stages' coefficients are structural (Roodman, 2011).

We therefore use the CMP model to estimate the following system of binary and ordered equations, respectively:

$$\text{I Stage: } \text{Fear}_{it}^* = \psi + \delta \text{Prop_atrisk}_{it} + \eta \text{More_women}_{it} + \beta_1' I_i + \beta_2' V_{it} + \beta_3' L_{it} + \beta_4' \text{EXP}_{it} + \beta_5 \text{Income}_{risk_{it}} + \varepsilon_{it} \quad (2.1)$$

²¹ SUR model is a system of linear equations with errors that are correlated across equations for a given individual but are uncorrelated across individuals.

$$\text{II Stage: } Exp_{C_changes_{it}} = \alpha + \beta'_1 I_i + \beta'_2 V_{it} + \beta'_3 L_{it} + \beta'_4 EXP_{it} + \beta'_5 Income_{risk_{it}} + \beta'_6 Fear_{it}^* + u_{it} \quad (2.2)$$

where in the *I Stage*, Eq. (2.1), however, the dependent variable is the explanatory variable *Fear* of the second stage, and it is a dummy variable as illustrated in Section 2. In the *II Stage*, Eq. (2.2) the dependent variable *Exp_C_changes* indicates the expectations on consumption changes. It is an ordered discrete outcome variable which takes the value of 0 for households that expect a decrease in their total spending for food, clothing and footwear, home goods and services in the next three months; 1 if they expect that their total spending will remain the same and 2 if they expect an increase. Hence, since that in the first stage of the CMP's system of equation the dependent variable is a dummy, the Eq. 2.1 is estimated using the Probit model. In the second stage, however, the outcome variable is ordinal, and an Ordered Probit is used for the Eq.2.2. Then, I_i are variables time-invariant (gender, marital status, education); V_{it} are variables time-variant (age, age squared); L_{it} are dummies variables that approximates liquidity constraints, which come directly from the SSIH and are based on the subjective evaluation that households make about their general economic condition in making ends meet. In addition, we control for the personal macroeconomic expectation, i.e. their personal expectation on the development of the general economic situation in Italy and the labour market, EXP_{it} . The variable $Income_{risk_{it}}$ is a measure of income risk based on the self-reported probability of losing the job in the next 12 months, which takes the value of 1 if the probability of losing the job is higher or equal to 50% for employed household members, and 0 otherwise. Additionally, since the survey was conducted in two periods, we also include a dummy variable to control for the period. Finally, we introduce our instrumental variables, *Prop_atrisk* and *More_women*. Our first instrument is a variable that indicates the proportion of over-55s in the household. According to the recent medical literature on Covid-19, the elderly and people with pre-existing medical conditions are more vulnerable to becoming severely ill with the virus and, in accordance with the national medical demography literature in the general Italian population (aged 18 and over), the prevalence of chronic diseases affects a very high percentage of people after the age of 55 and increases progressively with age²². Therefore, considering the proportion of over-55s in the household means to consider people at high risk of developing the most severe symptoms of the virus, both because of their age and because they are more likely to suffer from pre-existing chronic diseases. Hence, it seems reasonable

²² Masocco, M. Minardi, V. Contoli, B. Onder, G. Palmieri, L. Spinelli, A. Vanacore, N. "Il ruolo delle patologie croniche pregresse nella prognosi dei pazienti COVID-19." *Epicentro-ISS*, 11 Jun. 2020, www.epicentro.iss.it/coronavirus/sars-cov-2-flussi-dati-confronto-patologie-croniche-pregresse. Accessed: 22 December 2021.

to assume that the fear of Covid-19 is most intense in the households with a higher proportion of vulnerable persons. The second instrument is a variable equal to 1 if the number of female components is greater than the number of male components, and 0 otherwise. The rationale for this variable is discussed in recent psychological evidence (Broche-Pérez et al. 2020, Doshi et al. 2021, Nino et al. 2021), which suggests that gender significantly predicts the level of fear of contagion. As a results, being female is a predictor of medium and high levels of fear of Covid-19. Furthermore, these results corroborate international research that indicates a greater psychological vulnerability in women during the Covid-19 pandemic.

4. Results

In order to deal with endogeneity issues, we estimate the impact of health concerns on consumption expectations using an IV approach in a Conditional Mixed Process. Results are presented in Table 2.3 in the Appendix. However, before showing the results, we provide evidence on the validity of Iv-CMP approach. To assess the validity of the CMP model, we test the significance of the *atanhrho_12* statistic that measures the covariance between the error terms of the system equations, in our case Eq. (2.1) and Eq. (2.2). At the bottom of the Table 2.3, we can see that the parameter *atanhrho_12* (p-value=0.0577) is statistically different from zero, so we can conclude that there are unobserved factors that simultaneously affect *Exp_C_changes* and *Fear*, and therefore, the IV-CMP approach is superior to the standard single equation estimation techniques. Consequently, we prefer the CMP model to jointly estimate the two equations with linkages among their error processes. As suggested by Roodman (2011), we proceed by testing the validity of the instruments, implementing the Wald test, which reflects the joint correlation between the instrumental variables (*Prop_atrisk*, *More women*) and the endogenous variable, and it must be above the benchmark minimum value of 10. The test result is reported at the bottom of the Table 2.3, and it is equal to 11.59, suggesting that our instruments are sufficiently correlated with the *Fear* variable.²³ In terms of instrument validity, we can perform an auxiliary regression where the instrumental are added to the second stage, Eq. (2.2), and then we perform the Wald test of joint significance on these variables. The statistical significance of the instruments 'coefficients in the auxiliary regression would imply that they are not valid (Roodman and Morduch, 2014). However, in our case, the added instruments are both not-statistically significant, thus they may be considered exogenous (*Prop_atrisk* p-value 0.811 and *More women* p-value 0.948).

²³ The test results can nevertheless be cited as indicative even though their theoretical grounding is not fully carry over to the non-linear model. (Roodman, 2011)

In column (1) of the Table 2.3 we see that unemployed and self-employed are more likely to reduce their future spending compared to pensioners. Expectations on consumption changes are negatively influenced by the liquidity constraints, in fact the coefficients of the variable making ends meet are negative and statistically significant at all conventional levels. Moreover, macroeconomic uncertainty holds back spending: if households expect the economic and labour market situation to worsen in the next 12 months, they will negatively revise their consumption decision for the next 3 months (around 6.07% and 6.9% respectively). The coefficients of *Income risk* and *Fear* are significantly negative. Respondents who face an income risk have a higher probability to compress expenditure on essential goods in the next three months, (approximately 10%), since that households may want to save for negative labour market events. However, fear of contracting the virus has a greater negative impact on the expectation of changes in consumption than income risk. Fear of contagion increases the probability of reporting downward expectations on spending consumption by about 18.6%. However, these results reflect the Local Average Treatment Effects (LATE), that is the impact on the outcome variable of having *Fear* as a result of the instrumental variables (Angrist and Pischke, 2008), as opposed to the average effect over the entire sample.

5. Panel Analysis

5.1. CMP combined with Random Effects

In this section exploiting the panel nature of the survey, we present a panel analysis by combining the IV-CMP method and the Random Effects approach. We present results with and without random effects correlated between the two equations. All two methods used provide consistent evidence that *Income risk* and *Fear* are the two most important factors that drive household spending decisions. However, the results reported in the Appendix in Tables 2.4-2.5 highlight that the effects of the Covid-19 outbreak on consumption expectations mainly operate through households' fear of contagion, while income uncertainty has a lower importance. In fact, the fear of Covid-19 increases the expectation on consumption drop, by about 18.9% and 28% (IV-CMP with Re and IV-CMP with RE uncorrelated between the equations, respectively), while income risk increases the probability of reduced future spending by roughly 11% and 10%. Therefore, the fear of Covid-19 has led households to be prudent and keep people away from activities that expose them to a higher risk of being infected, becoming the main reducer of economic activity.

5.2. Individual Unobserved Heterogeneity: IV-CMP combined with CRE

The richness and unique properties of the panel dataset allow us to control for another potential problem, the individual unobserved heterogeneity. The expectations about the general economic situation, on labour market, as well as the fear of Covid-19 might reflect cognitive aspects such as personality (introversion, pessimism), and emotional aspects. For this reason, the residual errors of our model may include measurement errors related to personality. Consequently, if these errors are correlated with the independent variables, we might have an endogeneity problem. However, if we are prepared to assume that endogeneity is due to time-invariant unobserved individual characteristics, a Fixed Effect model would eliminate the problem. Unfortunately, Fixed Effects (FE) approach is not available for our non-linear model. Therefore, an alternative solution is to estimate the Correlated Random Effects (CRE). As suggest by Wooldridge (2010), who shows how the CRE approach can be used for a variety of nonlinear panel data. However, one drawback of the FE and CRE approaches is that they allow for only one kind of endogeneity: correlation between the time-varying explanatory variables, often through sometime like the time average of these variables, and time-constant heterogeneity, (Lin & Wooldridge 2018). However, we are also worried about the correlation between the covariate *Fear* and the dependent variable. Consequently, we implement an Instrumental Variables approach in a Conditional Mixed Process model combined with a Correlated Random Effects specification (IV-CMP-CRE).

Therefore, we estimate the system of Eq. (2.1) and Eq. (2.2) including the Mundlak individual averages for all-time varying variables in the first and second stages. Therefore, we test the validity of the instrumental variables to check if they are correlated with individual effects; because if so, it is necessary to include the instrument's means in both stages. For this reason, we proceed as in Section 4 performing the auxiliary regression where the instruments are added to the second stage, Eq. (2.2). We find that both coefficients of the *Prop_atrisk* and *More women* instruments are not statistically significant, so they are not correlated with the individual effects. In other words, our instrumental variables are exogenous. Thereby, it is not necessary to include the Mundlak means of the instruments in both stages. In the Table 2.6 in the Appendix, we present the results of IV-CMP combined with CRE with standard errors clustered at the household level and the marginal effects for our three outcomes. The Wald test (11.94), at the bottom of the Table 2.6, indicates that the instruments are sufficiently correlated with the variable *Fear*. Therefore, the conclusions do not change: the effects of the Covid-19 outbreak on consumption expectations mainly operate through households' fear of contagion.

6. Robustness Checks

In this section, we run some robustness checks to verify if our results are driven by some specific choices we have made in the analysis. As a robustness check of our results, we present results obtained using a different sample, and then estimates obtained considering a different specification for the indicator of the fear of Covid-19. First, we replicate the analysis by considering a sub-sample of households, those with only one member in paid employment, because they may be more concerned about losing their only available income and/or facing more economic difficulties. Therefore, we re-estimate the system of equations Eq. (2.1) and Eq. (2.3) using the IV-CMP method, the IV-CMP combined with RE uncorrelated between the two equations and the IV-CMP combined with CRE, the results are shown in the Appendix in Tables 2.7- 2.8- 2.9, respectively. We expect income risk turns out to be a more decisive factor in determining consumption expectations. However, all the different methods used provide consistent evidence of an increased effect of income risk on future spending decisions, but fear of contagion continues to significantly increase the expectation of a decline in consumption more than income uncertainty.

Finally, to confirm the robustness of the results and to be confident that the expected lockdown of certain activities does not determine the expected behaviour of the respondents, we construct an alternative variable to capture the fear of contagion as the number of infections increases.

We exploit the national strategy used to impose lockdown measures. Therefore, to construct our alternative measure of the fear of infection, we consider the activity of purchasing essential goods because it was defined by the government as a non-suspended (essential) activity, necessary to sustain citizens' livelihoods, in any epidemiological scenario assumed. Consequently, the variable *Fear_2* is a dummy variable equal to 1 if households decide to reduce spending on food and essential goods when in the region of residence there are more than 100 cases per day and, at the same time, they declare to eliminate spending in hotel, restaurants and coffee bars even in a more favourable epidemiological scenario (<10 daily Covid cases). This second condition is considered, because less than 10 new cases per day in the region do not increase the risk of a tightening of the restrictions imposed by the government on hotels, restaurants and bars, and highlights how people are afraid to do a particularly risky activity even in a favourable epidemiological situation. The estimates with the alternative definition of fear (*Fear_2*) and using the IV-CMP combined with CRE are reported in the Appendix, Table 2.10. We can see at the bottom of the Table 2.10, that the degree of correlation between the two equations $-atanhrho-$ is statistically significant, and the instrumental variables are sufficiently correlated with the variable *Fear_2*. Moreover, we also check that the IVs are both

exogenous²⁴. Therefore, we can again conclude that we obtain similar results: health concerns and income risk increase expectation of reduced future expenditure. However, the negative consumption expectations mainly derive from the fear to contract the virus.

Taken together, our findings suggest that it plausible to assume that when the epidemic will be under control, households may decide to spend part of their savings.

7. Conclusions

The aim of this paper is to estimate the differential impact of economic and health concerns on consumption expectations using an Instrumental Variable approach in a Conditional Mixed Process (IV-CMP). The dataset, which was created by importing data from the second and third wave of the Special Survey on Italian Households (SSIH), provides panel data at the household level and covers the period of the pandemic crisis from April to November 2020. Exploiting the panel component, we have been able to control for the Individual Unobserved Heterogeneity through the use of the IV-CMP combined with the Correlated Random Effects method. Our results show that economic reasons, including income risk, negatively affect households' future spending decisions, but the fear of contagion had a much larger impact on consumer decisions. Therefore, it could be argued that mitigating pandemic-related health concerns could counteract the observed drop in spending, as part of the savings may be mobilized when the epidemic is progressively brought under control, especially when the fear of infection is reduced or when a safe and effective vaccine is available. In this sense, our findings suggest that appropriate policies to sustain recovery during a pandemic should reward households which have experienced economic hardship, pumping liquidity and preserving employment levels, but at the same time they should mitigate households' health concerns, so as to increase the propensity to consume, and not to save.

²⁴ The p-value are equal to 0.704 and 0.900 for the variable *Prop_atrisk* and *More_women*, respectively.

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Appendix

Survey Questions

-a- Consider the expenditure for food, clothing and footwear, home goods and services. How will your household change total expenditure for these items in the next 3 months?

Will increase

Will stay the same

Will decrease

-b- Compared to ordinary times, how frequently would do the following activities if the daily Covid-19 cases in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.

1 = I would stop doing it/rarely; 2 = less often; 3 = with the same frequency; 4 = a little more often; 5 = I would do it more frequently

	<10					between 10 to 100					between 100 to 1000					>1000				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Shop For Food And Essential Goods																				
Make Purchases In Store Of Clothing, Etc																				
Go To The Salon/Barber/Cosmetician																				
Go Out To Shop Household Goods Or Furniture																				
Visits To Hotels/ Restaurants/Bars																				

Appendix Tables and Figures

Fig. 2.1: Illustration of the answers considered to construct the fear indicator

Compared to ordinary times, how frequently would do the following activities if the daily Covid-19 cases (Epidemiological Situation, ES) in your region were <10, between 10 and 100; between 100 and 1000; more than 1000.

Indicator of Frequency (*IF*):

1 = I would stop doing it/rarely; 2 = less often; 3 = with the same frequency; 4 = a little more often; 5 = I would do it more frequently

	EPIDEMIOLOGICAL SITUATION																			
	<10					between 10 to 100					between 100 to 1000					>1000				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Make Purchases In Store Of Clothing, Etc	•	•				•	•				•	•				•	•			
Go To The Salon/Barber/Cosmetician	•	•				•	•				•	•				•	•			
Visits To Hotels/ Restaurants/Bars	•					•					•					•				

In the econometric construction, fear of contagion is represented by a dummy variable, *Fear* (0,1). The variable assumes value 1 in the cases indicated by the dots in the table, i.e.:

Fear =1 when: the activities *Make purchases in store of clothing , etc.* and *Go to the salon/barber /cosmetician* have an *IF* less or equal to 2, while the *IF* associated to the activity *Visits to hotel/restaurants/bars* is equal to 1;

Table 2.1: Household heads Summary Statistics

	Mean	Std. Dev.	N
Age (years)	57.742	15.232	4423
18-34	0.069	0.254	4423
35-44	0.158	0.365	4423
45-54	0.209	0.406	4423
55-64	0.184	0.387	4423
Equal/more than 65 years	0.380	0.486	4423
Male	0.685	0.465	4423
Female	0.315	0.465	4423
Married	0.488	0.499	4423
Family size	2.386	1.292	4423
Qualification:			
None/Primary School Certificate	0.191	0.394	4423
Lower Secondary School Certificate	0.373	0.484	4423
Upper Secondary School Certificate	0.295	0.456	4423
University Degree	0.141	0.348	4423
Occupation:			
Employee	0.402	0.490	4423
Self-employed	0.095	0.293	4423
Unemployed	0.148	0.355	4423
Retirees	0.355	0.479	4423
Resident in the North	0.489	0.499	4423
Resident in the Centre	0.202	0.402	4423
Resident in the South	0.308	0.462	4423

Note. Statistics are computed using sample weights

Table 2.2: Summary statistics of the control variables

	DESCRIPTION	Mean	Std. Dev.	N
Making ends meet (very difficult)	Dummy variable equal to 1 if households report very difficult in making ends meet, and 0 otherwise;	0.209	0.407	4423
Making ends meet (difficulty)	Dummy variable equal to 1 if households report difficulty in making ends meet, and 0 otherwise;	0.345	0.475	4423
Making ends meet (easily)	Dummy variable equal to 1 if households report easily in making ends meet, and 0 otherwise;	0.299	0.458	4423
Making ends meet (very easily)	Dummy variable equal to 1 if households report very easily in making ends meet, and 0 otherwise;	0.147	0.354	4423
Exp. on economic situation	Dummy variable equal to 1 if households expect the economic situation to worsen in the next 12 months, and 0 otherwise;	0.521	0.499	4423
– Stay the same		0.195	0.397	4423
– Improve		0.198	0.398	4423
Exp. on labour market	Dummy variable equal to 1 if households expect the labour market to worsen in the next 12 months, and 0 otherwise;	0.554	0.497	4423
– Stay the same		0.168	0.374	4423
– Improve		0.210	0.408	4423
Exp. on consumption changes:	Answer to the question -a- (see Appendix);	0.323	0.468	4423
Will decrease	Multi-level dummy dependent variable	0.631	0.483	4423
Will stay the same	(0=will decrease; 1=will stay the same; 2=will increase)	0.046	0.210	4423
Will increase				
Income Risk	Dummy variable equal to 1 if self-reported probability of losing the job is higher or equal to 50% for employed household members	0.145	0.352	4423
Fear	See section 2, Question -b- and -Figure 2.1- in the Appendix	0.264	0.441	4423
Fear_2	See section 6	0.278	0.448	4423
Instrumental variables:				
Prop at risk	Continuous variable indicating the proportion	0.460	0.436	4423

More women	of people at risk in the household Dummy variable equal to 1 if the number of female components is greater than the number of male components, and 0 otherwise;	0.373	0.484	4423
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Note. Statistics are computed using sample weights

Table 2.3: The causal effect of Fear of contracting the Covid-19: IV-CMP approach

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes=will decrease X) dy/dx	Pr (Exp_C_changes=will stay the same X) dy/dx	Pr (Exp_C_changes=will increase X) dy/dx
PROP_ATRISK		0.256*** (0.0961)			
MORE_WOMEN		0.132** (0.0556)			
Age	-0.0386*** (0.0118)	0.0123 (0.0144)	0.0126*** (0.00385)	-0.00863*** (0.00263)	-0.00398*** (0.00124)
Age squared	0.000323*** (0.000105)	-8.47e-05 (0.000123)	-0.000105*** (3.43e-05)	7.21e-05*** (2.35e-05)	3.33e-05*** (1.11e-05)
Male	0.162*** (0.0560)	-0.0848 (0.0710)	-0.0530*** (0.0183)	0.0363*** (0.0126)	0.0167*** (0.00578)
College	0.0509 (0.0549)	-0.186*** (0.0713)	-0.0166 (0.0179)	0.0114 (0.0123)	0.00525 (0.00566)
Married	-0.0242 (0.0500)	0.134** (0.0616)	0.00790 (0.0163)	-0.00541 (0.0112)	-0.00249 (0.00514)
Employee	-0.00333 (0.0653)	-0.196** (0.0789)	0.00109 (0.0213)	-0.000743 (0.0146)	-0.000343 (0.00673)
Self Employed	-0.302*** (0.0818)	-0.137 (0.0967)	0.0987*** (0.0266)	-0.0676*** (0.0183)	-0.0312*** (0.00858)
Unemployed	-0.246*** (0.0756)	0.141* (0.0833)	0.0803*** (0.0247)	-0.0549*** (0.0170)	-0.0253*** (0.00783)
Making ends meet (very difficult)	-0.358*** (0.0718)	0.669*** (0.0825)	0.117*** (0.0235)	-0.0800*** (0.0167)	-0.0369*** (0.00722)

Making ends meet (difficult)	-0.265***	0.433***	0.0866***	-0.0593***	-0.0273***
	(0.0587)	(0.0755)	(0.0192)	(0.0135)	(0.00599)
Making ends meet (easily)	-0.115**	0.160**	0.0374**	-0.0256**	-0.0118**
	(0.0539)	(0.0762)	(0.0176)	(0.0121)	(0.00553)
Exp. on the economic sit.	-0.186***	0.0917	0.0607***	-0.0415***	-0.0191***
	(0.0572)	(0.0638)	(0.0187)	(0.0129)	(0.00591)
Exp. on the labour market	-0.210***	0.127**	0.0685***	-0.0469***	-0.0216***
	(0.0558)	(0.0635)	(0.0182)	(0.0126)	(0.00580)
Income risk	-0.320***	0.146**	0.104***	-0.0714***	-0.0329***
	(0.0581)	(0.0630)	(0.0189)	(0.0132)	(0.00612)
Fear of contagion	-0.571***		0.186***	-0.128***	-0.0588***
	(0.108)		(0.0338)	(0.0220)	(0.0124)
Constant		-1.836***			
		(0.705)			
cut_1_1	-1.253**				
	(0.569)				
cut_1_2	0.990*				
	(0.570)				
atanrho_12	0.100*				
	(0.0577)				
Wald Test	11.59***				
(p-value)	0.0030				
Observations	4,423	4,423			

Note. The table reports the results of the CMP approach and Robust Standard errors in parentheses. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. Reference category for occupational status is pensioner; reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.4: The causal effect of Fear of contracting the Covid-19: IV-CMP approach with Random Effects

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes=wi ll decrease X) dy/dx	Pr (Exp_C_changes=wi ll stay the same X) dy/dx	Pr (Exp_C_changes=wi ll increase X) dy/dx
PROP_ATRISK		0.322** (0.127)			
MORE_WOMEN		0.166** (0.0727)			
Employee	-0.00547 (0.0753)	-0.224** (0.102)	0.00169 (0.0232)	-0.00133 (0.0183)	-0.000359 (0.00495)
Self Employed	-0.332*** (0.0956)	-0.193 (0.124)	0.103*** (0.0294)	-0.0807*** (0.0233)	-0.0218*** (0.00666)
Unemployed	-0.281*** (0.0871)	0.177* (0.106)	0.0869*** (0.0269)	-0.0684*** (0.0214)	-0.0185*** (0.00591)
Making ends meet (very difficult)	-0.395*** (0.0841)	0.787*** (0.108)	0.122*** (0.0259)	-0.0959*** (0.0211)	-0.0259*** (0.00567)
Making ends meet (difficult)	-0.294*** (0.0688)	0.554*** (0.0994)	0.0908*** (0.0213)	-0.0715*** (0.0172)	-0.0193*** (0.00470)
Making ends meet (easily)	-0.109* (0.0623)	0.199** (0.0985)	0.0337* (0.0193)	-0.0265* (0.0152)	-0.00716* (0.00414)
Exp. on the economic sit.	-0.201*** (0.0666)	0.0888 (0.0804)	0.0620*** (0.0205)	-0.0488*** (0.0164)	-0.0132*** (0.00447)
Exp. on the labour market	-0.237*** (0.0643)	0.156* (0.0801)	0.0733*** (0.0199)	-0.0577*** (0.0159)	-0.0156*** (0.00447)
Income risk	-0.359***	0.170**	0.111***	-0.0874***	-0.0236***

	(0.0676)	(0.0811)	(0.0208)	(0.0167)	(0.00494)
Fear of contagion	-0.612***		0.189***	-0.149***	-0.0402***
	(0.130)		(0.0382)	(0.0288)	(0.0105)
Constant		-2.248**			
		(0.925)			
cut_1_1	-1.395**				
	(0.672)				
cut_1_2	1.240*				
	(0.670)				
lnsig_1_1	-0.460***				
	(0.0837)				
lnsig_1_2	-0.166**				
	(0.0756)				
atanhrho_1_12	-0.255***				
	(0.0970)				
atanhrho_12	0.246***				
	(0.0777)				
Wald Test	10.58***				
(p-value)	0.0050				
Observations	4,423	4,423			

Note. The table reports the results of the CMP approach with RE and Robust Standard errors in parentheses. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. Reference category for occupational status is pensioner; reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation; the parameters ln_sig* are the logarithm of the standard deviation for each error (Rodman, 2011).
Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.5: The causal effect of Fear of contracting the Covid-19: IV-CMP approach with Random Effects uncorrelated between the two equations

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes=w ill decrease X) dy/dx	Pr (Exp_C_changes=w ill stay the same X) dy/dx	Pr (Exp_C_changes=w ill increase X) dy/dx
PROP_ATRISK		0.322** (0.128)			
MORE_WOMEN		0.169** (0.0734)			
Employee	-0.0221 (0.0745)	-0.222** (0.103)	0.00661 (0.0223)	-0.00496 (0.0167)	-0.00165 (0.00558)
Self Employed	-0.341*** (0.0944)	-0.189 (0.125)	0.102*** (0.0282)	-0.0766*** (0.0214)	-0.0255*** (0.00756)
Unemployed	-0.262*** (0.0861)	0.180* (0.107)	0.0785*** (0.0258)	-0.0589*** (0.0198)	-0.0196*** (0.00654)
Making ends meet (very difficult)	-0.335*** (0.0844)	0.796*** (0.109)	0.100*** (0.0254)	-0.0753*** (0.0201)	-0.0251*** (0.00616)
Making ends meet (difficult)	-0.251*** (0.0687)	0.562*** (0.100)	0.0752*** (0.0207)	-0.0564*** (0.0161)	-0.0188*** (0.00515)
Making ends meet (easily)	-0.0944 (0.0620)	0.205** (0.0991)	0.0282 (0.0186)	-0.0212 (0.0140)	-0.00705 (0.00465)
Exp. on the economic sit.	-0.193*** (0.0663)	0.0914 (0.0813)	0.0576*** (0.0198)	-0.0432*** (0.0152)	-0.0144*** (0.00502)
Exp. on the labour market	-0.222*** (0.0639)	0.164** (0.0808)	0.0666*** (0.0192)	-0.0499*** (0.0147)	-0.0166*** (0.00502)
Income risk	-0.342*** (0.0671)	0.173** (0.0820)	0.102*** (0.0201)	-0.0767*** (0.0158)	-0.0255*** (0.00546)

Fear of contagion	-0.937*** (0.131)		0.280*** (0.0351)	-0.210*** (0.0228)	-0.0700*** (0.0149)
Constant		-2.360** (0.941)			
cut_1_1	-1.337** (0.661)				
cut_1_2	1.249* (0.659)				
lnsig_1_1	-0.484*** (0.0848)				
lnsig_1_2	-0.136* (0.0724)				
atanrho_12	0.400*** (0.105)				
Wald Test (p-value)	10.49*** 0.0053				
Observations	4,423	4,423			

Note. The table reports the results of the CMP approach with RE uncorrelated between the two equations and Robust Standard errors in parentheses. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. Reference category for occupational status is pensioner; reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, ; the parameters ln_sig* are the logarithm of the standard deviation for each error (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.6: The causal effect of Fear of contracting the Covid-19: IV-CMP approach combined with a CRE

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes= will decrease X) dy/dx	Pr (Exp_C_changes= will stay the same X) dy/dx	Pr (Exp_C_changes= will increase X) dy/dx
PROP_ATRISK		0.265*** (0.0963)			
MORE_WOMEN		0.131** (0.0556)			
Employee	0.00325 (0.0655)	-0.201** (0.0791)	-0.00106 (0.0213)	0.000726 (0.0146)	0.000335 (0.00673)
Self Employed	-0.289*** (0.0822)	-0.149 (0.0967)	0.0942*** (0.0267)	-0.0645*** (0.0184)	-0.0297*** (0.00861)
Unemployed	-0.236*** (0.0758)	0.133 (0.0836)	0.0768*** (0.0247)	-0.0526*** (0.0170)	-0.0242*** (0.00784)
Making ends meet (very difficult)	-0.351*** (0.0720)	0.662*** (0.0827)	0.114*** (0.0235)	-0.0783*** (0.0167)	-0.0361*** (0.00723)
Making ends meet (difficult)	-0.257*** (0.0586)	0.424*** (0.0758)	0.0837*** (0.0191)	-0.0573*** (0.0135)	-0.0264*** (0.00597)
Making ends meet (easily)	-0.115** (0.0539)	0.161** (0.0765)	0.0375** (0.0176)	-0.0257** (0.0121)	-0.0118** (0.00552)
Exp. on the economic sit.	-0.0923 (0.0824)	-0.0113 (0.0878)	0.0301 (0.0268)	-0.0206 (0.0184)	-0.00949 (0.00847)
Exp. on the labour market	-0.123 (0.0771)	0.0354 (0.0860)	0.0400 (0.0251)	-0.0274 (0.0172)	-0.0126 (0.00797)
Income risk	-0.198** (0.0847)	0.0829 (0.0954)	0.0646** (0.0276)	-0.0442** (0.0190)	-0.0204** (0.00877)
Fear of contagion	-0.560*** (0.107)		0.183*** (0.0335)	-0.125*** (0.0219)	-0.0576*** (0.0122)
Constant		-1.881***			

		(0.716)
cut_1_1	-1.416** (0.578)	
cut_1_2	0.831 (0.578)	
atanrho_12	0.0964* (0.0535)	
Wald Test	11.94***	
(p-value)	0.0025	
Observations	4,423	4,423

Note. The table reports the results of the IV-CMP approach combined with a CRE. Robust Standard errors in parentheses. Mundlak means for time-varying exogenous variables in both stages. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. Reference category for occupational status is pensioner; reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).
Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.7: The causal effect of Fear of contracting the Covid-19: IV-CMP approach (I) Robustness checks

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTI ON CHANGES	FEAR	Pr (Exp_C_changes=wi If decrease X) dy/dx	Pr (Exp_C_changes=wi If stay the same X) dy/dx	Pr (Exp_C_changes=wi If increase X) dy/dx
PROP_ATRISK		0.486*** (0.170)			
MORE_WOMEN		0.205* (0.107)			
Making ends meet (very difficult)	-0.363*** (0.126)	0.532*** (0.159)	0.123*** (0.0424)	-0.0876*** (0.0310)	-0.0352*** (0.0121)
Making ends meet (difficult)	-0.225** (0.109)	0.382** (0.153)	0.0761** (0.0368)	-0.0543** (0.0266)	-0.0218** (0.0105)
Making ends meet (easily)	-0.118 (0.108)	0.177 (0.156)	0.0400 (0.0363)	-0.0285 (0.0261)	-0.0115 (0.0104)
Exp. on the economic sit.	-0.215** (0.0963)	0.178 (0.119)	0.0725** (0.0324)	-0.0517** (0.0234)	-0.0208** (0.00937)
Exp. on the labour market	-0.204** (0.0950)	0.0650 (0.117)	0.0689** (0.0320)	-0.0492** (0.0231)	-0.0197** (0.00931)
Income risk	-0.400*** (0.0931)	0.238** (0.101)	0.135*** (0.0311)	-0.0963*** (0.0229)	-0.0387*** (0.00949)
Fear of contagion	-0.630*** (0.208)		0.209*** (0.0669)	-0.149*** (0.0455)	-0.0599*** (0.0226)
Constant		-1.595** (0.764)			
cut_1_1	-1.362** (0.583)				
cut_1_2	0.829 (0.582)				

atanrho_12	0.176*	
	(0.106)	
Wald test	10.77***	
(p-value)	0.0046	
Observations	1,394	1,394

Note. The table reports the results of the CMP approach and Robust Standard errors in parentheses. The sample is limited to households with only one income earner. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. Reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.8: The causal effect of Fear of contracting the Covid-19: IV-CMP with RE uncorrelated between the two equations approach (II)
Robustness checks

VARIABLES	(1)	(2)	Marginal Effects		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes=wi ll decrease X) dy/dx	Pr (Exp_C_changes=wi ll stay the same X) dy/dx	Pr (Exp_C_changes=wi ll increase X) dy/dx
PROP_ATRISK		0.639*** (0.228)			
MORE_WOMEN		0.284** (0.138)			
Making ends meet (very difficult)	-0.362** (0.145)	0.624*** (0.207)	0.116** (0.0460)	-0.0923** (0.0374)	-0.0236** (0.0101)
Making ends meet (difficult)	-0.211* (0.125)	0.468** (0.199)	0.0676* (0.0400)	-0.0538* (0.0321)	-0.0138 (0.00853)
Making ends meet (easily)	-0.0795 (0.124)	0.243 (0.201)	0.0255 (0.0396)	-0.0203 (0.0315)	-0.00519 (0.00815)
Exp. on the economic sit.	-0.253** (0.110)	0.173 (0.152)	0.0809** (0.0353)	-0.0644** (0.0286)	-0.0165** (0.00762)
Exp. on the labour market	-0.201* (0.109)	0.0878 (0.147)	0.0642* (0.0347)	-0.0511* (0.0279)	-0.0131* (0.00743)
Income risk	-0.470*** (0.110)	0.298** (0.132)	0.151*** (0.0347)	-0.120*** (0.0292)	-0.0307*** (0.00866)
Fear of contagion	-0.771*** (0.217)		0.247*** (0.0645)	-0.196*** (0.0493)	-0.0503*** (0.0188)
Constant		-0.522 (1.705)			
cut_1_1	-1.118 (1.203)				
cut_1_2	1.411				

	(1.204)	
Insig_1_1	-0.515***	
	(0.168)	
Insig_1_2	-0.194	
	(0.163)	
atanrho_12	0.307**	
	(0.155)	
Wald test	10.57***	
(p-value)	0.0051	
Observations	1,394	1,394

Note. The table reports the results of the CMP approach with RE uncorrelated between the two equations and Robust Standard errors in parentheses. The sample is limited to households with only one income earner. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. Reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation; the parameters ln_sig* are the logarithm of the standard deviation for each error (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.9: The causal effect of Fear of contracting the Covid-19: IV-CMP with CRE (III) Robustness checks

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR	Pr (Exp_C_changes= will decrease X) dy/dx	Pr (Exp_C_changes= will stay the same X) dy/dx	Pr (Exp_C_changes= will increase X) dy/dx
PROP_ATRISK		0.519*** (0.171)			
MORE_WOMEN		0.199* (0.106)			
Making ends meet (very difficult)	-0.348*** (0.126)	0.522*** (0.159)	0.116*** (0.0421)	-0.0827*** (0.0307)	-0.0337*** (0.0121)
Making ends meet (difficult)	-0.208* (0.109)	0.371** (0.153)	0.0695* (0.0364)	-0.0494* (0.0262)	-0.0201* (0.0105)
Making ends meet (easily)	-0.115 (0.108)	0.173 (0.156)	0.0385 (0.0361)	-0.0274 (0.0258)	-0.0111 (0.0104)
Exp. on the economic sit.	-0.200 (0.137)	0.133 (0.175)	0.0667 (0.0459)	-0.0474 (0.0327)	-0.0193 (0.0135)
Exp. on the labour market	0.0405 (0.132)	-0.0272 (0.154)	-0.0136 (0.0443)	0.00963 (0.0314)	0.00392 (0.0128)
Income risk	-0.422*** (0.157)	0.186 (0.160)	0.141*** (0.0523)	-0.100*** (0.0375)	-0.0408*** (0.0157)
Fear of contagion	-0.646*** (0.207)		0.216*** (0.0659)	-0.154*** (0.0444)	-0.0625*** (0.0227)
Constant		-0.785 (1.350)			
cut_1_1	-1.366 (1.043)				
cut_1_2	0.833 (1.038)				

atanhrho_12	0.190*	
	(0.106)	
Wald test	11.58***	
(p-value)	0.0031	
Observations	1,394	1,394

Note. The table reports the results of the IV-CMP approach combined with a CRE. Robust Standard errors in parentheses. Mundlak means for time-varying exogenous variables in both stages. The sample is limited to households with only one income earner. EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR is a dummy variable. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. Reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 2.10: The causal effect of Fear of contracting the Covid-19: IV-CMP with CRE and the alternative definition of fear

VARIABLES	(1)	(2)	MARGINAL EFFECTS		
	EXP. ON CONSUMPTION CHANGES	FEAR_2	Pr (Exp_C_changes= will decrease X) dy/dx	Pr (Exp_C_changes= will stay the same X) dy/dx	Pr (Exp_C_changes= will increase X) dy/dx
PROP_ATRISK		0.276*** (0.0938)			
MORE_WOMEN		0.0991* (0.0543)			
Making ends meet (very difficult)	-0.356*** (0.0721)	0.653*** (0.0810)	0.116*** (0.0236)	-0.0798*** (0.0168)	-0.0366*** (0.00723)
Making ends meet (difficult)	-0.252*** (0.0587)	0.458*** (0.0743)	0.0826*** (0.0193)	-0.0566*** (0.0136)	-0.0260*** (0.00598)
Making ends meet (easily)	-0.112** (0.0537)	0.176** (0.0742)	0.0368** (0.0176)	-0.0252** (0.0121)	-0.0116** (0.00550)
Exp. on the economic sit.	-0.0670 (0.0816)	0.160* (0.0863)	0.0219 (0.0267)	-0.0150 (0.0183)	-0.00689 (0.00840)
Exp. on the labour market	-0.131* (0.0760)	-0.0229 (0.0880)	0.0429* (0.0249)	-0.0294* (0.0171)	-0.0135* (0.00788)
Income risk	-0.202** (0.0838)	0.0651 (0.0999)	0.0660** (0.0275)	-0.0453** (0.0189)	-0.0208** (0.00870)
Fear_2	-0.499*** (0.104)		0.163*** (0.0328)	-0.112*** (0.0216)	-0.0514*** (0.0118)
Constant		-1.710*** (0.428)			
Cut_1_1	-2.235*** (0.357)				
Cut_1_2	0.00658 (0.357)				
atanrho_12	0.0959*				

	(0.0546)	
Wald test	10.96***	
(p-value)	0.0042	
Observations	4,423	4,423

Note. The table reports the results of the IV-CMP approach combined with a CRE. Robust Standard errors in parentheses. Mundlak means for time-varying exogenous variables in both stages EXP. ON CONSUMPTION CHANGES is an ordered discrete dependent variable. Coded so that the value of the variable goes from expected decrease to expected increase in expenditure on essential goods. FEAR_2 is a dummy variable. The model includes socio-demographic variables (age, age squared, gender, marital status, regional dummies, and occupational dummies) and a temporal dummy. Reference category for making ends meet is very easily; reference category for expectation on economic situation and labour market is improve or stay the same. Prop_atrisk and More_Women are the two IV variables. cut_1_1 and cut_1_2 are the ordered-probit cuts, and they are unknown parameters for estimation, (Rodman, 2011).

Significance: *** p<0.01, ** p<0.05, * p<0.1

Chapter III

Chapter III

Fear of Covid-19 and willingness to be vaccinated

Abstract

This study uses data from the second wave of the Survey of Health, Aging and Retirement in Europe (SHARE) Corona Survey, to provide evidence on the effect of Covid-19 Case Fatality Rate (CFR) information on the willingness to be vaccinated in France and Spain. We take advantage of the different age stratification used by the National Authorities of these countries for their official communication on the severity of the virus in a Regression Discontinuity Design approach. Findings reveal that communication can play a positive role to combatting vaccine hesitancy, since that people respond “proactively” to health-based threatening communications. This evidence has implications for the public health intervention strategies to promote vaccine uptake, when mandates are not possible, governments might consider the sensitivity of individual behaviour to the official communications.

1. Introduction

In a response to limit the spread of the Covid-19 disease to alleviate pressure on the health system, many governments worldwide adopted non-pharmaceutical interventions (NPIs) such as social distancing, mobility restrictions and quarantine, the only viable actions, whereas the non-existence of a vaccine. However, if on the one hand these orders have had success to reduce the transmission of the virus, on the other they have had unprecedented effects on economic activity; several categories of consumption were prohibited (Baker et al. (2020) and Cox et al. (2020), Chronopoulos et al. (2020), Andersen et al. (2020)); restrictions orders led to a reduced workforce across all economic sectors and caused the loss of many jobs. Indeed, the largest losses can be attributed to industries and occupations most affected by closures (such as public-facing occupations in accommodation and food services) and to workers who are younger, paid hourly, and non-union (Chetty et al. (2020); Lemieux et al. (2020)). Consequently, the NPIs are unsustainable in the long-term and therefore hopes to control the pandemic and sustain the global economic recovery rely heavily on vaccination.

Vaccines are among the most cost-effective health technologies of all time. There are several views on how vaccination contributes directly and indirectly to the economy. First, and perhaps most obviously, the positive impact on healthcare resources. Beyond the reduction of the costs for the healthcare system, the reduction in mortality and morbidity also contributes to decrease lost labour force productivity and increasing consumption and gross domestic demand. Moreover, there is evidence that immunization from Covid-19 caused a reduction in the households' economic insecurity and household savings, resulting in an increase in consumer spending (Ren and Zheng (2023)). Therefore, the mass vaccination campaigns can have economic enhancing spill-over effects well beyond the inoculated individuals' antibody presence and can contribute to a boost in the level of optimism in the economy—optimism which can, in turn, help the economy to recover faster (Belmonte and Pickard, (2022)). Additionally, by choosing to be vaccinated, an individual protects themselves but also protects their community by preventing disease transmission. Hence, a vaccinated population would minimize the risk of the virus evolving into new and more dangerous variants facilitating the safe reopening of the economy, which is crucial for economic recovery and growth.

However, in economic terms, the non-excludable and non-rivalrous nature of herd immunity makes it a public good, and consequently, it is vulnerable to free-riding or use by individuals who do not contribute to maintaining it (Buttenheim and Asch, (2013)). More concretely, individuals will choose to vaccinate at a rate that is lower than optimal for society, since the herd immunity protects them from disease even in the absence of vaccination. However, in the presence of vaccine hesitancy and

relaxation of other public health measures, mortality could increase by up to seven times compared with the ideal vaccination coverage of the population (Oliviera Mesa et al. (2022)). Therefore, vaccine acceptance appears to have a decisive role, as a failure to reach herd immunity potentially draws out the crisis as well as extends social distancing and lockdown measures putting economic recovery at risk. Accordingly, longer, and more stringent public health measures would be required to compensate for the lower vaccine uptake. Consequently, the return to some normality and the recovery of economies is dependent on the success of measures such as vaccination. Therefore, improving the knowledge on vaccination willingness and/or vaccination hesitancy and finding out what strategies may encourage vaccination is as important as discovering a safe and effective vaccine, since widespread vaccinations not only keep people healthier, but it also has a significant impact on the national economy. In this sense, we seek to provide evidence on the effect of Covid-19 Case Fatality Rate information strategies on the willingness to be vaccinated in France and Spain.

We decide to use data from the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) Corona Survey conducted between June and August 2021, and designed to estimate the impact of the pandemic on individuals above 50 years old in Europe. Thus, in our study, we consider the elderly who were targeted as a priority group for vaccination in many countries because people that are aged 50 and over constitute a large and growing segment in many areas of consumption, and the expansion of this demographic group is expected to boost demand in many sectors.²⁵ We exclude Italy from this analysis since at the time of the Survey vaccination was compulsory, but we can provide evidence on the effect of Covid-19 CFR information strategies on willingness to vaccinate against the virus for France and Spain. Since these countries are characterized by similar demographic and epidemiological profiles during the pandemic (Antonini et al. (2022)) but adopted different communication strategies on the severity of the disease. In addition, they share the main goal in their Covid-19 vaccination strategies.

Empirically, the estimation of the effect of the information on vaccine intake poses several challenges: individuals' perception of the value of information and information acquisition are strongly influenced by unobserved characteristics, which in turn may also influence vaccine compliance. Simply regressing information about Covid-19 on such a decision will therefore lead to a biased estimation due to an underlying endogeneity problem. To provide causal evidence, we exploit the different age stratification used by the “*Santé publique France*” and “*Centro de Coordinación de Alertas y Emergencias Sanitarias*”, which are the French and Spanish National

²⁵ This topic is related to the so called “Silver Economy”. See: European Commission, Directorate-General for Communications Networks, Content and Technology, Worthington, H., Simmonds, P., Farla, K., et al., *The silver economy : final report*, Publications Office, 2018, <https://data.europa.eu/doi/10.2759/685036>

Health Authorities respectively, for their official communications on the severity using a Regression Discontinuity Design approach. We implement a RDD to verify if any discontinuity in the willingness to get the vaccine against Covid-19 arises at two different cut-offs, at which the CFR of the virus increases significantly and identified according to the age stratification used in national epidemiological updates. Results suggest that people respond proactively to the perception of death from Covid-19 induced by official statements by deciding to get the vaccine, thus providing benefits not only to epidemic dynamics but also to economic recovery. In addition, this evidence confirms the sensitivity of individual behaviour to the communication strategy used for official statements and may be considered in support of our identification strategy used in the first chapter for Italy.

The paper proceeds as follows. The next section is a review of the existing literature on vaccination hesitancy. The dataset is described in Section 3, and the variables used in the analysis are defined. Section 4 outlines the identification strategy and results. In Section 5 we check the validity of RDD. Section 6 concludes.

2. Previous Literature

The Covid-19 pandemic has simultaneously resulted in high global mortality and major economic disruptions and vaccination could be an effective strategy for slowing the spread of the disease and supporting economic recovery. Understanding the factors driving vaccine hesitancy can help in guiding interventional measures aimed at building and maintaining responses to tackle populations' concerns about getting vaccinated. According to the Strategic Advisory Group of Experts on Immunization (SAGE), individuals may accept all vaccines but remain concerned about vaccines, some may refuse or delay some vaccines but accept others; some individuals may refuse all vaccines. Consequently, present day debates around vaccination, determinants of vaccine acceptance are increasing. However, studying the global impact of vaccines, the willingness to accept Covid-19 vaccines is a complex issue by the multifaceted nature of this phenomenon, ranging from cognitive, cultural, ideological to socio-demographic factors. Vaccine hesitancy is as old as vaccines themselves; in the context of the Covid-19 pandemic, Neumann-Böhme et al. (2020) and Bughin et al. (2021) find that individuals' preference for vaccination is dictated by their perceptions of the vaccine's advantages and risks and their concerns about safety, efficacy thinking that a vaccine produced in a rush is too dangerous (De Figueiredo et al., (2020)). These findings are consistent with a meta-analysis conducted by Brewer et al. in 2007 based on conditioned risk questions, according to which people are more likely to accept vaccination when they perceive a high risk of contracting the disease when

they are unvaccinated, a greater personal vulnerability to the disease, and a greater severity of the disease. Consequently, vaccine refusal arises from underestimated risk of disease or overestimated risk of vaccine-induced adverse effects. On the other hand, nowadays low vaccine uptake has gained momentum in recent years due to a growing people's social media usage and distrust in science and institutions and their conventional or authoritative media sources (Gehrau et al. (2021); Murphy et al., (2021), Martinez-Bravo and Stegman, (2022)). Therefore, interventional educational campaigns targeted towards populations at risk of vaccine hesitancy are therefore urgently needed to combat misinformation and avoid low inoculation rates. Among other social and cultural factors death anxiety elicited by the Covid-19 pandemic plays an essential role in influencing people's reaction to vaccination campaigns. Indeed, Scrima et al. (2022) find a positive relationship between fear of Covid-19 and intention to get vaccinated. Their results are in line with Terror Management Health Model, which states that in facing health threats, humans may strive to reduce their own perceived vulnerability by engaging in healthy behaviours.

Starting from the above-mentioned results, the goal of our study is to investigate on the impact of Covid-19 CFR information on vaccination decision. Our hypothesis is that the systematic exposure to news on CFR related to the disease emphasising the risk of death may have produced an intensification of fear of infection and anxiety, which in turn increases the willingness to get the vaccine. Therefore, our study is part of the growing literature that examines the responses of willingness to get the vaccine against Covid-19 to strategic health communication channels which contribute to more effective promotions of vaccination intention and the reduction of misleading information about Covid-19 vaccines.

3. Data

This analysis is based on individual-level data from the special questionnaire of the Survey of Health, Ageing, and Retirement in Europe (SHARE) - the SHARE Corona Survey (SCS). SHARE provides data on health, socio-economic status and social and family networks of European citizens aged 50 or older. During the outbreak of the Covid-19, a special Corona survey questionnaire was designed and conducted in all 28 European countries to examine the impact of the Covid-19 pandemic on the health and living situation of the 50+ population. In this study, we consider the second SCS fielded between June 2021 and August 2021 that contains information about vaccination decisions²⁶. First, each respondent answers whether they have been vaccinated against Covid-19, and those who

²⁶ The specific wording of questions is reported in the Appendix, Question -a- and -b-

answered “No” received another question whether they have already scheduled an appointment, want to get vaccinated, do not want to get vaccinated or are still undecided. Starting from these questions, we construct our outcome variable equal to 1 if a respondent replies that she/he is vaccinated or she/he wants to get vaccinated (with or without a scheduled appointment), and 0 otherwise.

We exclude Italy from our study since that at the time of the survey vaccination was compulsory for healthcare workers. In fact, the 1st of April 2021, Italy became the first country in Europe to begin to make compulsory vaccination against Covid-19, the government having approved Decree Law No. 44 with the intent to stop a third wave of the disease. Therefore, we restrict our analysis to France and Spain. These countries share similar demographic, and epidemiological profiles and experienced a significant first wave of Covid-19 cases during the first year of the pandemic, as well as Italy.

In total, we have about 1,700 respondents for France and about 1,600 for Spain. Tables 3.1a-3.1b, in the Appendix, provide some descriptive statistics on the respondent, for France and Spain, respectively. We use sample weights to make the statistics population-representative.

4. Identification Strategy

During the first part of 2020, Spain and France were the most severely affected countries by the virus, with high fatality rates (CFR) and intensive care unit (ICU) admissions. In addition, they adopted similar Covid-19 vaccination strategies, namely, to prioritise the most vulnerable group, such as elderly, high-risk individuals, and virus-susceptible individuals (e.g., health workers). However, they were also characterized by a different vaccine acceptance rate; France was amongst the European countries that faced public resistance against massive vaccination campaigns, leading the government imposing compulsory vaccination for selected groups, (but at a later date than the survey, and the Health Pass); while in Spanish population acceptance was relatively high, which meant that the government did not intervene with any kind of obligation to encourage vaccination. The Covid-19 vaccines provide strong protection against serious illness, hospitalization and death and play a key role to return to a pre-pandemic lifestyle, and for a safety reopening of business, cultural and creative activities.²⁷ Therefore, the widespread vaccinations is an important issue for policy makers to address, because it not only keeps people healthier, but increases overall economic activity. In this study, we focus our attention on the threatening information about the severity of the virus by age group. We argue that daily exposure to CFR news and updates, which emphasises that the advanced

²⁷ *Coronavirus disease (COVID-19): Vaccines-Q&A*, 17 May 2022 [https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-\(covid-19\)-vaccines](https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-(covid-19)-vaccines), Accessed: December 2022

age appears to be a crucial factor in Covid-19 health outcomes may have increased the feeling of fear of infection according to the belonging to a specific age group, incentivising preventive behaviour, such as vaccination.

However, perception, acceptance and understanding information about the virus and vaccine, depend on individual unobserved characteristics; consequently, to provide causal evidence simply regressing information about Covid-19 on a decision to get the vaccine will therefore lead to a biased estimation due to an underlying endogeneity problem. Therefore, we can provide evidence on the effect of Covid-19 CFR information on the willingness to be vaccinated in France and Spain, exploiting the different communication strategies on the severity of the disease adopted by “*Santé publique France*” and “*Centro de Coordinación de Alertas y Emergencias Sanitarias*”, which are the French and Spanish National Health Authorities respectively. In particular, the National Health Authorities of these countries disseminate weekly and/or daily national epidemiological updates considering different age-group strata.²⁸ Since that the age strata varied considerably between the countries, we apply a Regression Discontinuity Design (RDD) approach, setting different cut-offs according to the age clusters used in the two countries. Based on national epidemiological updates, the age strata is 10-years for Spain and France but the age group is defined differently. In Spain grouping starts at the age of 10 (10-19, 20-29, 30-39...etc), while in France it starts at the age of 15 (15-44, 45-64, 65-74, 75+). To set the cut-off, we take into account the temporal inconsistency between the information on the fatality rate of Covid-19 and the age of the respondents at the time of the survey which was conducted during the second half of 2021. Indeed, we take into account the CFR recorded before the start vaccination against the Covid-19, which started at the end of December 2020. Consequently, we move the cut-offs forward, to make sure that respondent identifies himself in the right age group and recognises the associated CFR. Hence, we set the cut-off at the age 66 for France and 62 for Spain.²⁹ The Regression Discontinuity Design method relying on the fact that a higher level of vaccination is defined as a discontinuous function of the respondent’s age (Lee and Lemieux 2010; Angrist and

²⁸All information on age strata were extracted from National Health Authority websites, in particular: France. Sante Publique France. Covid-19: point épidémiologique <https://www.santepubliquefrance.fr/recherche/#search=COVID%2019%20%20%20point%20epidemiologique&publications=donn%C3%A9es®ions=National&sort=date>
Spain. Centro de Coordinación de Alertas y Emergencias Sanitarias. Actualización n° 120. Enfermedad por el coronavirus (Covid-19). 29.05.2020 (datos consolidados a las 12:00 horas del 29.05.2020) Situación En España. Source: https://www.sanidad.gob.es/profesionales/saludPublica/ccayes/alertasActual/nCov/documentos/Actualizacion_120_COVID-19.pdf

²⁹ We set the cutoff at the age 62 for Spain to be sure that individuals would recognise themselves as being in their sixties and not as being in their fifties, an idea that is already well established for those who are already 65 and will turn 66, which is the case for France.

Pischke 2009). In general, a Regression Discontinuity Design allows to compare the outcomes of units just above the threshold with the outcomes of units just below the threshold. In our case, RDD compares willingness to get the vaccine against Covid-19 just before and after the age at which the CFR rises sharply. We start with a graphical analysis, that is an integral part of any RDD study.

[Fig. 3.1]

The Fig. 3.1 in the Appendix shows with dots the sample average within each bin of willingness to get the vaccine against French and Spanish respondents' age. The continuous line predicts the values of a 4-order polynomial, estimated separately on each side of the cut-off point represented by the vertical line at 66 and 62 age of the respondent, for France and Spain respectively. In all panels of Fig. 3.1, we can see a clear jump in the relationship between the outcomes (Willingness to vaccinate against Covid-19) and the respondents' age variable in the proximity of the threshold.

Then, we follow a Non-Parametric RD approach. This approach tries to produce reliable estimates focusing on small samples to the right and to the left of the cut-off point ("bandwidths"), through the so-called Local Linear Regressions and Polynomial Regressions that represent a sort of Weighted Least Squares estimations, where the weights are larger the closer the observations are to the cut-off. In the Columns (1) and (2) of the Table 3.2 in the Appendix are reported the non-parametric estimates for France and Spain, respectively. We use a Uniform Kernel, a linear polynomial and the Mean Squared Error optimal bandwidth selection (*Mserd*), a data-driven bandwidth selection that optimizes the Mean Squared Error, that selects a bandwidth of about 4 years before and 4 years after the cut-off for France, and ± 8 for Spain. We find that at the cut-off the propensity to get the vaccine increases by around 13,5 % for France and 8 % for Spain.

Empirical evidence suggests that many factors influence vaccination decision-making, like gender, family size, occupation, chronic diseases, self-reported health status and if respondents know someone who has contracted the virus. Therefore, to check the robustness of our results, we decide to replicate the same estimates but including the above-mentioned covariates. Again, we find quite similar results, which are reported in Table 3.2 column (3) for France and (4) for Spain in the Appendix. Our findings confirm that threatening health messages that focus on severity influence behaviour change. Since that, according to the recent psychological and behavioural literature, people are most likely to take preventative actions if they perceive the threat of a health risk to be serious.

4.1. Robustness Check

As further robustness checks, we investigate if the discontinuity at the cut-offs identified by considering the age stratification used to disseminate the information about the CFR related to the Covid-19 pandemic information continues to exist if we consider vaccination against seasonal flu. Seasonal influenza such as Covid-19 is a highly contagious disease, causing an acute respiratory infection in humans that can progress from a mild infection to a severe and sometimes fatal illness, especially in young children, the elderly and people with chronic illnesses. For this reason, the Ministries of Health of different countries promote flu vaccine uptake to reduce risk of death and serious illness among the most vulnerable groups. Starting from the survey question, which asks whether one is vaccinated against seasonal flu, we construct the dependent variable equal to 1 if the respondent declares that he or she is vaccinated against seasonal influenza, and 0 otherwise.³⁰ Therefore, we conduct a graphical analysis, that is one of the main advantages of the RDD approach.

[Fig. 3.2]

In both panels of Fig. 3.2 in the Appendix, we find no discontinuity at the age of 66 years for France and 62 for Spain in the probability of vaccinating against seasonal flu. However, we do not find any discontinuity in the relationship between the outcome (vaccinated against flu) and the respondents' age in the proximity of the threshold, which is determined considering the age stratification used to spread news about Covid-19, in particular the Case Fatality Rate.

5. Check the validity of RDD

In this section, we check the validity of the RDD. The assumptions underlying this approach are that unobservable characteristics do not vary discontinuously around the cutoff point and, there is no “manipulation” of the forcing variable and so the cut-off provides exogenous variations in the treatment.

In our case manipulation of the running variable, it is potentially impossible; respondents cannot decide their age, so the requirement of “no manipulation”, namely that individuals must not have precise control over the assignment variable seems satisfied. However, we decide to carry out the

³⁰ The specific wording of questions is reported in the Appendix, Question -c-

formal McCrary test (2008), using local polynomial density estimation and find a coefficient of 0.037, which, with a p-value= 0.9704, for France that is far from being significant; while for Spain coefficients found is equal to 1.900, with a p-value= 0.057; the null hypothesis is not rejected at any conventional level for France, whereas for Spain it is not rejected at the 1% and 5% significance level, suggesting there is no self-selection or sorting of units into the treatment around the cut-off. The absence of manipulation is confirmed by inspection of the graph of the density of the forcing variable (respondent's age) around the cut-off.

[Fig. 3.3]

Both panels of the graph in the Appendix do not show any evidence of jumps. Since, there is no discontinuity in the distribution of the respondent's age at the cut-off point, we are certain that this variable was not manipulated by the respondents.

The other requirement for the validity of the RDD is that in the absence of manipulation, respondents around the threshold age should not differ significantly in terms of observable and unobservable variables. Therefore, to check for continuity assumption, we examine the continuity of observed covariates. Hence, we conduct a parallel RD analysis on covariates to determine whether they are continuous at the threshold at the respondent's age of 66 years for France and 62 for Spain.

[Fig. 3.4a - Fig.3.4b]

The observable characteristics are all sufficiently continuous at the cut-offs, assuring the similarity of the two groups around the cut-offs, with the exception for the variable "male" for Spain. Hence, we proceed by replicating the RDD analysis for Spain distinguishing respondents by gender. The results are reported in the Table 3.3 in the Appendix. On the other hand, for France observable characteristics are all sufficiently continuous at the cut-off, assuring the similarity of the two group around the cutoff, confirming that the effect estimated in our main analysis is not due to any spurious correlation between the age and other factors.

6. Conclusions

Vaccines are an important tool for governments to contain the Covid-19 pandemic, reduce mortality and morbidity. However, despite their effectiveness and safeness a substantial portion of the population is hesitant to get the inoculation. Therefore, it is important to design effective strategies to encourage vaccination against Covid-19. In addition, beyond the impact on health status, vaccination contributes to reducing the costs incurred by the healthcare system and welfare expenditure, thus the economic conditions improve, and this helps ease people's uncertainties about their job losses and financial situation during the pandemic. Consequently, motives to accumulate precautionary savings are lessened, and individuals could increase their consumption and so that gross domestic demand increases. Therefore, getting inoculated should be considered an investment not only in society's health but also in the nation's ongoing economic recovery efforts. For these reasons, in this study, by using data from the second wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) Corona Survey, we examine the causal effect of information on the Case Fatality Rate of Covid-19 to the willingness to get the vaccine for France and Spain. In particular, we exploit the different age stratification used by National Authorities of these countries for their official communications on the severity of Covid-19 to show that at the age at which CFR increases considerably, the willingness to vaccinate also increases.

The rationale for these results is discussed in recent psychological literature. During the pandemic, it was impossible to read newspapers, to visit a social media website without being inundated with information on the pandemic; therefore, according to the Terror Management Theory, the salience of death intensifies the perception of fear of infection, thus people respond with protective behaviours aimed at reducing risk and may entail rational choices, such as the intention to vaccinate as soon as possible. Our evidence confirms that communication is a powerful tool for influencing attitudes toward various health-related issues, such as vaccine reluctance, provided it is well-designed and thoughtfully conducted. Indeed, results offer an important insight for those working in public health: people respond "proactively" to health-based threatening communications.

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Appendix

Survey Questions

-a- Have you been vaccinated against Covid-19?

Yes

No

-b- (if **-a-**=No) Do you want to get vaccinated against Covid-19?

Yes, I already have a vaccination scheduled.

Yes, I want to get vaccinated.

No, I do not want to get vaccinated.

I'm still undecided.

-c- In the last 12 months, did you get a flu vaccination?

Yes

No

Appendix Tables and Figures

Table 3.1a: Summary Statistics: France

	MEAN	STD. DEV	N
Age (years)	67.893	8.279	1,726
Male	0.429	0.494	1,726
Female	0.571	0.494	1,726
Family size	1.940	0.821	1,726
Chronical Disease			
Heart Problem	0.122	0.328	1,715
Diabetes	0.124	0.329	1,715
Chronic Lung Disease	0.064	0.244	1,715
Cancer or Malignant Tumour	0.047	0.211	1,715
Hip Fracture	0.008	0.090	1,715
Others	0.359	0.479	1,715
Self-reported Health status			
Poor	0.079	0.269	1,725
Good	0.470	0.499	1,725
Excellent	0.050	0.218	1,725
Know someone with Covid-19	0.335	0.472	1,707
Willingness to be vaccinated against Covid-19	0.894	0.307	1,723
Note. Statistics are computed using sample weights			

Table 3.1b: Summary Statistics: Spain

	MEAN	STD. DEV	N
Age (years)	68.179	8.982	1,586
Male	0.419	0.494	1,586
Female	0.581	0.494	1,586
Family size	2.279	1.097	1,586
Chronical Disease			
Heart Problem	0.122	0.328	1,572
Diabetes	0.185	0.388	1,572
Chronic Lung Disease	0.050	0.219	1,572
Cancer or Malignant Tumour	0.031	0.173	1,572
Hip Fracture	0.024	0.152	1,572
Others	0.416	0.493	1,572
Self-reported Health status			
Poor	0.092	0.289	1,582
Good	0.430	0.495	1,582
Excellent	0.024	0.153	1,582
Know someone with Covid-19	0.356	0.479	1,563
Willingness to be vaccinated against Covid-19	0.974	0.160	1,582

Note. Statistics are computed using sample weights

Table 3.2: RD estimates using local polynomial regression

	(1) Willingness to get the vaccine France	(2) Willingness to get the vaccine Spain	(3) Willingness to get the vaccine France	(4) Willingness to get the vaccine Spain
RD_Estimate	0.135* (0.0757)	0.0820* (0.0441)	0.129* (0.0748)	0.0812* (0.0439)
Bw Type	Mserd	Mserd	Mserd	Mserd
Kernel	Uniform	Uniform	Uniform	Uniform
Covs	No	No	Yes	Yes
Observations	1723	1582	1696	1552
Eff. obs- Left of c	179	92	178	92
Eff. obs - Right of c	330	548	328	540
Bandwidth	3.626	8.018	3.573	8.219
Order polyn.	1	1	1	1

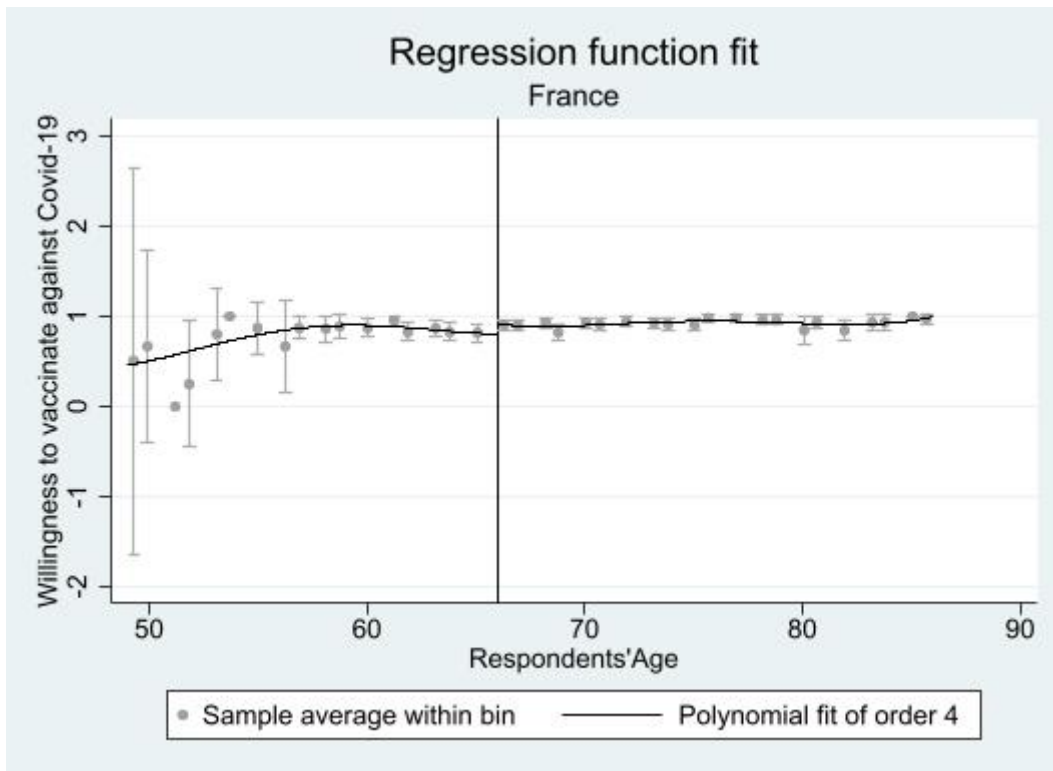
Note. Table reports in Columns (1)-(3) and (2)-(4) the RD estimates using local polynomial regression without and with covariates for France and Spain, respectively; the outcome variable is the willingness to get the vaccine and the running variable is the respondent's age. RD estimates using local polynomial regression. The estimates are implemented using the Stata program *rdrobust* by Calonico, Cattaneo, Farrell, and Titiunik. Mserd indicates one common MSE-optimal bandwidth selector for the RD treatment effect estimator. Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 3.3: RD estimates using local polynomial regression for Spain: gender

	(1) Willingness to get the vaccine “Men”	(1) Willingness to get the vaccine “Men”
RD_Estimate	0.253* (0.139)	0.278* (0.146)
Bw Type	Mserd	Mserd
Kernel	Uniform	Uniform
Covs	No	Yes
Observations	674	662
Eff. obs- Left of c	33	30
Eff. obs - Right of c	134	82
Bandwidth	5.046	3.837
Order polyn.	1	1

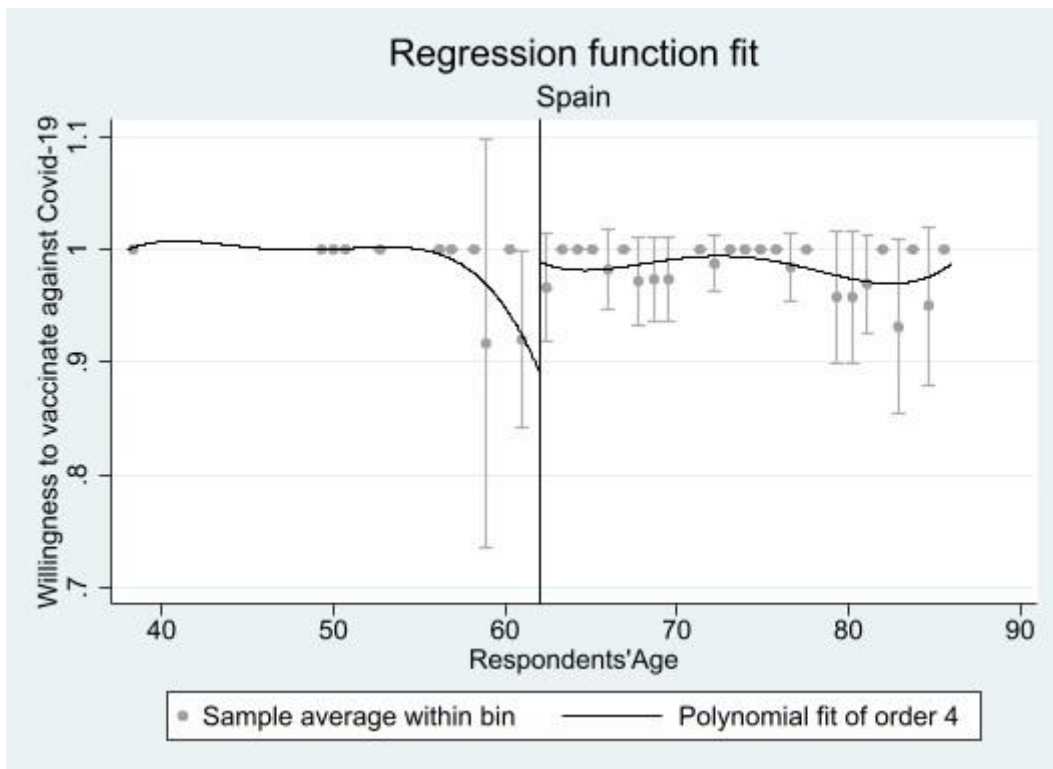
Note. Table reports in Columns (1) and (2) the RD estimates using local polynomial regression without and with covariates for Spain, by gender; the outcome variable is the willingness to get the vaccine and the running variable is the respondent’s age. RD estimates using local polynomial regression. The estimates are implemented using the Stata program *rdrobust* by Calonico, Cattaneo, Farrell, and Titiunik. Mserd indicates one common MSE-optimal bandwidth selector for the RD treatment effect estimator. Significance: *** p<0.01, ** p<0.05, * p<0.1

Fig. 3.1: Graphical analysis of the relationship between the willingness to vaccinate against Covid-19 and the respondents 'age



The vertical line at age 66 denotes the cut-off

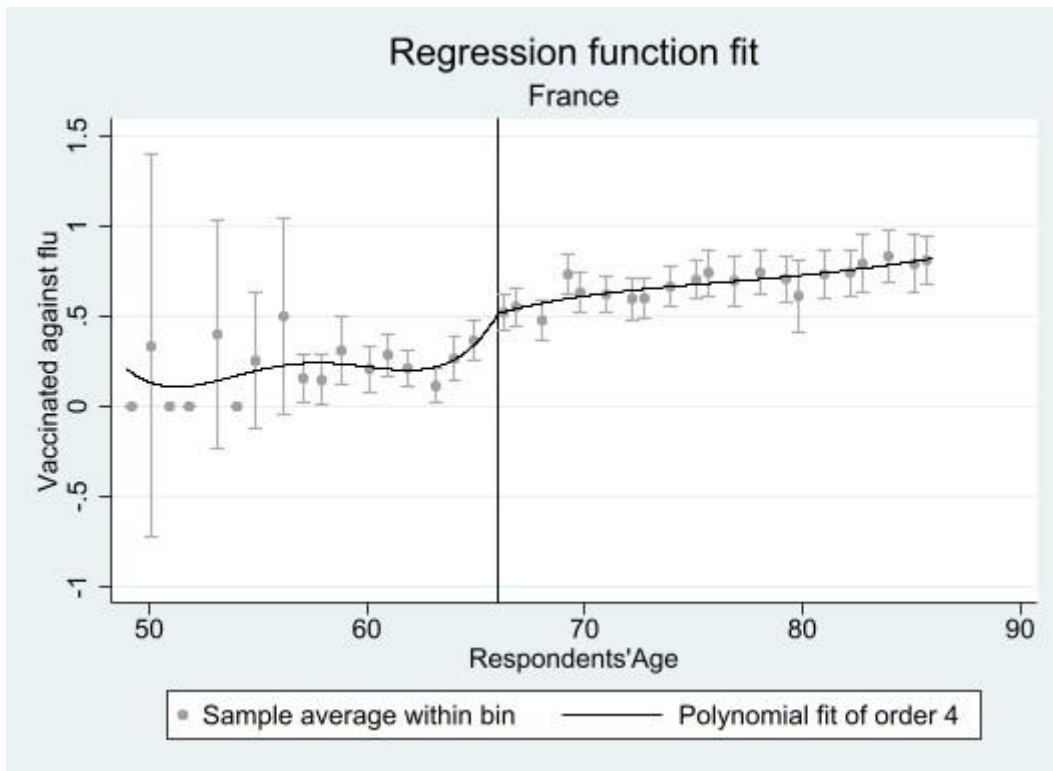
Panel (a)



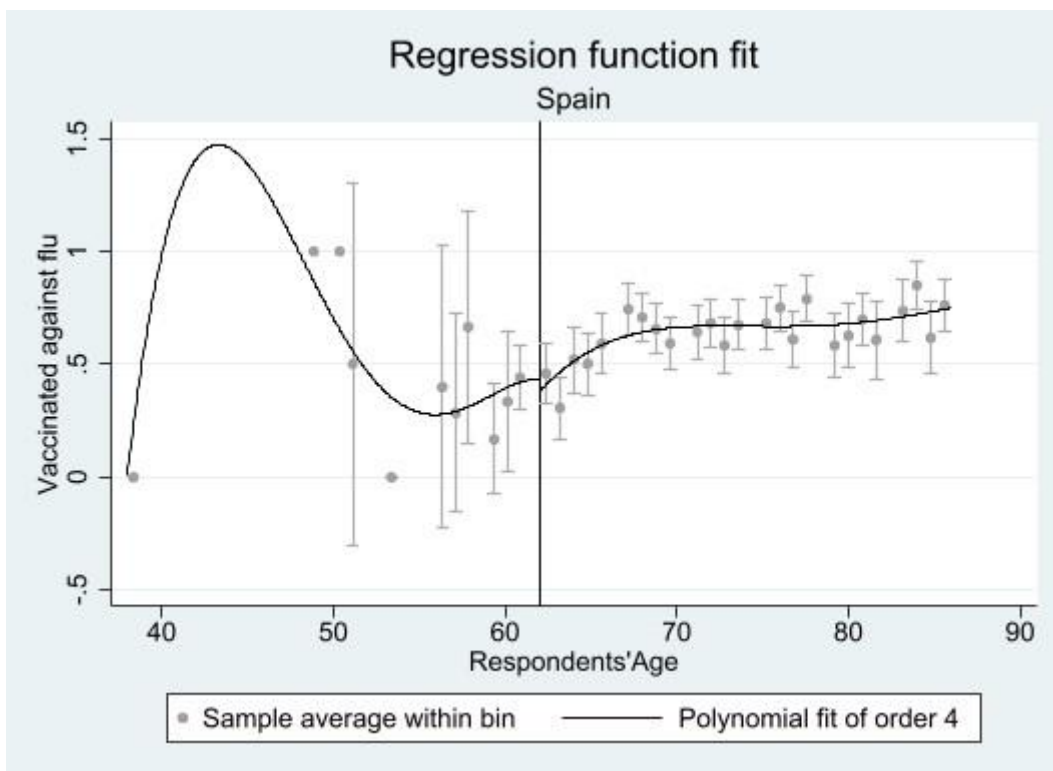
The vertical line at age 62 denotes the cut-off

Panel (b)

Fig. 3.2: RD Robustness check: Graphical analysis of the relationship between the vaccination against flu and the respondents 'age



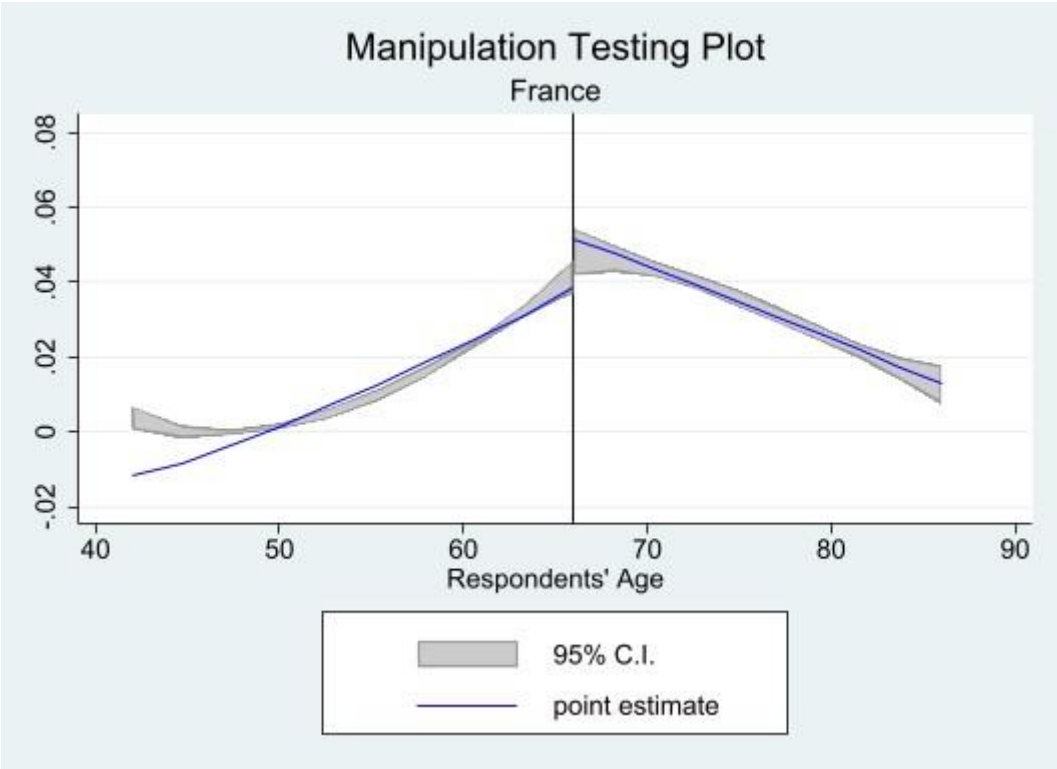
Panel (a)



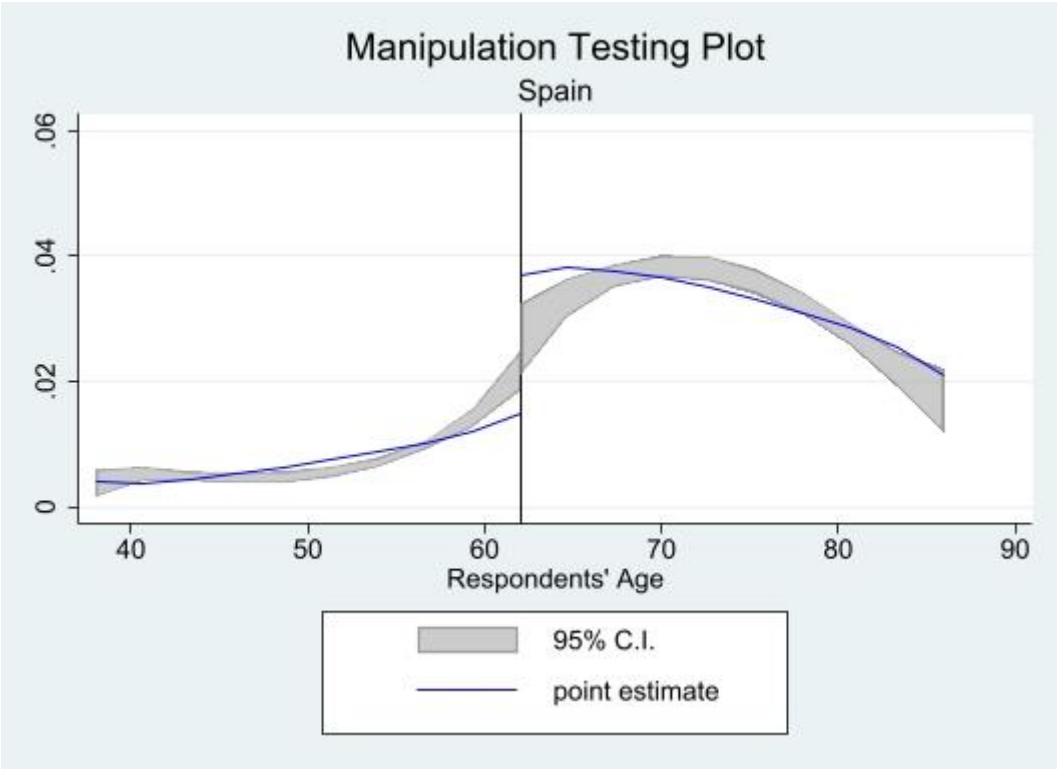
Panel (b)

Fig. 3.3: RD validity check I:

Density of the forcing variable (Respondent's age)



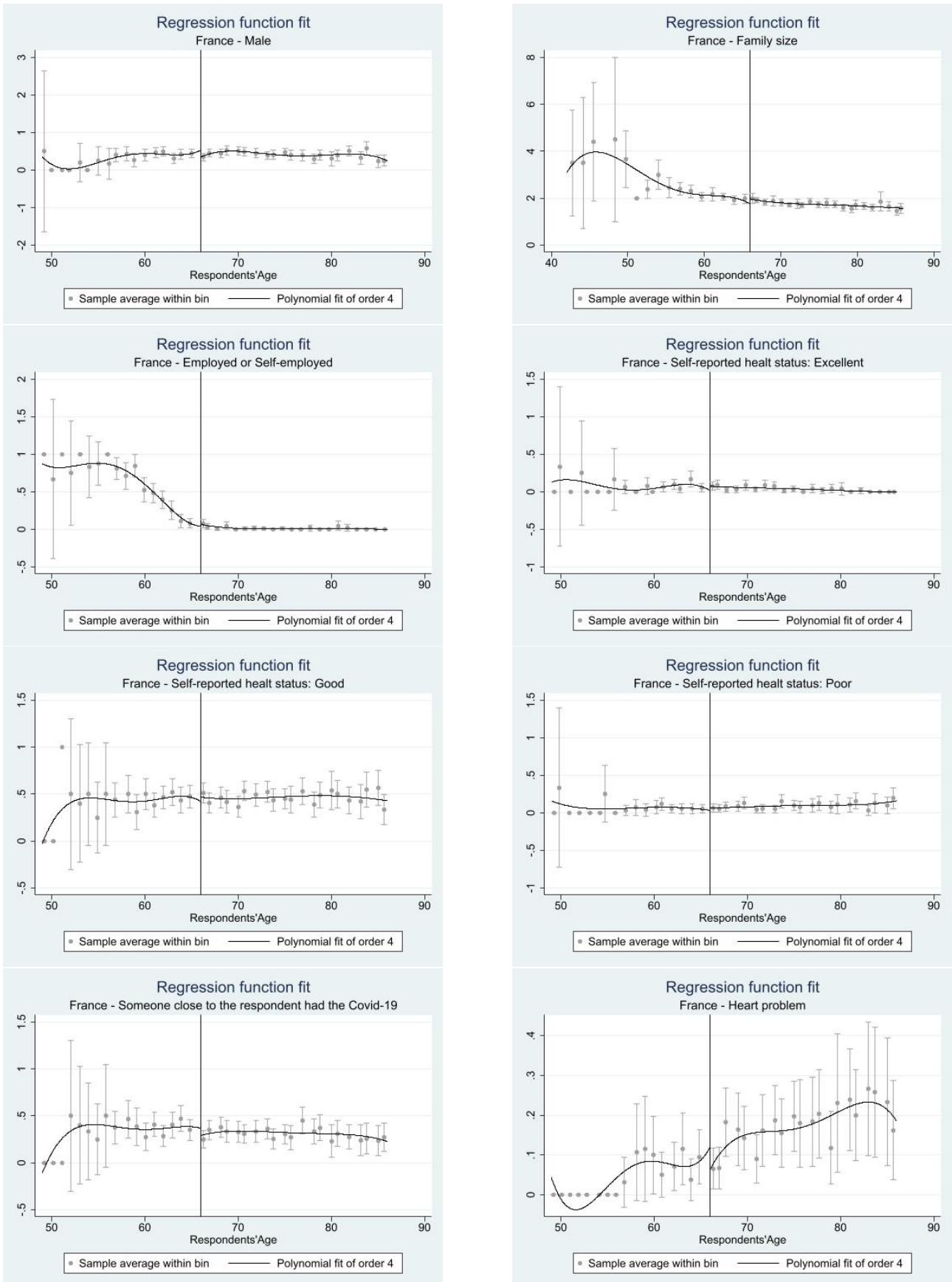
Panel (a)



Panel (b)

Fig. 3.4a: RD validity check II:

Continuity of observed covariates – France



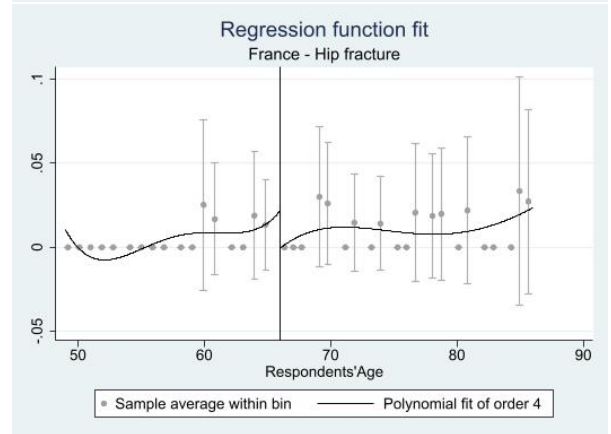
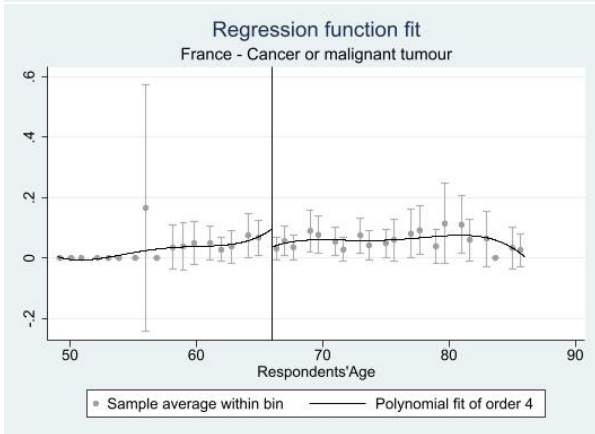
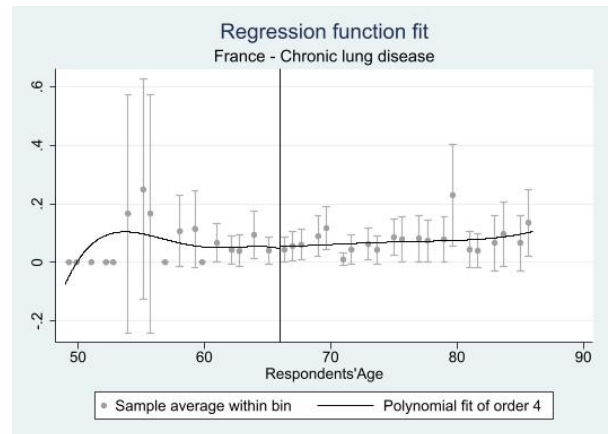
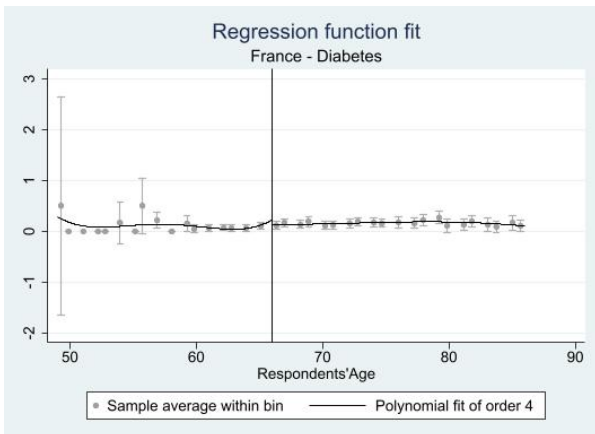
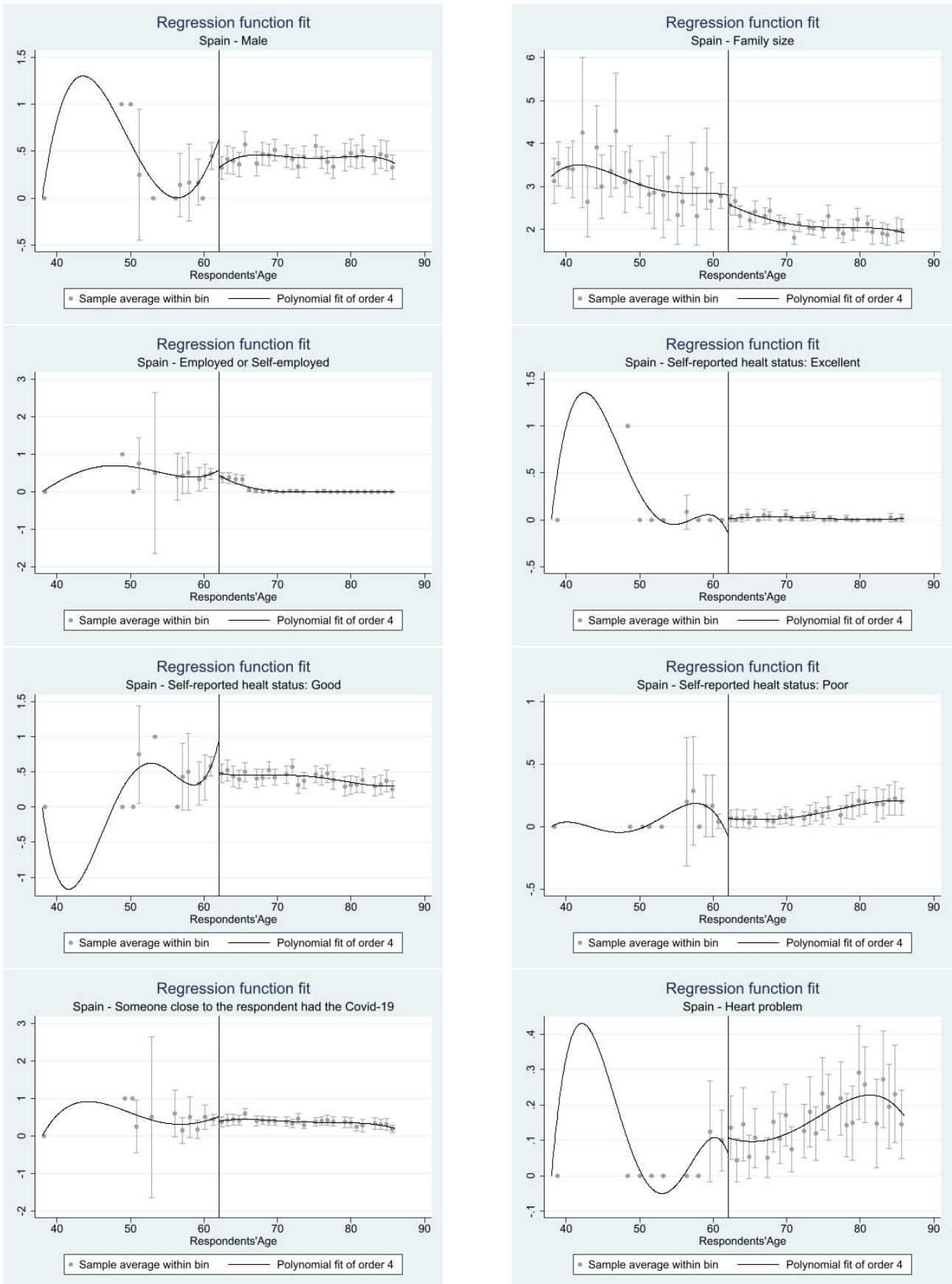
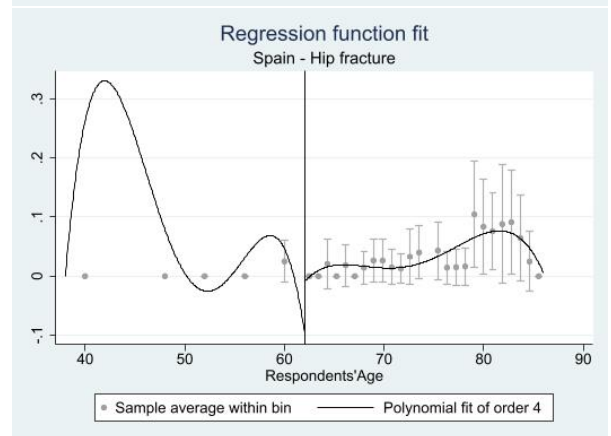
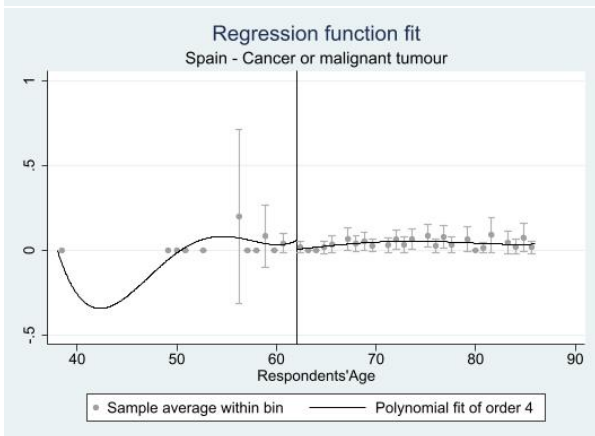
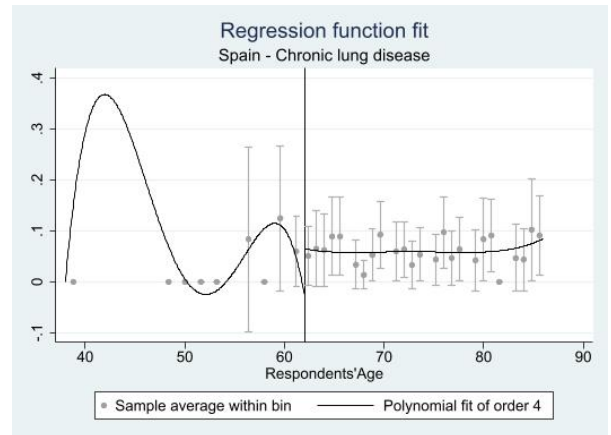
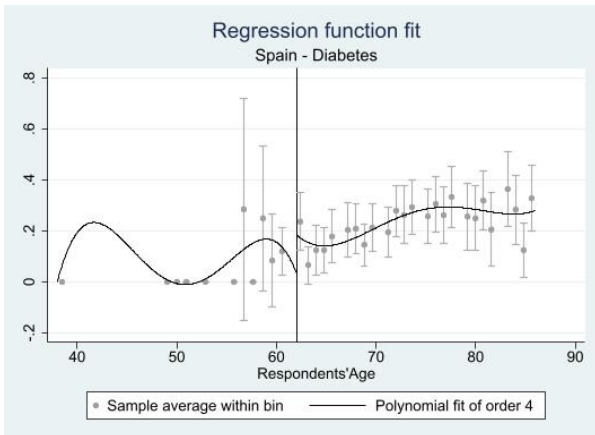


Fig. 3.4b: RD validity check II:

Continuity of observed covariates - Spain





Concluding Remarks

From December 2019, the world's population has been battling with what is now called the Covid-19 pandemic. As a control measure, non-pharmaceutical interventions such as lockdowns, social distancing, mobility restrictions and quarantine have been put in place worldwide in order to slow the spread of the disease. Consequently, people were faced with drastic changes in many aspects of their lives, adjusting how they lived and worked, losing confidence in the economy, and changing their consumption behaviour. Empirical evidence suggests that during the first wave of the Covid-19, consumers' behaviour changed and propensity to save reached a twenty-year high, while consumption decreased much more than gross disposable income. This evidence is in conflict with standard economic models of consumption smoothing which suggest that since households prefer to maintain a stable level of spending, during recessions income falls more than consumption.

There are essentially three possible explanations for this unusually increase in the saving rate: firstly, the government restrictions severely reduced consumption opportunities, thus driving an involuntary increase in savings; secondly, as uncertainty about the future has increased, people are expected to increase their precautionary savings; thirdly, the fear of Covid-19 generated a reduction in consumption since individuals may voluntarily decide to limit their purchasing activities to reduce the risk of contracting the virus during in-person shopping.

The aim of this article is to make a contribution to the current debate on the effects of the Covid-19 pandemic on consumption expectations, the importance of health and possible policy interventions to support economic recovery.

In the first chapter, we examine the causal effects of fear of Covid-19 on consumption expectations, using the second wave of the Bank of Italy's Special Survey of Italian Households (SSIH). The survey is designed to collect information on the economic situation of households during the Covid-19 crises in Italy. The dataset spans the period of August-September 2020 characterised by less stringent containment measures. Since that, the fear of contagion may depend on unobservable characteristics that lead to endogeneity and reverse causality problems due to the simultaneous relationship between fear and expectations on consumption changes, we implement a Fuzzy Regression Discontinuity Design, exploiting the discontinuity in the fear of contagion observed for people above a specific age threshold. The age threshold is exogenously determined by official statements that in Italy focused on stacked age groups separating individuals in the 60-69 age group, who had a significant higher risk of death, from those in younger groups. Our estimates provide direct evidence that the evolution of expenditure is affected by fear of Covid-19 due to the infectious nature of the disease. Therefore,

policy interventions will be efficient in stimulating aggregate demand if they are designed to also restore consumers' confidence by addressing health concerns, because traditional macroeconomic tools might have a reduced capacity to boost consumption and promote economic recovery.

In the second chapter, we aim to estimate the differential impact of economic and health concerns on consumption using an *Instrumental Variable approach* in a *Conditional Mixed Process* (IV-CMP). In addition, exploiting the panel component of the second and third wave of the SSIH we control for endogeneity problem due to the time-invariant unobservable factors, using a new identification strategy the IV-CMP with *Correlated Random Effects*. The analysis is extremely relevant in order to shape government interventions for a faster and more resilient economic recovery after a recession caused by infectious disease. Our results suggest that the fear of infection plays the largest role, followed by uncertainty about the income in influencing future spending decisions. Therefore, we argue that part of the savings piled-up in the first stage of the pandemic may be used when the health concerns are mitigated, especially when the fear of infection is reduced. Consequently, fiscal policy cannot preserve consumption levels without timely public policies that reduce feelings of vulnerability caused by health concerns, and which have led remarkable shifts in consumers' perceptions and behaviours.

In the third chapter, indeed, using data from the second wave of the SHARE Corona survey, we examine the effect of Covid-19 Case Fatality Rate (CFR) information on the willingness to be vaccinated in France and Spain, which share similar epidemiological profiles during the pandemic but adopted different communication strategies on the severity of the disease. In particular, the National Health Authorities of France and Spain disseminate weekly and/or daily national epidemiological updates, in which the most important indicators (confirmed cases, new hospitalizations, deaths) for monitoring the Covid-19 outbreak are presented as age-group specific data. Since that the age strata varied considerably between the countries, we take advantage of the different age stratification used for official communications on the severity of the virus using a Regression Discontinuity Design approach. Our results suggest that communication can play a positive role to combatting vaccine hesitancy, since that people respond "proactively" to health-based threatening communications. According to the recent psychological literature, the systematic exposure to news on CFR related to the Covid-19 pandemic may have increased the perception of fear of contagion according to the belonging to a specific age group, encouraging individuals' decision to get the inoculation. Additionally, our findings offer insights to authorities on how a vaccination campaign needs to deliver processes and information necessary to limit the phenomenon of vaccine hesitancy, which is a growing threat to public health with implications for businesses and

the economic recovery by limiting movement and trade, increasing unemployment, and causing a resurgence of new variants of the virus.

Overall, the results obtained in all three chapters converge on one conclusion: health and the economy are inextricably linked and, therefore, good policies should consider them together rather than as competing interests.

I would like to express my sincere gratitude to Professors Patrizia Ordine and Giuseppe Rose for their precious advice, their help and guidance during my PhD study. I am extremely grateful to my family who profound believed in me, supported and encouraged me more than anyone else: Thanks for your patience, that cannot be underestimated!!! Special thanks to my colleagues: Doctors, PhD Students and PhD, who shared adventures and misadventures with me throughout the duration of this project. Last but not least, a special thanks to Nunú.