LISER
LUXEMBOURG INSTITUTE OF
SOCIO-ECONOMIC RESEARCH

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Égalité entre
les femmes et les hommes

REPORT

COVID-19 and Gender Equality in Luxembourg

COVID-19 and Gender Equality in Luxembourg

Commissioned by:

Project Coordinator :
Eugenio **PELUSO**

Contributors:
Fofo S. **AMÉTÉPÉ** - STATEC
Francesco **ANDREOLI** – LISER & Università di Verona
Anne-Sophie **GENEVOIS** - LISER
Giorgia **MENTA** - LISER
Eugenio **PELUSO** – LISER & University of Luxembourg
Ioana C. **SALAGEAN** - STATEC
Philippe **VAN KERM** – LISER & University of Luxembourg
Bertrand **VERHEYDEN** - LISER

Contents

Introduction[1,2]

Two years after the emergence of the SARS-CoV-2 and the ensuing lockdown measures taken to contain the spread of the disease, the ongoing pandemic has had significant and wide-reaching implications on many aspects of life – health, economic and social – affecting different social groups in highly asymmetric ways.

At the beginning of the crisis, the OECD pointed out the burden that women were carrying: "First and foremost, women are leading the health response: women make up almost 70% of the health care workforce, exposing them to a greater risk of infection. At the same time, women are also shouldering much of the burden at home, given school and childcare facility closures and longstanding gender inequalities in unpaid work. Women also face high risks of job and income loss".

The predictions set out by the OECD seem to be confirmed worldwide by a growing body of literature investigating the gender gradient in the COVID-19 crisis. Whether the costs of the pandemic fell more heavily on one of the genders depends on the outcome of interest as well as on the interaction that gender has with other important dimensions, such as family formation, the presence of children in the household and the way the time allocation between childcare, work and leisure differs across spouses within the same household. This report considers three important domains of the living conditions of adult Luxembourgish residents that have been affected by the pandemic: their health, their labor market opportunities and their perceived financial insecurity. All dimensions display gender inequalities, albeit the direction of the gender gradient is often unclear, per se, and needs to be analyzed holding other characteristics of the households and of the individuals as constant in our analysis.

From a health perspective, data show that the incidence of COVID-19 cases has not differed significantly between men and women. Nonetheless, men have been much more likely to develop severe forms of COVID-19, namely intensive care admissions and deaths; see, e.g., the "Sex, Gender and COVID-19 Project" online global data tracker on gender differences in COVID-19 health impacts (Global Health 50/50, 2021).

Health effects are interlaced with those affecting the socio-economic sphere. Attitudes, behaviors and habits vary across genders due to history, culture and social norms and are likely to be important determinants of individual responses to the pandemic. These "mediating factors" have influenced the different exposure to contamination and the different responses of the population both to the risks of the pandemic and to the policies implemented to fight this new plague (see, among others, Galasso *et al.*, 2020[3]). These factors have also exacerbated gender differences in the economic and social sphere. Prior to the pandemic, women in developed economies were more often than men in low-paying and insecure jobs. During the pandemic, differences in compliance with social-isolation norms and in risk-taking behavior have been observed between men and women that can explain some of the observed gender differences in the socio-economic consequences of COVID-19. Recent evidence proves that women suffered more than men along the dimensions such as employment, working hours, earnings and income (see Todorovic *et al.*, 2021a,[4] for a review). Traditionally, women are also

---

[3] Alon, T., Doepke, M., Olmstead-Rumsey, J., and Tertilt, M. (2020). "The impact of the coronavirus pandemic on gender equality." Covid Economics Vetted and Real-Time Papers, 4, 62-85.

[4] Todorovic, J., Van Kerm, P., and Peluso, E. (2021a). "Unemployment and working hours of women and men during the pandemic." LISER-MEGA series on gender issues in the COVID-19 pandemic.

more likely to shoulder the burden of childcare and elder care, which is particularly relevant during a period of school closure and shielding of the elderly (Alon *et al.*, 2020,[5] or see Todorovic *et al.*, 2021b,[6] for a review).

In order to develop new a new body of quantitative research about the multifaceted effects of COVID-19, the "Ministère de l'Égalité entre les femmes et les hommes" (MEGA), which is in charge of encouraging the development of an egalitarian society and of developing innovative plans for equality between women and men, prompted the Luxembourg Institute of Socio-Economic Research (LISER) to integrate the gender dimension in scientific research on the COVID-19 pandemic and its social consequences. This report presents research focused on gender inequalities in the specific context of Luxembourg, drawing on refined administrative data on COVID-related cases as well as an innovative dataset collected during the COVID-19 crisis, which elicits the attitudes of Luxembourgish residents on health, labor, family, financial and educational dimensions vis-à-vis the pandemic shocks. Based on such data sources, our empirical analysis allows to account for the institutional and policy context, thus entailing some of the specificities that might have affected gender differences differently from other countries.

During the last two years, the LISER has collaborated with the University of Luxembourg, LIH, LIST, STATEC and other research institutes to analyze the impact of the COVID-19 pandemic in Luxembourg. More than 10 projects and 70 reports and articles have been produced by LISER's researchers to investigate several facets of the impact of the pandemic and understand the effects of this phenomenon on the Luxembourgish society. Some of these pieces of research, as the report "Santé pour tous: La COVID-19 au Luxembourg: Le gradient social de l'épidémie", or the "SEI Socio-Economic Impacts of COVID-19: Collecting the data" have fuelled the present report, by providing important data sources based on administrative data and online surveys.

With the analysis of such original data through statistical and econometric tools, this project produces an assessment of the COVID-19 crisis from the angle of equality between the sexes. We have analyzed the main effects of the crisis and of the subsequent policy responses on several dimensions of individual well-being, such as health, income, life conditions, employment, time use and social activities. We have also explored how gender differences in attitudes have shaped the determinants and the roots of gender inequalities. Policies carried over to face the COVID-19 emergency have contributed affecting these dimensions. One the one hand, emergency measures have supported firms and families from the economic side. On the other hand, these measures have imposed severe restrictions, such as the limitation of public events, curfews, and the closure of shops and services, which sacrificed social interaction to minimise COVID-19 infections.

The evidence illustrated in this report brings forward several contributions on the role that individual attitudes, working conditions and family relationships have played on gender disparities. Our analysis aims to provide guidance on empirical evidence addressing the following questions: to what extent does gender segregation by sector and occupation exacerbate differences among men and women in terms of health, wage and employment? Does the family play a role of safety-net also under these special circumstances or does it amplify gender differences, due to unbalanced time-use and increased needs of childcare? Are there differences between men and women in terms of compliance with policies such as social distancing, testing and vaccination, and if so, what drives these

---

[5] Galasso, V., V. Pons, P. Profeta, M. Becher, S. Brouard and M. Foucault (2020), "Gender differences in COVID-19 related attitudes and behavior: Evidence from a panel survey in eight OECD countries." Proceedings of the National Academy of Sciences of the United States of America 117, 27285–91.
[6] Todorovic, J., Van Kerm, P., and Peluso, E. (2021b). "Time use, childcare and home schooling." LISER-MEGA series on gender issues in the COVID-19 pandemic.

differences? Do household composition, age and working conditions generate differences in the risk of loneliness and social isolation or feelings of economic insecurity?

The report develops on three chapters, each aiming at providing separate answers to the questions highlighted above in each of three distinct domains.

Chapter 1 covers the health effects of the COVID-19 crisis, by analyzing the gender gradient of infections, severe illness and deaths during the first 18 months of the pandemic in Luxembourg. The main messages are that (i) if men and women show similar figures at the aggregate level, gender differences in health are hidden behind age, employment sector and especially family structure and (ii) men have been much more adversely hit by severe forms of the COVID-19.

Chapter 2 explores how individual traits affect gender differences in complying with the policies implemented during the COVID-19 crisis in Luxembourg. It shows that attitudes towards social distancing (mask-wearing, hand-washing, physical distancing), testing and vaccination depend on socio-demographic factors, on deep personality traits such as risk aversion, as well as beliefs (trust in science and in the government) and the type of media consumption. These individual characteristics are globally similar between women and men, with the exception of the perception of COVID-19's danger and risk aversion, which are more pronounced among women. Still, even after taking these characteristics into account, women appear to be more compliant than men with most measures. A notable exception pertains to vaccination intentions, which are slightly lower among women due to stronger concerns about side effects.

Chapter 3 completes the analysis by focusing on gender differences of COVID-19 impacts along three domains: the labor market and time use, economic insecurity, and social interactions. Among several other results, we observed that women lost their job more often than men during the pandemic. Additionally, they were more likely than men to benefit of the special leave for family reasons at the beginning of the pandemic and more likely to be in temporary unemployment in the spring of 2021. The gender gap also increased in terms of unpaid work among employed men and women in June 2020, which was qualitatively larger than it was before the pandemic. When it comes to perceptions of economic insecurity, single men and women worry the same or more about their finances and the economy in 2021 (as compared to April 2020). For those in a couple, instead, we find evidence of an insurance effect: partnered men and women worry the same or less about their finances and the economy in 2021 (as compared to April 2020). Last the Chapter shows that women in Luxembourg had a significantly lower amount of social interactions than men, the gender difference being larger among the single.

Chapter 1: A gendered disease? Gender differences in contaminations and severe forms of COVID-19[7]

1. Introduction

The aim of this first chapter is to examine gender differences in the most immediate impacts of the outbreak of COVID-19, namely contaminations with the virus and the development of the disease. Looking back over the first twenty months since the first cases were diagnosed in Luxembourg –on February 29 2020–, this chapter documents whether women's health has suffered more than men's from the "Severe Acute Respiratory Syndrome Coronavirus" (SARS-CoV-2) infection disease (COVID-19) in the country.

Why could we expect gender differences in contaminations and in the prevalence of COVID-19? Two factors need to be distinguished. The first concerns exposure to the virus, the SARS-CoV-2. Exposure is determined by the extent and nature of social interactions. While these are partly determined by one's own actions and behavior (such as limiting contacts, respecting social distancing and isolation recommendations), they are largely influenced by people's environment and their living and working conditions. Family sizes and household structures are key to private interactions. In the professional sphere, social contacts vary substantially with one's occupation – notably to the extent that the activity can be done "remotely" through teleworking arrangements. For the most part, this environment was set before the onset of the pandemic and individuals had little control over it when the virus struck. The variation in the (potential) exposure to the virus according to one's environment means that not everyone was equally vulnerable. Given gender differences in occupational profiles and in gender roles in the households, it is easy to think that such vulnerability might have varied along the gender dimension.

The second factor concerns the risk of developing severe forms of COVID-19 once one is infected. Infections by the SARS-CoV-2 have had very different health consequences on different people; many developed mild forms of the disease, some remained asymptomatic, but a fraction of the population developed severe forms of respiratory complications that necessitated hospitalization and sometimes had fatal consequences. It quickly emerged that age was a key determinant of the risk of developing severe forms of the disease. But a series of risk factors were also identified, such as (in no particular order of importance, nor exhaustivity) having pre-existing chronic kidney, lung or liver diseases, cancer, diabetes, heart conditions, substance use disorders, mental health conditions, overweight and obesity, or pregnancy. The extent to which the prevalence of these risk factors may differ across gender can lead to differences across gender in the risk of suffering from severe forms of COVID-19. Pregnancy is without a doubt the most gender-biased of such risk factors. Beyond these pre-existing risk factors, potential gender differences in biological pre-disposition to the specific development of COVID-19 (related to hormonal, immune and inflammatory responses to the infection) were later identified (see, e.g., Conti and Younes, 2020). So, not only may have men and women's exposure to the virus been different, also the risk of suffering its most severe forms may have differed. As The Lancet put it "Women and men are affected by COVID-19, but biology and gender norms are shaping the disease burden" (The Lancet, 2020).

---

[7] Authors: Philippe Van Kerm, Ioana Cristina Salagean, and Fofo Senyo Amétépé.

Various studies across the world have now examined these questions. The picture that emerges globally is that contaminations have not differed much between men and women, but that men have been much more likely to develop the most severe forms of COVID-19, those requiring intensive care admission or that lead to the death of the patient; see, e.g., Lakbar *et al.* (2020) Peckham *et al.* (2020), Ya'qoub *et al.* (2021) and the "Sex, Gender and COVID-19 Project" online global data tracker on gender differences in COVID-19 health impacts (Global Health 50/50, 2021). We examine in this chapter how the situation in Luxembourg compared to the global picture. Did we also not observe difference in contaminations? Did we also see men suffer from severe COVID-19 complications in much greater proportions – in spite of the broad availability of care and ability of the health care system to absorb the inflow of patients throughout the pandemic?

Exploiting rich population data on test results and hospitalizations n Luxembourg between March 2020 and October 2021, this chapter looks for signs of differences in contaminations between men and women and for gender-related excess mortality or morbidity from COVID-19. The results presented draw on data compiled in the context of the project "Santé Pour Tous" initiated by the Luxembourg Ministry of Health, in collaboration with STATEC (Institut national de la statistique et des études économiques), the Luxembourg Institute of Socio-Economic Research, the Health Directorate (DiSa) and the Inspection générale de la sécurité sociale du Luxembourg (IGSS). The project had set out to study social inequalities in health and to draw lessons from the COVID-19 pandemic in Luxembourg using administrative records provided by the DiSa (on hospitalisations, test results, death records, vaccination) and the IGSS (on several socio-demographic and economic variables). In a first report, Van Kerm, Salagean and Amétépé (2022) (henceforth VKSA) present a "social cartography" of COVID-19 among Luxembourg residents – illustrating how different groups defined by a number of social, demographic and economic characteristics have been impacted by the SARS-CoV-2 and the COVID-19. Although gender is one of the characteristics examined in the study, the VKSA report provides relatively limited detail about how men and women have been affected. Most notably it does not document how the gender gap in COVID-19 health impacts has varied by age or according to different private and professional environments. The present chapter summarizes the VKSA results on gender and then extends them to provide a fuller picture of how men and women's health has been directly affected by the pandemic.

The results generally confirm international evidence: Luxembourg has been no clear outlier. On the whole we do find some marginally higher risk of contamination for women than for men. However, we also show that one ought to look behind the surface of aggregate gender differences: below the age of 50, contaminations were noticeably more frequent among women than among men. Above the age of 50, the pattern reverses however and old age men were more likely to be contaminated. Examination of severe forms of COVID-19 confirm the (much) greater vulnerability of men towards developing the most critical conditions. Men in Luxembourg were approximately two times more likely to die from COVID-19 or to need admission in intensive care. This relative risk appears particularly big, when compared to international estimates provided by Global Health 50/50 (2021).

2. Data and methods

2.1 The data

The data put together for the Santé Pour Tous project used in the VKSA report and re-examined here combine information on a range of socio-demographic and economic characteristics of the population residing in Luxembourg at the end of 2019 – just before the onset of the pandemic. Variables drawn

from registers of the IGSS contain data on age, sex, household income, household composition, employment status, country of birth, canton of residence, and receipt of unemployment benefit. The information is available for the population of residents in Luxembourg in December 2019 aged 6 and above and covered by the national social security. This represents a population of 48170 residents for whom all variables are available.

These variables are linked to the registers held by the health directorate on (i) COVID-19 tests conducted in Luxembourg between March 1 2020 and October 27 2021; (ii) hospital admissions in Luxembourg with a COVID-19 diagnostic in the same period (and indication whether the stays required admission in an intensive care unit); (iii) death records with COVID-19 identified as main cause of death.; and (iv) vaccine injections.

The data on test results allow us to assess the spread of contaminations in the country over the first twenty months of the epidemic, separately for men and women of different ages and different socio-demographic background. In total 13.81% of the subjects have been tested positive to a SARS-CoV-2 contamination. With data ending on October 27 2021, the latest wave of infections with the omicron variant is not taken into account. Also, we only consider "detected cases" confirmed by a positive PCR test in Luxembourg. In spite of the large number of tests conducted in the country (notably through the Large Scale Testing infrastructure) it is possible that some infections have remained undetected, especially when they were asymptomatic and at the early stages of the pandemic. We do not see any strong reason however why the possible under-coverage would systematically bias estimation of the gender differences in infections.

Registers of hospital admissions with a COVID-19 diagnostic and death registries allow us to examine severe forms of the disease. These indicators are also robust measures of the spread of the most severe forms of the disease in the population – and how it varied across gender -- which do not suffer from the possible underestimation that may affect contaminations. In total, 0.78% of subjects (3771 people) have been admitted to hospital with a COVID-19 diagnostic, 0.11% were admitted to intensive care and 0.16% died with COVID-19 identified as primary cause of death.

Finally, listings of vaccine injections allow us to assess the participation to the vaccination campaign across genders. With data availability ending in October 2021, the campaign for the 'booster shot' is not taken into account but the data cover a period during which residents of all age groups have been invited to obtain vaccination.

2.2 Methods

Our objective in this chapter is straightforward: we compare contamination rates, hospitalization rates, ICU admission rates, death rates, and vaccination rates for men and women – on the whole and for some specific population subgroups (defined by age, household structure, etc.). We refer to gender differences in those rates as "gender gaps" in COVID-19 impacts.

However, men and women differ in many different respects. Notably, employment rates are higher among men. Or there are more lone mothers than lone fathers. To the extent that employment status or household structure are also correlated with exposure to COVID-19, these might contaminate the comparison of COVID-19 impacts for men and women. To address this concern, we therefore compare women's rates to those of a set of men whose observable characteristics are similar to those of women. The 'observable characteristics' are employment status, age, household income, household structure and country of birth. Note that these characteristics are measured at their value in December 2019 (for income and household structure) and in February 2020 (for employment and

age). Throughout the text below, estimates for "men" must therefore be interpreted as "men with observable characteristics similar to those of women" or "adjusted men" for short.

Technically this is done by propensity score reweighting. Each man in our data is attributed an "adjustment factor" (or weight) which reduces the weight of those men that have a profile (a set of characteristics) underrepresented among women and that increases the weight of men whose profile is overrepresented among women. The adjustment factors are computed from logistic regression of the probability to be a woman conditional on the observed characteristics. When the adjustment factors are applied, the frequency distributions of characteristics of the male subjects in the dataset (that is, of employment, of household structure, etc.) are the same as the those of women. Applying these adjustment factors to the calculation of contamination or hospitalization rates for men provides our estimates for male rates adjusted for differences in characteristics. Note however, that we can only adjust for characteristics that are observable in the data. One important missing variable is the level of education. Housing conditions are also unavailable. These are likely reflected in the income variable, but probably only partly.

A further elaboration of this adjustment mechanism is applied to examination of severe forms of COVID-19. A number of factors or co-morbidities have been identified by the medical and epidemiological literature as risk factors for the development of respiratory complications after infection by the SARS-CoV-2. These include a range of pre-existing pathologies, such as diabetes, cirrhosis, cancer, or other conditions such as obesity. Some of these risk factors may be more prevalent among men than among women (or vice versa). It is useful to try and assess how much gender differences in these risk factors account for gender differences in the development of severe forms of COVID-19. The data collection of Santé Pour Tous provides an indicator of pre-existing pathologies. The variable captures whether subjects have received drug prescriptions for 0, 1, 2 or 3 and more diseases among a range of diseases identified as COVID-19 risk factors. We have therefore developed a second adjustment that incorporates this variable in the construction of the weights. Application of this second set of weights to our male subjects makes them comparable to women in terms of the prevalence of these risk factors. The remaining gender difference in hospitalization rates after application of the weights to the male subjects is "net" of the effect of the measured risk factors and therefore reflect the contribution of other causes. One must however bear in mind that our indicator of risk factors is somewhat rudimentary as it does not capture the severity of the pre-existing pathologies and ignores some important risk factors such as obesity, or smoking.

3. Gender differences in SARS-CoV-2 contaminations

We examine first whether men and women have been contaminated by the virus in similar proportions.

It is generally agreed that the virus has been infecting men and women in similar proportions. Estimates from the VKSA report indeed show that just under 14% of both men (13.70%) and women (13.89%) aged six and above residing Luxembourg have been "confirmed cases" between March 2020 and October 2021. After adjusting for a number of potential factors that might affect exposure to the virus (notably age, employment status, household income, household structure and country of birth), VKSA find some more noticeable gender differences in expected infections: 14.10% for women against 13.51% for men. The difference remains small.

The fact that differences in infections appear to increase after adjusting for differences in a number of characteristics suggests that, although, on the whole, gender differences in contaminations are small,

this might hide variations in some particular sub-populations. We therefore extend here the estimations presented in VKSA and probe into gender differences for more detailed groups of the population.

The risk of contamination is expected to vary greatly with age. The environment (the school, the job, the family) and, correspondingly, the number and nature of human interactions that we are engaged in differs drastically as people age.

Figure 1.1 shows infection rates for men and women in sixteen different age groups. The rate for women is marked by a purple dot; the rate for men in the same age group is marked by a green triangle. The length of the arrows represents the difference between the two rates. It is red and upward pointing if women have higher infection rates; it is green and downward pointing if women have lower infection rates. Recall that the rates for men are "adjusted" for a set of observable confounders as described in Section 1.2. Most importantly here the procedure adjusts for differences between men and women in household income, employment status, country of birth and family structure. So the male population reported here has been "adjusted" to be comparable in those dimensions to the female population.

Figure 1.1 reveals an interesting pattern, hidden from comparison of the aggregate contamination rates. For all age groups until the age of 50 contamination rates are higher among women than among men. The differences are most substantial below the age of 30. From the age of 50, the pattern reverses and contamination rates are lower among women. The differences are most substantial from the age of 80.

This first set of results is important. It challenges the view that contaminations did not discriminate by gender. Figure 1.1 shows that contamination rates did indeed vary by gender, but one needs to look at differences by age groups. The nature of social interactions differs very much by age and it is easy to think of potential reasons why the gender gap in contaminations varies with age. At younger ages, the risk of contamination can be driven by one's employment situation and type of job or the household structure (notably the presence of children). These factors tend to recede at older ages when household structures tend to be smaller and people gradually leave employment.

Figure 1.1: Share of the population infected, by gender and age group
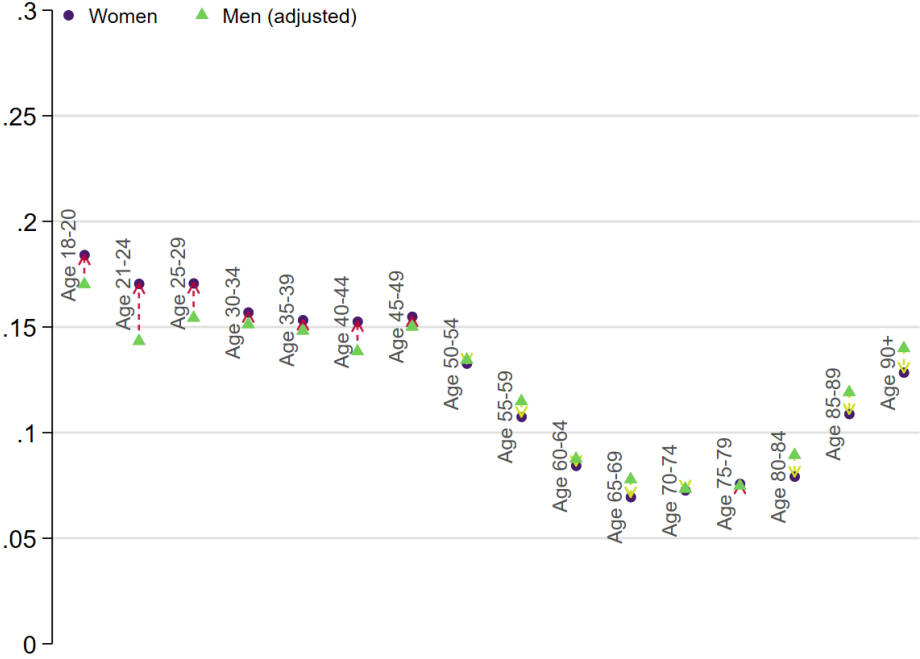
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

Following up on the results of Figure 1.1 and to probe further into potential areas where men and women's contaminations might differ, Figure 1.2 shows contamination rates for men and women by employment status. The figure shows contamination rates for inactive individuals (separately for individuals aged below or above 50), for public and private sector workers, and for the self-employed. The expectation is that contamination rates may be higher among employed individuals because of the potential social interactions involved.

Only small gender differences emerge by employment status, however. No difference is observed among the self-employed. Contaminations are slightly higher among men in the public sector and among the elderly inactive. Contaminations are higher among women for the younger inactive and among private sector workers. There is little evidence that infections among women and men vary by employment status.

Figure 1.2: Share of the population infected, by gender and employment status
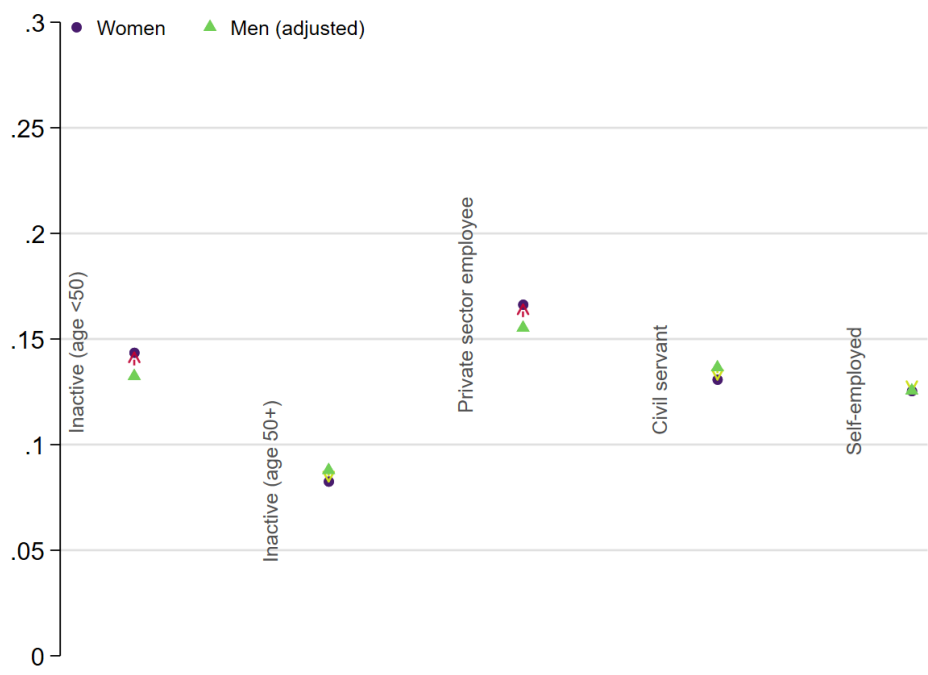
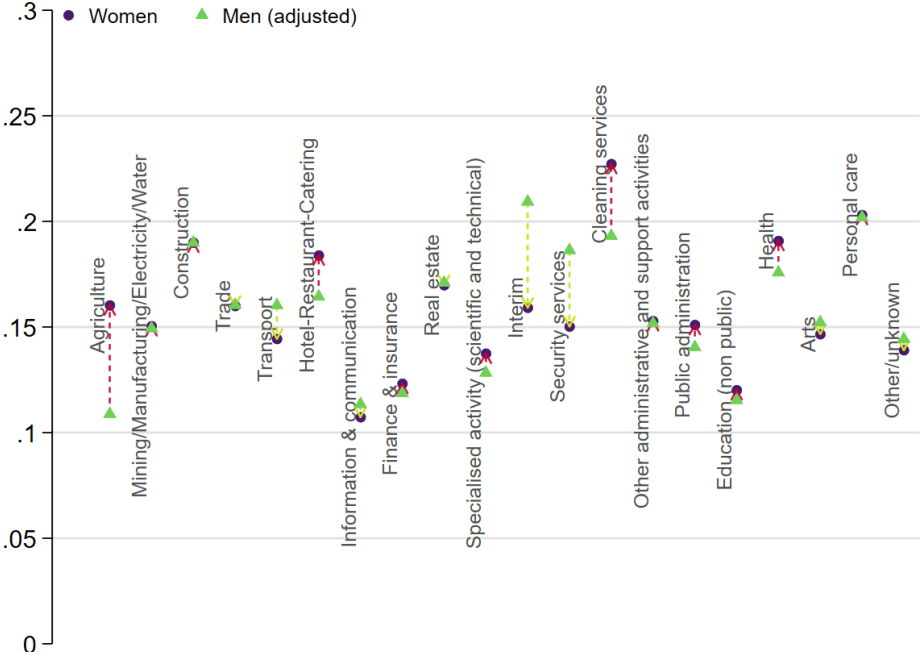*Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).*

Examining just "employment" may be too broad to detect differences in infection risks. As has been widely documented since the onset of the COVID-19 pandemic, exposure to risks differs widely across types of jobs and occupations. Frontline workers (in the health sector notably) were first exposed to the virus. More generally occupations differ in the extent of the implied proximity to co-workers and customers, in the potential exposure to infectious agents, and perhaps most importantly in the context of the COVID-19 pandemic, in the extent to which the tasks can be conducted remotely by 'teleworking' arrangements (see, e.g., Baker *et al.*,2020; Mongey *et al.*, 2021).

Figure 1.3 shows gender differences in contamination rates by industry of employment. The data are for salaried workers aged 20 to 65 only. Note that our data only allows a classification of jobs by industry, not by occupation. Many different occupations are found in all industries. Clerical and management jobs are likely found in all types of industries (with probably similar degrees of exposure to the SARS-Cov-2). Industries' jobs will differ more markedly in industry-specific occupations (such as nursing in the health sector, sales worker in the trade sector, teachers in the education sector, etc.), but the share of these industry-specific occupations may differ across industries. Note also that some industries shown in Figure 1.3 only employ a small number of people in Luxembourg (such as Agriculture, Interim, Security services, Arts, or Personal care that each employ less than one percent of resident salaried workers; see VKSA).

Figure 1.3: Share of the population infected among salaried workers, by gender and industry

Note: Salaried employees residing in Luxembourg aged between 20 and 65.
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa)

Figure 1.3 confirms the observation that contaminations on the job did not differ markedly across gender. In most industries, contamination rates are identical for men and women. The few notable exceptions are the "HoResCa" (hotels, restaurants, catering services), cleaning services and agriculture (and to a smaller extent health) where contamination rates have been substantially higher among women; and the transport and security services where male contamination rates have been higher. In most of these instances the female contamination rates have been higher in 'female-dominated' sectors, and male contamination rates have been higher in 'male-dominated' sectors.

The professional sphere is one big place for social interactions and, therefore, a first candidate for generating gender differences in contaminations. Results just shown however reveal that, in Luxembourg, no systematic difference in contamination rates is observed between men and women along employment characteristics. The second major sphere of social interactions is the family. Although interactions within the household typically involve less people than on the job, they involve much closer interactions. Social distancing and other measures to prevent contamination (such as mask-wearing) do not apply within one's household. We therefore examine next whether gender differences in contaminations emerge for different configurations of households.

Figure 1.4 shows contamination rates for men and women living in twelve different household configurations. First, the figure distinguishes households with children (aged 15 and below) from childless households. For the latter, households are classified according to the number of adults and by age of the individual for which contamination is assessed. For the former, the figure shows different combinations of number of adults and children.

The results shown in Figure 1.4 are striking. For household configurations without children, we observe very little gender differences in contaminations. Only among singles do we note differences: single women aged less than 50 appear more likely to be infected than single men aged less than 50; the pattern is reversed for singles above 50. Once we examine households with children, however, contamination rates are higher among women, sometimes significantly so. Notably, among single adults with children, infection rates are much higher among women than men. Also, infection rates are much higher among women in large households composed of multiple adults and two or more children.

These results suggest that the presence of children is an important factor driving contamination risks among adults (note how the infection rates are higher in households with children – for both men and women), and also that women face a higher risk of contamination in such household configurations. We conjecture that this pattern echoes gender differences in the time spent in child care. In two-adult households however the difference in contamination is small; This is not unsurprising and reflects contamination between partners and between children and adults.

Figure 1.4: Share of the population infected, by gender and household composition
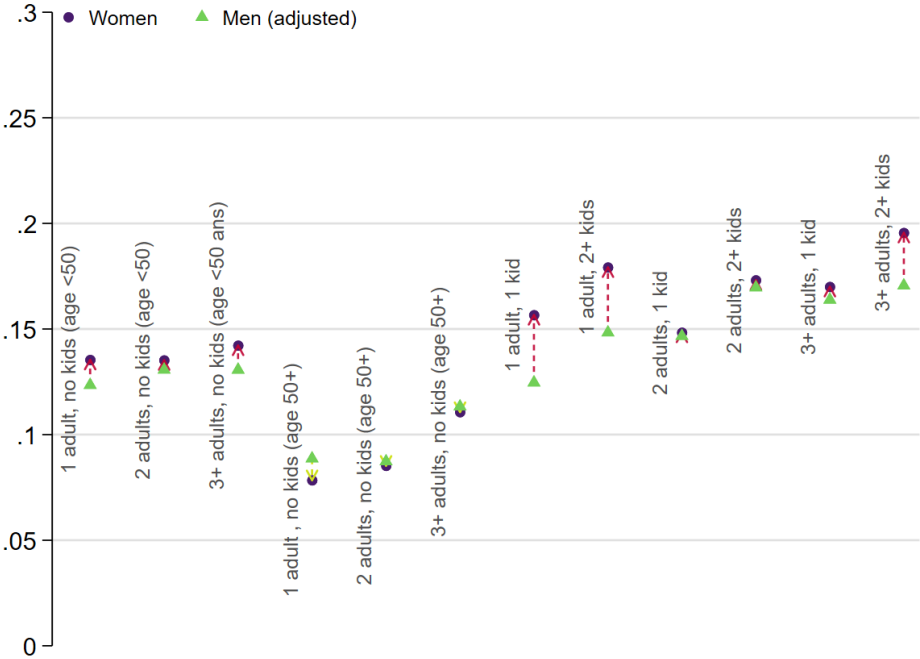
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

The VKSA report documents somewhat surprising and relatively large differences in infections according to the country of birth of residents in Luxembourg (from less than 10% among residents born in Germany to more than 25% among residents born in a country of ex-Yougoslavia). While this partly reflects the impact of differences in the socio-demographic and economic profiles, variables such as income, employment status or household structure only partly explain differences in infections across these groups.

Building upon this observation, Figure 1.5 shows gender differences in infection rates for nine groups based on country of birth. Each group counts at least 10,000 residents in Luxembourg.

Figure 1.5 illustrates the striking differences in contamination rates already outlined in the VKSA report. Very little variation by gender appears. The largest gender gap observed within any of the groups concern residents born in Portugal. Infection rates among women born in Portugal are approximately two percentage points higher than among men born in Portugal. We do not have an explanation for this difference. We conjecture that the gap could be driven by a higher share of Portuguese women holding jobs relatively more exposed to the SARS-Cov-2, and/or by the household structure which, as Figure 1.4 shows, can lead to higher contaminations among women in large households. Why those factors do not appear to lead to a gender gap in contaminations among people born in Italy or ex-Yougoslavia remains puzzling.

Figure 1.5: Share of the population infected, by gender and country of birth
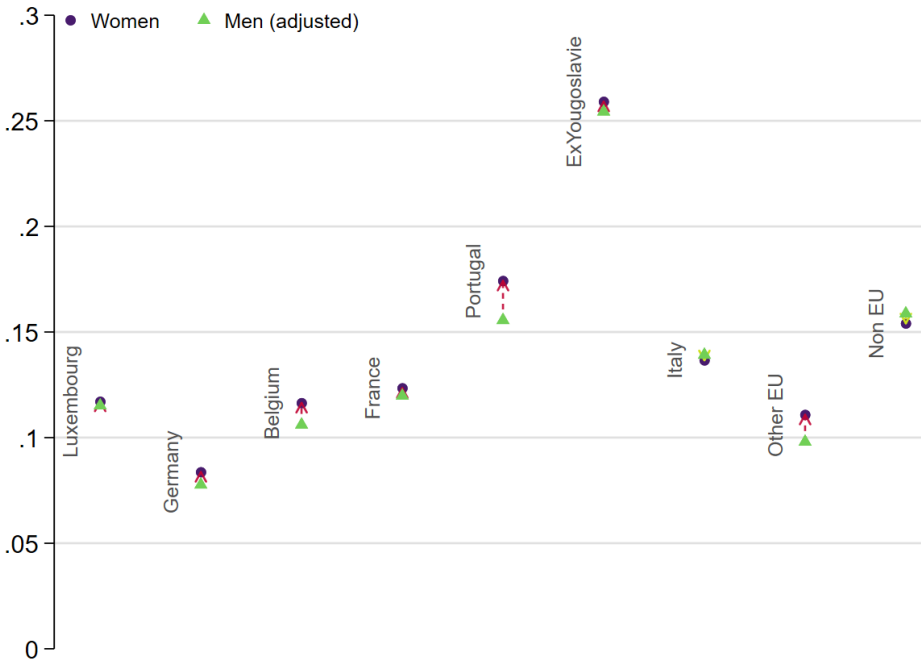
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

To summarize, although it is generally considered that the virus SARS-CoV-2 has been "gender-blind" and contaminated men and women alike, looking behind the surface of the aggregate contamination rates reveals a more nuanced picture. The overall contamination rates for both men and women are just under 14% -- at a remarkably similar level. Yet, among young adults in Luxembourg, infection rates have been higher among women than men, sometimes substantially so (e.g., in the age group 21-24). Among the older age groups the picture is reversed with old age men more likely to be contaminated than old age women (notably above the age of 80). These differences do not seem to be related to gender differences in contaminations related to employment status. Relatively little gender gap is found by industry. Household structure and, notably, the presence of children however appear more significant. Lone mothers appear significantly more likely to have been contaminated than lone fathers. Women in households with multiple children and adults also appear to face higher

contamination rates. We therefore suspect that the household structure and the presence of children partly explains the higher contamination rates among women aged below 50.

Examining contaminations, or more precisely "detected cases", is important to understand the spread of the virus and how men and women have been exposed to the risk of contracting COVID-19. However, the vast majority of people who became infected did not develop any severe form of the disease. Some cases remained asymptomatic –a number of which may therefore be missing from the used in this study– and in most cases the symptoms remained relatively benign, albeit unpleasant (and one could count the isolation measures imposed on infected people leading to limited work, schooling or social relations as part of the nuisance of contaminations). Nonetheless, a significant fraction of people developed much more worrisome, severe forms of COVID-19 and required respiratory assistance in hospitals, sometimes required admission in intensive care units, and sometimes did not survived. The next section explores gender differences in such hospitalisations and deaths due to COVID-19.

4. Gender differences in severe forms of COVID-19: hospitalisations and death

While international evidence has generally not established gender differences in contaminations by the SARS-Cov-2, ample research has shown that men have been more severely hit than women. Most notably, COVID-19 mortality rates have been shown to be higher for men than for women (see, e.g., Bhopal and Bhopal, 2020, Lakbar *et al.*, 2020). Although Nielsen *et al.* (2021) argue that such excess mortality among men may not be specific to contaminations by the SARS-CoV-2 and generally applies to many infectious diseases, such a gender gap remains a source of concern for inequity in health outcomes.

As explained in Section 1.2, our data allows us to estimate the share of the population that has been hospitalised with a COVID-19 diagnostic, the share of these hospitalisations there required entry in an intensive care unit, and the share of the population that has died in between March 2020 and October 27 2021 with COVID-19 identified as primary cause of death. All these conditions represent the most severe forms of the health impacts of COVID-19. We are therefore able to assess whether the patterns observed abroad were also seen in Luxembourg.

Figure 1.6 presents, by gender and age, the share of the population that has been admitted to hospital at any point in time between March 1 2020 and October 27 2021 following a confirmed or suspected COVID-19 case. As before the purple dot shows the rate for women, the green triangle shows the rate for "adjusted" men –men adjusted to have the same socio-demographic characteristics as women (income, employment, household structure, country of birth)– and the arrows emphasize the sign and magnitude of the difference between the two. Two markers are added. The green circle shows the "unadjusted" rate among men. The position of the circle relative to the green triangle gives a sense of how important is the impact of the adjustment for socio-demographic characteristics. The green cross shows a second version of "adjusted" men. The second adjustment not only corrects for differences in socio-demographic characteristics between men and women, but it also corrects for differences in the prevalence of pre-existing pathologies observed prior to the onset of the pandemic and which have been shown to be factors of risk in the development of severe forms of COVID-19 (it includes treatment for diabetes, cirrhosis, chronic respiratory diseases, cancer, etc. – see VKSA for details). To the extent that such risk factors may be more prevalent among men, they could explain the higher male mortality. Our second "adjusted" male rates eliminate this potential source of gender differences

in hospitalisations for COVID-19. The "adjusted" male rates correspond to rates that would be observed if males experienced similar prevalence of pre-existing pathologies as women.
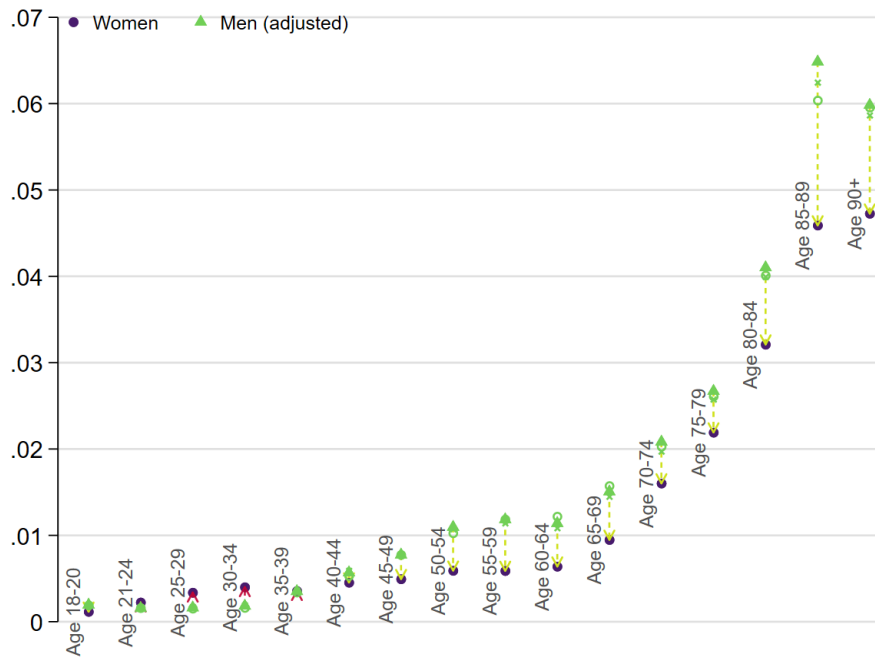
Unsurprisingly hospital admissions are largely determined by age. The share of hospitalised people increases gradually from the 18-20 years old group, then starts going up more significantly from the age of 40, then increases substantially from the age of 65. More than one in twenty people aged 85 or above in March 2020 have been admitted to hospital because of COVID-19 (and more than half of that number died of COVID-19, as we show below).

Beyond the relationship with age, the difference in rates between men and women is also clear. In almost every age group, men were more likely to be hospitalised for COVID-19 than women.

Let us however highlight the exceptions first: the age ranges running from 21 through to 39 years old. In absolute terms, hospitalisation rates are low in these ages – well below 5 per thousand people –, however the relative differences between men and women are large. Between 25 and 34 years old, the hospitalisation rates are twice larger for women than for men. This must partly be a consequence of the higher infection rates shown in Figure 1.1 among women, yet these relatively small differences in contamination cannot, alone, explain the differences in hospitalisations in this age range. While we would like to stress this observation, we cannot offer any other explanation for this added hospitalisation risk among women of prime child-bearing age. Note that the gap persists when we examine the "adjusted" males that take pre-existing pathologies into account.

The risk of hospitalisation for men starts increasing from the age of 35 to 59 and then accelerates to reach its peak above 85. Among women hospitalisation rates only grow slowly until the age of 65 and then start increasing to peak beyond the age of 90. These different age-hospitalisation relationships imply that hospitalisation rates for men are higher at every age from the age of 40 onwards. At age 80-84 men are one percentage point more likely to be hospitalised for COVID-19 (at just above 4% chance) than women (at just above 3% chance), and at age 85-89 the gap reaches almost two percentage points. Perhaps surprisingly, the adjustment for differences in pre-existing pathologies has only little influence on these results. The source of these gender differences in old age have to be found in other, possibly more complex, biological factors.

Figure 1.6: Share of the population admitted to hospital with COVID-19 diagnostic, by gender and age

.07 ● Women ▲ Men (adjusted)

.06

.05

.04

.03

.02

.01

0

Age 18-20, Age 21-24, Age 25-29, Age 30-34, Age 35-39, Age 40-44, Age 45-49, Age 50-54, Age 55-59, Age 60-64, Age 65-69, Age 70-74, Age 75-79, Age 80-84, Age 85-89, Age 90+

Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

We highlighted above differences in contamination rates household structures. Figure 1.7 shows that the higher contaminations of women observed in households with children does not translate into higher hospitalisation risks. On the contrary, men have higher hospitalisation rate in almost all household types. The gap is, unsurprisingly, larger in household structures related to old age – echoing the higher hospitalisation rates of old age men. Hospitalisation rates of men remain higher in households with children (except for lone parents with one child).

Figure 1.7: Share of the population admitted to hospital with COVID-19 diagnostic, by gender and household composition
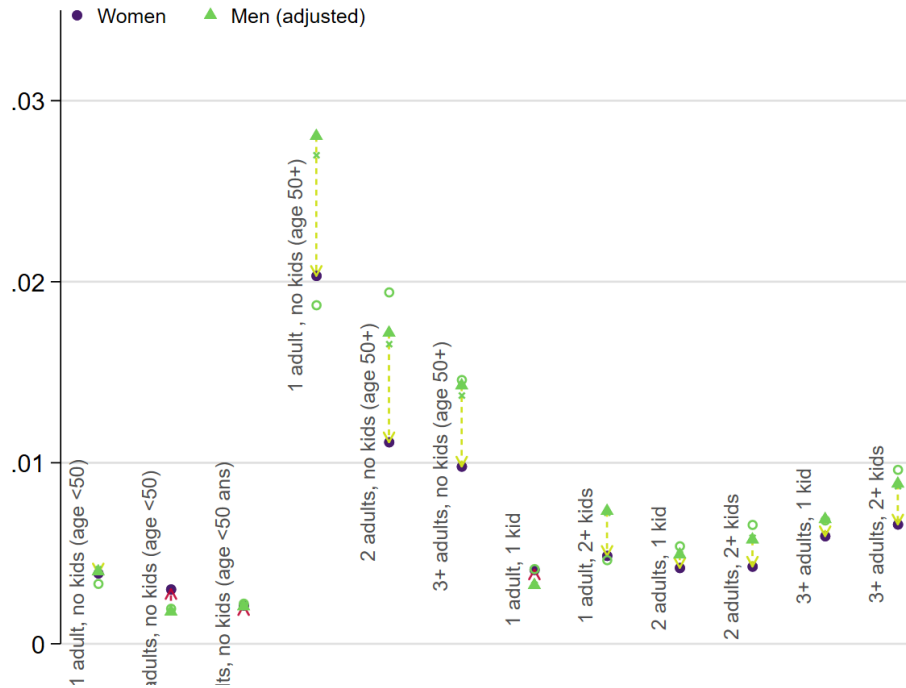
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

In their most severe forms, the COVID-19 disease required admission in intensive care units (ICU). Figure 1.8 shows the rates of ICU admissions by gender and age. We only report rates for the population aged above 50 (the number of cases for younger age groups is too small to report). Gender differences in ICU admissions are striking. The risk of ICU admission for men is twice as large as women's in almost all age groups. Again, adjusting for pre-existing pathologies hardly makes any difference to the gender gap in admissions.: all else equal, men were admitted in ICU much more frequently than women.

Figure 1.8: Share of the population admitted to intensive care for COVID-19 complications, by gender and age
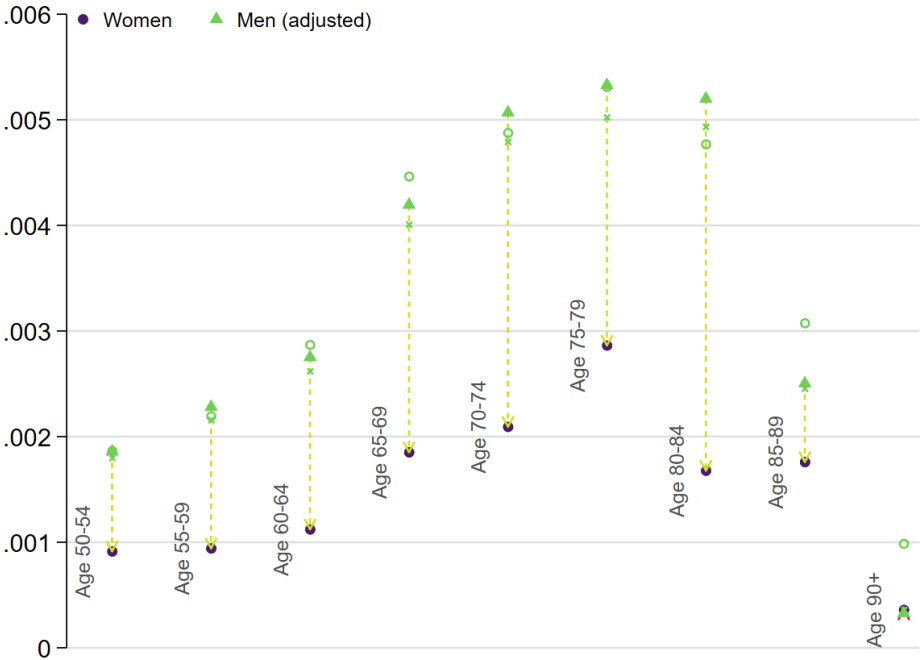
Note: Calculations based on residents aged 50 and above.
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

The final picture is given by gender differences in mortality due to COVID-19, depicted in Figure 1.9. These estimates confirm that Luxembourg is no exception and that COVID-19 killed many more men than women. Similarly to ICU admissions, men's risk of dying from COVID-19 have been about twice as large as women's. For example, COVID-19 has been the primary cause of death of 3.5% of women aged 90 and above, and of 6% of men aged 90 and above.

Figure 1.9: Share of the population dead of COVID-19 infections, by gender and age

Note: Calculations based on residents aged 50 and above.
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

In sum, Luxembourg has been no exception: men (and notably old men) have been hit by severe forms of COVID-19 much more frequently than women. Infections that lead to complications requiring ICU admissions or that lead to the death of the victim where generally around twice more frequent among men than among women. Such a pattern has been shown in many other countries.

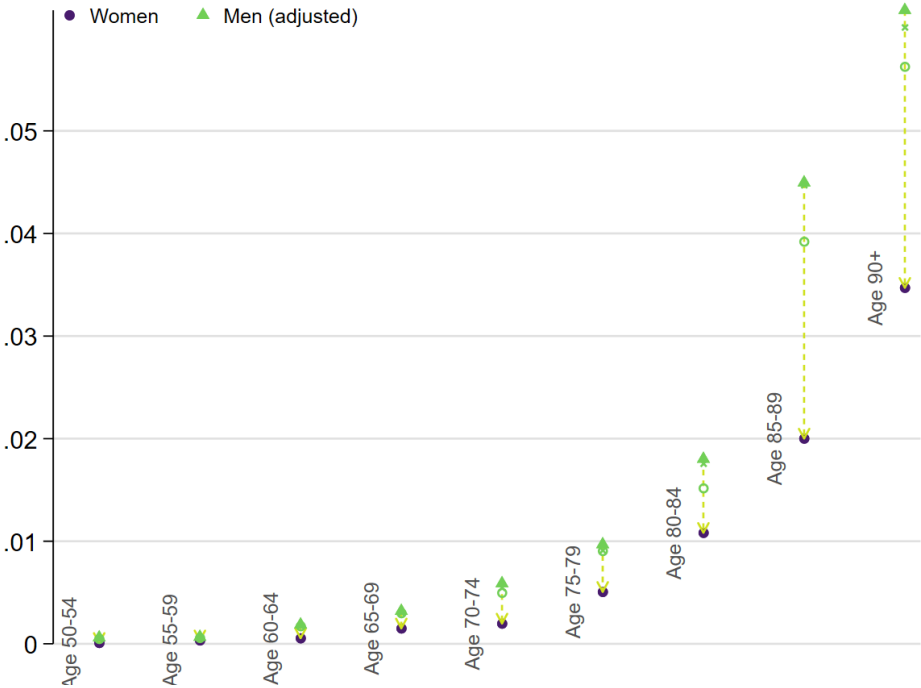These most severe forms of COVID-19 impacts are largely concentrated on the old-age population. Much of the explanations for the greater vulnerability of men to fatal infections are therefore to be sought in factors observed in old-age. While these patterns are generally true for all hospital admissions caused by COVID-19, the gender gap is less striking when we consider hospitalizations that did not require ICU admissions. Furthermore, the female advantage disappears at younger ages and we observe that women of child-bearing age were in fact twice more likely to be hospitalized than men of similar ages. Just like for contaminations, looking under the surface of aggregate rates reveals patterns that are more complicated than what is expected.

5. Is vaccination the explanation? Gender differences in vaccination rates

The vaccination campaign started in Luxembourg in December 2020, some ten months after the first case officially detected in the country. By the Summer 2021, all residents have had the opportunity to receive a complete vaccination protocol.

Vaccination has been shown to reduce drastically the risk of developing severe form of COVID-19 among people infected by the SARS-CoV-2. So, can the large gender differences in hospitalisation rates between men and women be explained by differences in vaccination? The answer is no. First,

and most obviously, gender differences in mortality were observed in 2020, before the availability of vaccines. Second, as we now show, men and women have adopted vaccination in very similar proportions.

Figure 1.11 shows the share of the population fully vaccinated (as of October 27 2021) by age and gender. Women have generally been more likely to be vaccinated –notably in the age age 25 to 50– but the difference with men's vaccination rates is small. In old ages, when vulnerability to COVID-19 is the strongest, no gender difference in vaccination appears (with the only notable exception of the 90+ among whom men were much more likely to be vaccinated).

Figure 1.11: Share of the population vaccinated against COVID-19, by gender and age
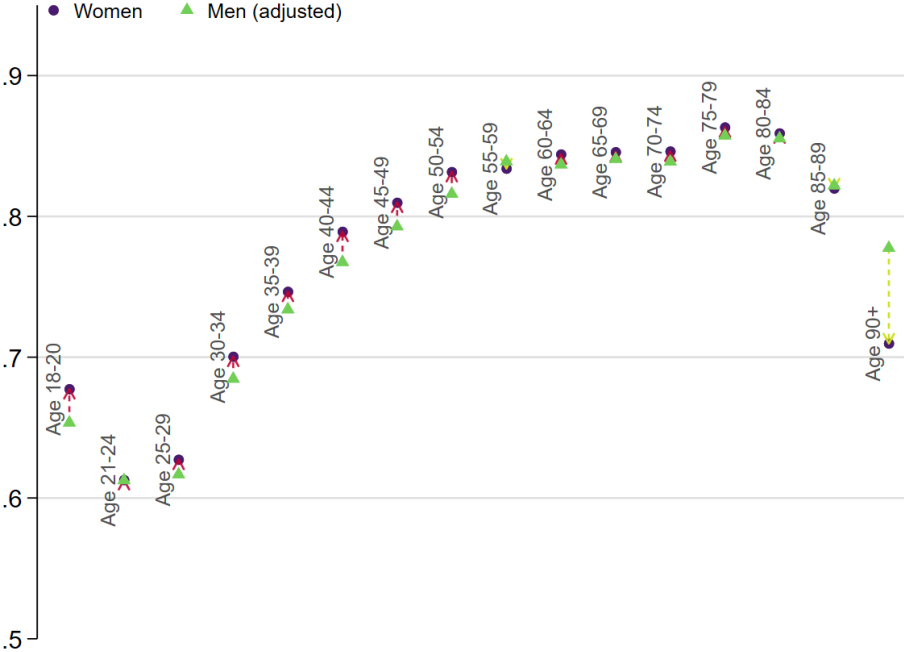
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

Participation to the vaccination campaign is one of the key instruments available in the fight against the pandemic. In Luxembourg, vaccines have been made available to all residents, free of charge. In this context, being vaccinated is largely an individual decision. In spite of the ease of access to the vaccines, vaccination rates remain comparatively low – at least in comparison with neighboring or other European countries. VKSA document a "social gradient" in vaccination, with vaccination rates varying with household income and country of birth, most notably.

The variation in vaccination by country of birth is particularly puzzling. Figure 1.12 shows these vaccination rates separately for men and women. Clearly the variations in vaccination by country of birth is observed for both sexes. Although women are somewhat more likely to be vaccinated than men among residents born in Germany, Portugal or a country for the former Yugoslavian Republic, the gender gap is small compared to the variations in vaccination across countries. The gender perspective does little to explain the puzzle of the variations in vaccination rates by country of birth.

Figure 1.12: Share of the population vaccinated against COVID-19, by gender and country of birth
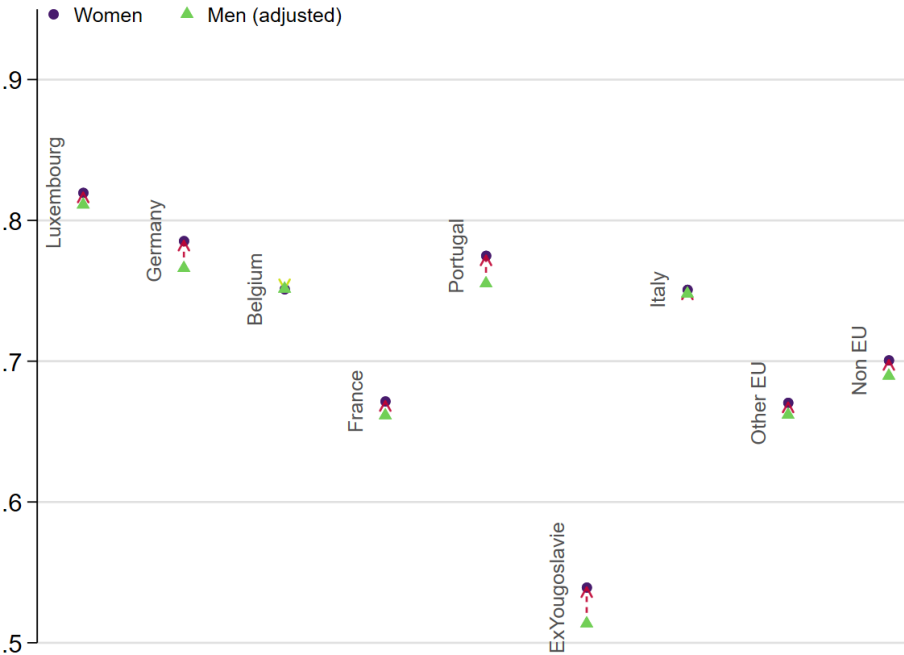
Source: Santé Pour Tous (calculations based on registers provided by IGSS and DiSa).

6. Conclusion

The answer to the question 'Have men and women's health been impacted in similar proportions by the pandemic?' is a clear "no". The most dramatic consequences of infections by the SARS-CoV-2 appear to have been much stronger on men than on women, notably old age men. In Luxembourg, like in other countries around the globe, women generally appear to have had a better biological response to infections than men. This apparent better immune response (Conti and Younes,, 2020; Nielsen *et al.*, 2021) is fortunate because we show that women have been more frequently contaminated than men, albeit relatively marginally and mostly among relatively young populations who were at lower risk of developing severe form of the disease. The increased contamination risk of young women appears to be related to household structures and the presence of children notably, more than to employment characteristics.

The Lancet's editorial on "the gendered dimension of COVID-19" stated that "The success of the global response—the ability of both women and men to survive and recover from the pandemic's effects—will depend on the quality of evidence informing the response and the extent to which data represent sex and gender differences" (The Lancet, 2020). The analysis conducted here and presented in this chapter can be seen as a contribution towards this goal, one which illustrates the value of data accessibility for research purposes.

Although the results shown here are based on rich data, the analysis is not without limitations and much critical information is also missing. Notably, the information on employment remains relatively coarse. The fact that we do observe much gender differences in contaminations related to employment may be because we are not able to see differences in the types of occupation at a

sufficiently detailed granularity. Also, to be able to design the most effective prevention measures, one would ideally want to try and understand how much gender differences in severe outcomes of COVID-19 are driven by differences in the prevalence of a compete set and detailed risk factors. The limited information on pre-existing conditions prevents us from making detailed recommendations here. Future more detailed epidemiological studies will certainly fill this gap. Finally, there is one outcome which we have not examined at all: the prevalence of "long COVID" (generally viewed as the persistence of symptoms such as fatigue or shortness of breath long after the initial infection). Some research suggests that women are more likely affected by persisting symptoms (e.g., Bai *et al.*, 2021) – this is however a dimension that our study is not able to document.

References

Bai F, Tomasoni D, Falcinella C *et al.* (2021). Female gender is associated with long COVID syndrome: a prospective cohort study. Clinical Microbiology and Infection, in press. https://doi.org/10.1016/j.cmi.2021.11.002.

Baker MG, Peckham TK, Seixas NS (2020). Estimating the burden of United States workers exposed to infection or disease: A key factor in containing risk of COVID-19 infection. PLoS ONE 15(4): e0232452. https://doi.org/10.1371/journal.pone.0232452

Bhopal SS, Bhopal R (2020). Sex differential in COVID-19 mortality varies markedly by age. The Lancet Correspondence. 396(101250), 532-533.

Conti P, Younes A. (2020). Coronavirus COV-19/SARS-CoV-2 affects women less than men: clinical response to viral infection. Journal of Biological Regulators and Homeostatic Agents 34(2),339-343. doi: 10.23812/Editorial-Conti-3. PMID: 32253888.

European Commission, Directorate-General for Research and Innovation, Oertelt-Prigione, S. (2020). The impact of sex and gender in the COVID-19 pandemic: case study, Publications Office, https://data.europa.eu/doi/10.2777/17055

Global Health 50/50 (2021). COVID-19 Sex-disaggregated Data Tracker. https://globalhealth5050.org/the-sex-gender-and-covid-19-project/ (accessed February 14, 2021).

Lakbar I, Luque-Paz D, Mege JL, Einav S, Leone M. (2020). COVID-19 gender susceptibility and outcomes: A systematic review. PLoS ONE, 15(11), e0241827. https://doi.org/10.1371/journal.pone.0241.

Mongey S, Pilossoph L, Weinberg A (2021). Which workers bear the burden of social distancing? Journal of Economic Inequality, 19, 509–526. https://doi.org/10.1007/s10888-021-09487-6

Nielsen J, Nørgaard SK, Lanzieri G, Verstergaard LS, Moelbak K (2021). Sex-differences in COVID-19 associated excess mortality is not exceptional for the COVID-19 pandemic. Nature (Scientific Reports) 11, 20815. https://doi.org/10.1038/s41598-021-00213-w

Peckham H, de Gruijter NM, Raine C. *et al.* (2020). Male sex identified by global COVID-19 meta-analysis as a risk factor for death and ITU admission. Nature Communications 11, 6317. https://doi.org/10.1038/s41467-020-19741-6

The Lancet (2020). The gendered dimensions of COVID-19 (Editorial). The Lancet, 395, 1168.

Van Kerm P, Salagean, IC, Amétépé, FS (2022). La COVID-19 au Luxembourg. Le gradient social de l'épidémie. Rapport Santé Pour Tous #1. Ministère de la Santé, Luxembourg.

Ya'qoub L, Elgendy IY, Pepine CJ (2021). Sex and gender differences in COVID-19: More to be learned! American heart journal plus: cardiology research and practice, 3, 100011. https://doi.org/10.1016/j.ahjo.2021.100011

Chapter 2: Gender differences in attitudes towards COVID-19 and health measures[8]

In this work package, we review the differences between women and men in terms of compliance with COVID-19 measures. To this end, we have developed a questionnaire about attitudes towards COVID-19 measures, behavioral traits, and concerns about COVID-19 and trust in institutions. This module was incorporated in an online survey which was administered in March 2021 on a sample of citizens from Luxembourg and its neighboring regions. It allows us to capture the attitudes of almost 700 individuals (mostly Luxembourgish nationals) towards physical distancing, mask-wearing, testing, vaccination, and support and consciousness towards measures in general.

We first show that rates of compliance with these measures are rather high for both women and men, though this depends on the measures considered. Large scale testing and avoidance of physical contacts are adopted by more than 85% of respondents. More than 75% also intend to get vaccinated and perceive that mask-wearing is a civic duty. About two thirds of respondents try to avoid public places and always wear masks in such places, get tested if they feel sick or had a high-risk contact. The same proportions of respondents remains as careful in applying safety measures as they were in the pandemic's beginning, and are globally supportive of the government's long-term actions. The domain in which individuals struggle the most pertains to being systematic in the application of safety measures. Indeed, about 48% of respondents admit that they do not manage to apply these measures consistently throughout the day as they tend to forget them once in a while.

We then analyze gender differences in these various outcomes. The proportion of women who comply with health measures is higher than men's for almost all measures. This is particularly true for mask-wearing, consistent application of safety measures, proactive testing and general support of the government's actions, for which the proportion of women is about 7 to 11 percentage points higher than men's. The proportion of women who avoid contacts and public places and participate in large scale testing is also larger, though only by 4 to 6 percentage points. The proportion of individuals intending to get vaccinated is the same across genders.

In the main section, we introduce multiple individual characteristics as potential factors explaining compliance with health measures. This allows us to refine our understanding of gender differences. We find that about half of these differences results from the fact that women are more risk averse and that they are more likely to perceive COVID-19 as dangerous for their health. On the other hand, women's lower average educational attainments negatively impact compliance.

When we compare of women and men with identical socio-demographic and personal characteristics, we find that women's compliance remains higher than men's in several outcomes. In particular, the proportion of women behaving responsibly and conscientiously in terms of mask-wearing and safety measures is about 6 percentage points higher than that of men with similar education, risk aversion, perception of danger and other individual characteristics. Women are also more involved in testing, though the difference with men is only about 3 percentage points. On the other hand, proactive risk avoidance through physical contacts and public places is identical between women and men with similar traits. The only dimension in which women are less involved than men pertains to vaccination intentions, which is 5 percentage points lower than men's.

---

[8] Author: Bertrand Verheyden.

We shed more light on the lower vaccination intentions of women in the last section. To this end, we exploit the natural experiment provided by the wave of suspensions of Vaxzevria (Astrazeneca's vaccine) in the European Union during the first half of March 2021, right at the start of our data collection process. We find that vaccination intentions of both women and men declined until March 18th, when the European Medicines Agency (EMA) provided public reassurances that the vaccine was effective and safe. Although this decline was sharper for men, the EMA's statement was more effective on them than on women. Our data shows that women's vaccination intentions remained more dispersed after March 18th, suggesting that the EMA was less effective at restoring trust among women. This is sensible, considering the fact that side effects and rare blood clots were overwhelmingly reported on women, and that women are more risk averse than men in general.

Overall, this report provides evidence that women are by a reasonable margin more compliant than men, and that this difference goes beyond the fact that they are more risk averse and more worried about the impact of COVID-19 on their health. All else equal, only risk avoidance appears to be identical between women and men, whereas vaccination is the only dimension in which women have lower participation intentions.

These results suggest that women and men are not sensitive to COVID-19 and health policies in the same way, and therefore communication about the importance of these policies might gain to be gender-specific. For instance, men should be specifically alerted about the risks of COVID-19 and about the benefit of policies, whereas concerns related to vaccination should concentrate on reassuring women. Also, it appears that communications to women are more effective at stimulating vaccination intentions if they are made by women (Chang *et al.*, 2021).

1. Introduction

In order to mitigate the adverse effects of COVID-19 in terms of life losses, of pressure on health systems, and of economic costs, policy makers have implemented a number of health policies. These measures imply different forms of constraints on the population's interactions (safety measures, mask-wearing) and freedom of movements (quarantines, school and workplace closures, cancelling of public and private events, curfews,...). Large scale testing as well as self-testing is important for assessing the evolution of the number of infections and to prevent contaminations, but are tedious or uncomfortable to many individuals. Last but not least, vaccination policy is particularly polarizing, being perceived by some as a welcome solution, as a civic duty, but by others as an attempt on their freedom of choice and on their physical integrity.

All these measures are demanding significant efforts from the population in already difficult times. Furthermore, they are in many situations difficult, or impossible, to enforce, and may even face opposition by some parts of the population. It is therefore crucial to encourage the population in complying with these health measures so that they are integrated as norms. In a context of equal opportunities, this is particularly critical since groups which are facing socio-economic disadvantages in general tend to be those who suffer the most from this health crisis. In particular, other work packages of this project show that women tend to be more affected by COVID-measures than men.

In this report, we study gender differences in attitudes towards a number of policies such as mask wearing, social distancing, testing and vaccination, as well as perceptions towards some of these measures and the government's actions in general in this crisis. We also compare the degrees of resilience in compliance, both in the short term (whether people remain equally careful throughout the

day) and in the long term (whether people tend to be less careful than in the beginning of the health crisis).

Recent evidence establishes the existence of gender differences in compliance with most of these policies. Galasso *et al.* (2020) use data from a multi-country study over the months of March and April 2020. They report that women are more likely to consider the virus as a serious risk than men. Based on various public-health and social-distancing measures, the authors build an overall index of compliance, which they use to show that the proportion of compliant women is about 5 percentage point higher than men. These findings are in line with ours, though we find differences in terms of vaccination and testing, which were not in place at the time of their study. Higher compliance by women is consistent around the world across various types of measures (Lin *et al.*, 2021; Rosha *et al.*, 2021; Alshammary, 2021). As in our analysis, the only exception to women's higher compliance pertains to vaccination. Indeed, women have lower intentions to get vaccinated (Green *et al.*, 2021).

Explanations to women's higher compliance are multidimensional. In this report, we stress that women's characteristics make them more prone to comply with health measures, in particular risk attitudes and fear of COVID-19. The literature indeed shows that women tend to be more emotionally affected by this health crisis than men (Alsharawy *et al.*, 2021 ; Levkovich and Shinan-Altman, 2021 ; Liu *et al.*, 2020; Park *et al.*, 2020 ; Wang *et al.*, 2020 ; Xiao *et al.*, 2020). Possible explanations to these stronger emotional reactions are that women's concerns actually pertain more to their family's health than financial aspects (McLaren *et al.*, 2020), and that their perceptions of COVID-related health risks are stronger than mens' (Rodriguez-Besteiro, 2021), and that they are thus more averse to being exposed to the virus (Kowalik and Lewandowski, 2021). Second, women may be more careful since the objective risk that they face is higher than men's. Indeed, they disproportionately operate in high-risk occupations and sectors, such as education and health (Barbieri *et al.*, 2020). Third, the positive impact of education on compliance appears to be more pronounced among women (Algara, 2021). In line with our analysis, Clark *et al.* (2021) find that factors such as the feeling of vulnerability to COVID-19 and trust in government play an important role in explaining compliance.

An interesting note of conclusion of this literature review is that gender differences appear to matter in terms of leadership style in the face of this health crisis. Garikipati and Kambhampati (2020) indeed show that the management of the pandemic in countries led by women was superior to that of countries led by men. A potential explanation for this is that the overall approach of female leaders of Northern Europe and New Zealand was democratic, inclusive and transparent in comparison with the management of countries such as the US, the UK or Brazil.

2. Data and descriptive statistics

We exploit data from an online survey conducted among the residents of Luxembourg and the border regions from early March to mid-April 2021. The survey was organized by Luxembourg Institute of Socio-Economic Research (LISER) in collaboration with the University of Luxembourg and advertised at the beginning of March on social media and on some local council websites.

After a general section on demographic characteristics, respondents were redirected to one of four randomly assigned blocks of questions covering various themes. Our block of interest, which was specifically designed for this report, concerns attitudes towards COVID-19 measures (social distancing, testing and vaccination) as well as behavioral traits and beliefs. A total of 2,549 individuals completed the main survey, about a fourth (689 individuals) completed the relevant block of questions used in this analysis. However, some individuals did not provide answers to some of the questions

that we exploit in this analysis, in particular those pertaining to personality traits and beliefs. The question which received the smallest number of answers (642) concerns the behavioral trait of self-determination, or locus of control.

2.1 Descriptive statistics of respondents' characteristics

Figure 2.1 (which is drawn from Table A2.1 in Appendix) provides descriptive statistics of individual characteristics which are exploited in the analysis as determinants of the attitudes towards COVID-19. These characteristics are split into three categories: socio-demographic characteristics, behavioral traits, and beliefs. These three categories of individual characteristics will be incrementally introduced in the statistical analysis (see Section 2.3).

Figure 2.1: Mean values of individual characteristics
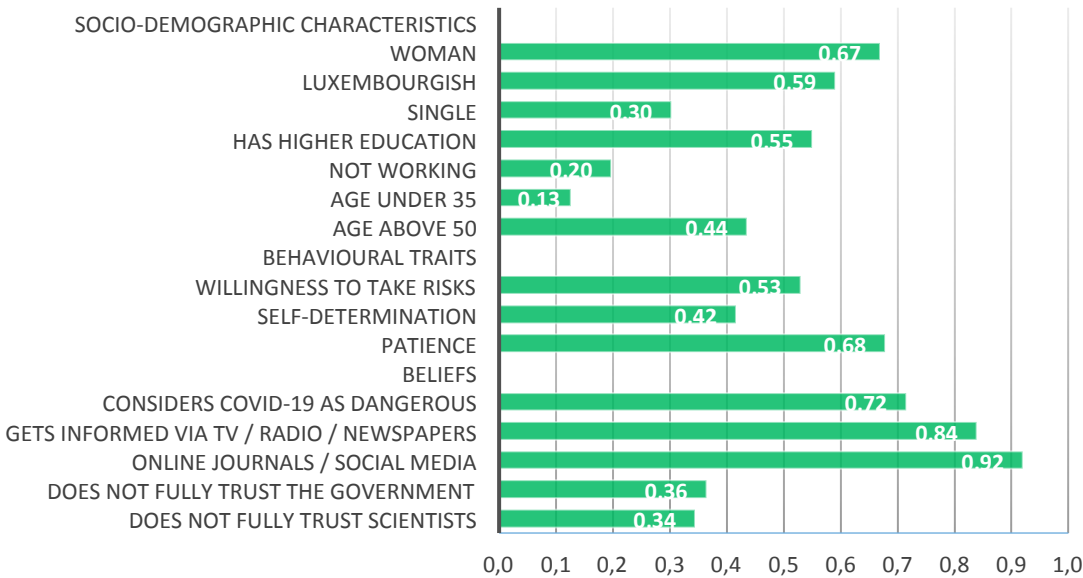
Figure 2.2 provides a distinction by gender for the five characteristics which are significantly different between women and men.[9]

We start with a description of respondents' general <u>socio-demographic characteristics</u>. Individuals who responded to our module are mostly women (67%). A majority of respondents are working (80%), a bit more than half of the sample has tertiary education (55%), and 59% of individuals have the Luxembourg nationality. In terms of age, 13% are below 35 years old and 44% are above 50 years old. In terms of gender differences, the proportion of women with higher education is about 9 percentage points lower than men's. This is also the case for the proportion of working women, which is 6,6 percentage points lower than men's (see Figure 2.2 below).

---

[9] Statistical significance means that it is not plausible that the "true" difference between women and men in the entire population is equal to zero. More specifically, it means that the probability to be wrong -when rejecting the possibility that this difference is zero- is sufficiently small (e.g. 5%).

Figure 2.2: main differences between women and men's characteristics
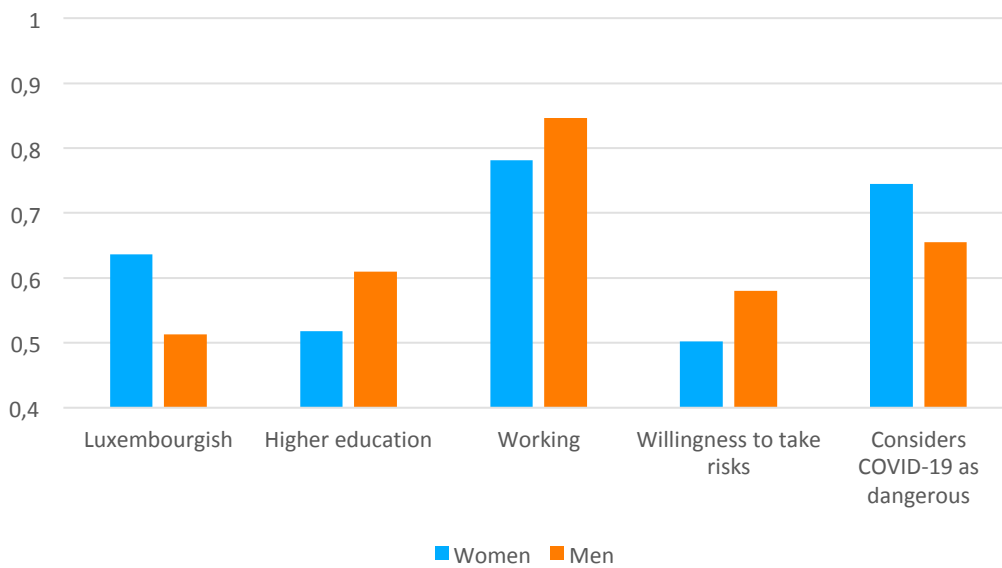
The second category of individual characteristics pertains to <u>behavioral traits</u>, namely the willingness to take risks, self-determination and patience. These variables are built thanks to questions specifically designed and validated in the literature to capture these traits, and which have been standardized here on a scale between 0 and 1. In line with the literature, the average willingness to take risks is significantly higher for men (0,58) than for women (0,50). Women also exhibit a slightly higher locus of control (0,43) than men (0,39), which captures the notion of self-determination, i.e. that events occurring in life result more from one's own actions than from random events imposed on oneself. Women and men appear to be equally patient (almost 0,7).

The third category of individual characteristics pertains to <u>beliefs and belief formation</u>. The majority of our sample considers COVID-19 as dangerous, with women being more concerned for their health (75%) than men (66%). Women and men appear to get informed about the news through the same channels, with 84% of the sample consulting every day traditional media (newspapers, TV or radio) and 92% consulting online media or social media daily. Finally, there are no gender differences in terms of trust in institutions, with 64% of respondents having a strong confidence in the Luxembourgish government's action, and 66% having a strong confidence in the scientific community.

While women are similar to men in our sample in most dimensions, Figure 2.2 summarizes the key dimensions in which gender differences exist. It shows that <u>higher education, employment, and willingness to take risks are less prevalent among women, whereas fear of COVID-19 is stronger among women</u>. These dimensions play an important role in attitudes towards COVID-19 measures, and thus capture an important share of the gender differences which we are now presenting. It is also worth noting that, conditional on gender, the proportion of Luxembourgish women (64%) is larger than the proportion of Luxembourgish men (51%) in our sample.

2.2 Descriptive statistics of respondents' outcomes

Let us now provide a statistical description of the outcomes that we will study in Section 2.3, i.e. respondents' levels of compliance with COVID-19 measures. Figure 2.3.A and 2.3.B (which are drawn from Table A2.2 in Appendix) provide comparisons of the differences in attitudes towards COVID-19 measures between women and men. A first look at these mean comparisons suggests that women are significantly more compliant than men in virtually all dimensions.

Figure 2.3.A: Average levels of attitudes towards COVID-19 measures, by gender

Figure 2.3.A pertains to mask-wearing and social distancing and safety measures in general. Women are more supportive of mask-wearing, with 81% of women considering it as a civic duty, compared to 71% for men. Also, 66% of women claim to always wear masks in public places, while this proportion is only of 55% for men. Second, women appear to be more conscientious and supportive than men in terms of social distancing and safety measures in general. Indeed, 54% of women (47% of men) claim to never forget safety measures throughout the day, 69% of women (60% of men) consider themselves as careful about applying safety measures in March 2021 as in the beginning of the pandemic, and 73% of women (63% of men) support the government's actions against the pandemic.

Figure 2.3.B: Average levels of attitudes towards COVID-19 measures, by gender
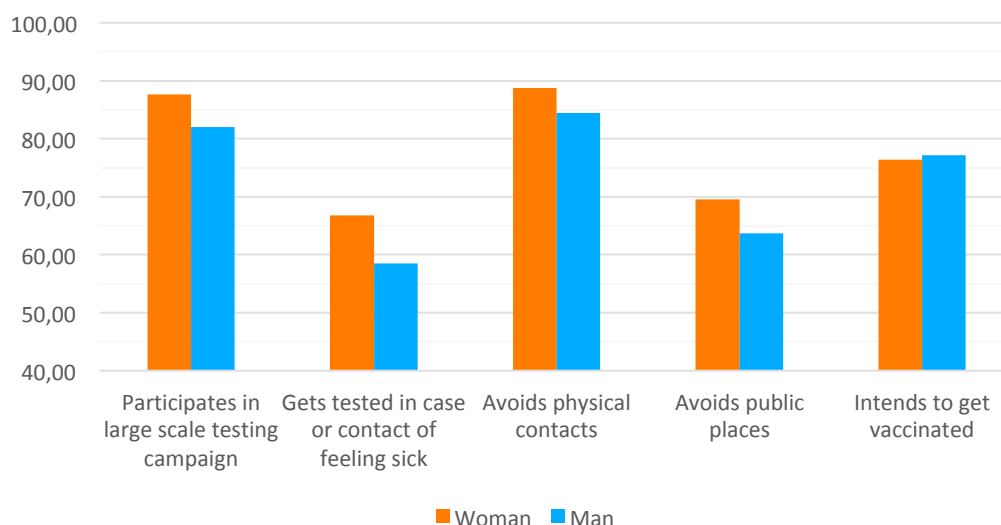
Figure 2.3.B pertains to testing, proactive risk avoidance and vaccination outcomes. First, it shows that women are also more involved in testing. The Luxembourgish government put in place a large-scale testing campaign in view of assessing the spread of the virus, and 88% of women in our sample participated in it, compared to 82% of men. Also, spontaneous testing, in case of feeling sick or in case of contact with an infected person, is more prevalent among women (67%) than men (59%). Second, proactive behaviors of risk avoidance seem slightly more pronounced among women. Indeed, 89% of women and 84% of men avoid physical contacts (shaking hands, kissing, hugging,…) and 70% of women and 64% of men try to avoid public places since the start of the pandemic. Finally, the only exception to the overall higher compliance of women pertains to vaccination. Indeed, about three quarters of both women and men intend to get vaccinated.

Though quite informative, these comparisons of average compliance levels between women and men however have an important limitation. Indeed, these comparisons are "unconditional", in the sense that they do not take into account the fact that women and men do not have the same characteristics, in particular -as we have seen from Table A2.1- in terms of higher education, attitudes towards risk and fear of COVID-19 and nationality. In the next Section, we apply a statistical method which allows to measure gender differences that take these characteristics into account.

3. Empirical analysis

In this Section, we pursue the comparison between women's and men's compliance with COVID-19 measures in a way that is more robust than simple mean comparisons. Indeed, we use an "Ordinary Least Squares regression" which allows us to account for the fact that women and men in our sample have different observable characteristics affecting compliance. This approach allows us to identify the extent to which the results presented in the descriptive statistics section are attributable to factors that are correlated with gender, such as education, risk attitudes, and fear of COVID-19. We will see that these factors indeed play an important role in explaining attitudes towards COVID-19 measures, but that gender per se remains an important factor once these dimensions are taken into account.

The results described here are to be interpreted as "ceteris paribus". This means that, considering the characteristics that are included in the regression, gender effects result from the comparison of outcomes between women and men who have the same values of these characteristics, also called control variables.

To make this interpretation concrete, let us consider a first regression in which the various compliance outcomes (listed in Figures 2.3.A and 2.3.B) are explained by gender and by the main socio-demographic characteristics (age, nationality, employment status, marital status and education). In such a regression, the estimated effect of gender corresponds to the difference between the average outcomes of women and men belonging to the same age group, having the same nationality, the same employment status, the same marital status and the same education level. Unlike the "unconditional" differences presented in Section 2.2, the gender effect estimated here is not affected by the fact that men and women differ in these characteristics (e.g. nationality and education). It thus provides a gender effect that is "net" of the differences in observable characteristics.

As we introduce additional sets of individual characteristics (behavioral traits and beliefs), we increase our ability to explain the outcomes, and we refine our understanding of which variables are key in this explanation. The sequential addition of potential drivers of compliance also allows us to understand the roots of gender differences. In particular, this allows us to assess the extent to which gender differences described in Section 2.2 are driven by the fact that women and men are different in characteristics that also impact their compliance with COVID-19 measures, and conversely the extent to which structural gender differences remain even after accounting for these additional characteristics.

Results of this approach are summarized in Figures 2.4.A and 2.4.B (which are drawn from Table A2.3 to Table A2.7 in the Appendix). Figure 2.4.A reports the effects of being a woman (relative to a man) on the first five outcomes, i.e. mask-wearing, conscientiousness and support towards safety measures. Figure 2.4.B reports the effects of being a woman on the last five outcomes, i.e. testing, proactive risk avoidance and vaccination. For each of the 10 outcomes, four orange dots (representing the mean difference between women and men) and black lines (representing the corresponding statistical 95% confidence interval) are presented.

- The first dot on the left represents the unconditional mean difference between women, i.e. a difference between "raw" means, which does not take into account any other explanatory factors. These first dots correspond to the differences between women's and men's bars in Figures 2.3.A and 2.3.B.

- The second dot represents the "Woman" effect in a regression which includes basic socio-demographic characteristics (age, education, nationality, marital status and employment status). These coefficients (which are displayed in the first columns of Tables A2.3 to A2.7), must be interpreted as the mean difference between women and men who belong to the same age group, education category, nationality, marital status and employment status, but who may still differ in terms of behavioral traits and beliefs.

- The third dot is based on the same approach, with a regression which also includes personality traits (willingness to take risks, self-determination and patience) as variables explaining the outcomes. The third dot thus represents the mean difference between women and men who have the same set of socio-demographic characteristics as well as the same levels of willingness to take risks, self-determination and patience.

- The fourth and last dot represents the mean difference between women and men having the same socio-demographic characteristics, personality traits and also the same beliefs (fear of COVID-19, type of media consumed and trust in government and in science).

The interpretation of each dot is thus different, and one may argue that since, for instance, women are intrinsically less willing to take risks, comparing women and men who have the same willingness to take risks is an artificial exercise. However, some men are more risk-averse than some women, and one should typically avoid stereotypical generalizations when measuring gender effects. In particular, Paramita *et al*. (2021) stress that the way gender is treated empirically significantly matters for the interpretation of gender effects. They indeed show that gender psychology (feminine vs masculine) and gender-role (traditional vs egalitarian) are more effective at explaining compliance towards health measures than the dichotomous treatment of sex. Controlling for various personal characteristics is therefore both informative and relevant.

Figure 2.4.A: Differences between women and men, by outcome and controls
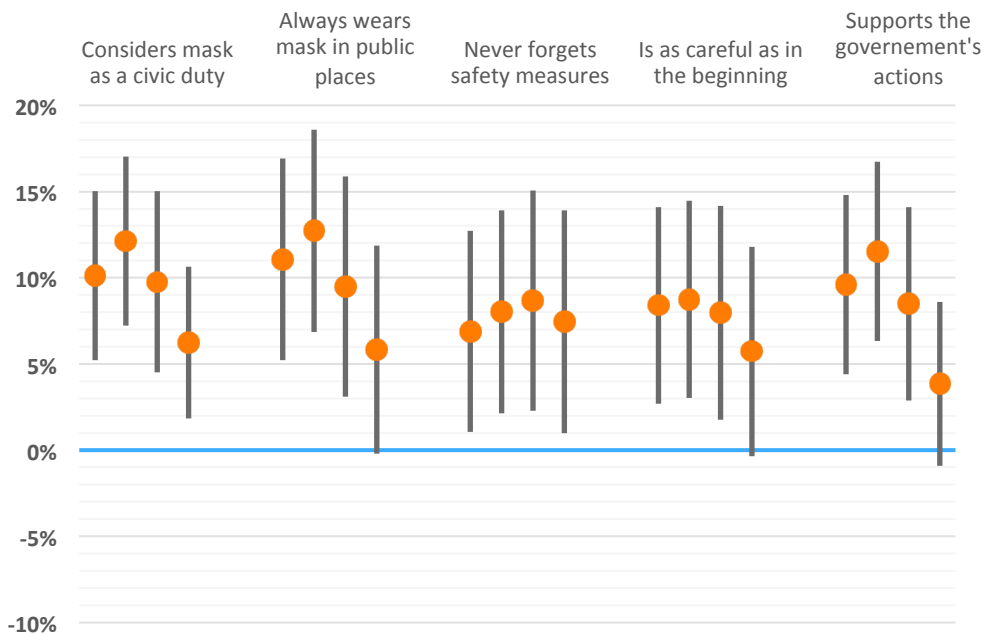
Figure 2.4.B: Differences between women and men, by outcome and controls
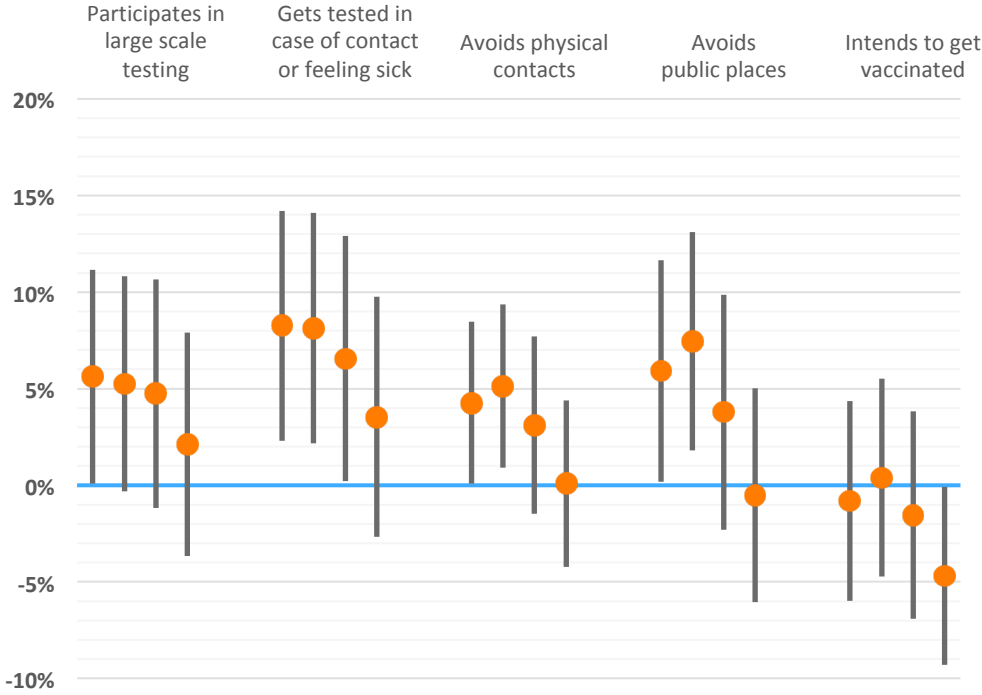
For each dot, gender differences are statistically significant (i.e. different from zero) if the black line (the confidence interval) does not cross the blue horizontal axis representing 0%. We start the discussion of the main results by making some general comments about the relative position of the four dots which hold for almost all outcomes.

First, for all outcomes except vaccination, the first dot's confidence interval (i.e. the specification which does not account for any individual characteristic but gender) does not cross the horizontal axis. This means that overall, women are significantly more compliant than men, though these men's characteristics may be very different from those of women.

Second, almost systematically, the second dot is higher than the first. This means once socio-demographic characteristics are taken into account, the difference between women and men is even stronger. This stems from the facts that (i) women are on average less likely to have higher education than men, and (ii) less educated individuals tend to comply less with COVID-19 policies.[10] Hence, the basic "unconditional" gender difference (first dot) was underestimating the gender effect because it was incorporating the negative effect of low education, which is more prevalent among women. Indeed, the gender compliance gap is larger once comparisons are made on women and men with the same education levels.[11]

Third, as we introduce additional characteristics (behavioral traits for the third dot, and beliefs in the fourth dot), we observe that the difference between women and men tends to become smaller, and in

---

[10] The gender difference in education is common, in particular among older cohorts, whereas the lower compliance of less educated individuals has been vastly.

[11] A second socio-demographic characteristic may counterbalance this effect for specific measures. It indeed appears from our regressions that remaining careful throughout the pandemic and avoiding public places are facilitated by not being in a work environment. Women, who are less active on the labor market on average, are thus more likely to comply with these specific measures.

many cases statistically insignificant. The reason thereof stems from similar mechanisms, although they apply here in the opposite direction. First, the third dot is generally lower than the second essentially because it takes risk attitudes into account. Indeed, women tend to be more risk averse, and both the literature and our analysis confirm that high risk aversion is associated with higher compliance with COVID-19 measures. Hence, the inclusion of behavioral traits highlights the fact that the first two dots were estimating gender differences which were incorporating the fact that women are more compliant because they are on average more risk averse. This explains why the third dot is lower than the first two dots, as it is based on a comparison between women and men with the same levels of risk aversion (and the same socio-demographic characteristics). Second, we observe the same drop in gender effects when comparing the third dot to the fourth. Belief-related factors greatly contribute to improving the understanding of compliance. In particular, trust in the government and in science and the intensive consumption of traditional media are strong positive determinants of compliance. However, these characteristics are equally distributed between women and men, hence they do not impact gender effects. The key channel which explains why gender effects are weaker in the final regressions stems from the inclusion of the variable capturing individuals' perception of danger regarding COVID-19. The fear of COVID-19 is indeed much more prevalent among women, and it provides a significant stimulus to comply with health measures. Hence, previous estimates, which were not conditioning on beliefs, were overestimating gender differences, at least if we are interested in comparing women and men who have the same beliefs.

Finally, comparing the first (no control variables) to the fourth dot (all control variables) shows us the sensitivity of gender effects to important factors influencing compliance. Depending on the outcome, we observe that unconditional gender effects are generally between 5 and 10 percentage points, and the effects which account for all individual characteristics are about 5 percentage points lower. Hence, for some outcomes, gender effects become small in magnitude and statistically insignificant. Let us now identify nuances from these general observations by looking more specifically at the various outcomes. Most of our focus here is on the full model represented by the fourth dots.

Whether one considers simple mean comparisons or uses the full model with all individual factors, mask-wearing is a domain in which women are significantly more compliant. In the full model (fourth dot), women remain 6 percentage points more likely than (comparable) men to consider masks as a civic duty and to always wear them in public places.

Women are also more conscientious with respect to safety measures, they are very significantly more likely to apply safety measures in a consistent way throughout the day than men, by about 7 percentage points. Although less significant, the proportion of women who are as careful with safety measures as in the beginning is also larger than men's (6 percentage points). Similarly, and again weaker in significance, women are slightly more supportive than men towards the government's actions (4 percentage points difference).

Then, there are a number of outcomes for which conclusions on gender effects are strongly impacted by the inclusion of variables such as education, risk aversion and fear of COVID-19 (among other). First, participation in large scale and proactive testing are still slightly larger for women (2 percentage points and 4 percentage points, respectively). However, these testing-related outcomes are no longer statistically different between women and men who have the same characteristics. Furthermore, average levels of avoidance of physical contacts and of public places are equal between women and men once their education, risk aversion and fear of COVID-19 are taken into account (0% difference).

Last but not least, women's intentions to get vaccinated become significantly lower than men's. This effect can be attributed, as discussed in the next Section to the fact that women are generally more

risk averse, and vaccination per se also entails a risk. Furthermore, the risks related to vaccination are more prevalent among women. Indeed, adverse effects have been reported more frequently on women than on men (Gee *et al.*, 2021; Menni *et al.*, 2021), in particular rare severe blood clots which caused some vaccines to be suspended (LaPreze, 2021).

To conclude, women are more compliant with most health measures than men. About half of the differences in compliance levels results from the fact that women are more risk averse and that they are more likely to perceive COVID-19 as dangerous. While both risk perception and risk aversion greatly contribute to women's more careful attitudes, on the other hand women's lower average educational attainments negatively impacts compliance. When we compare the compliance levels of women with identical socio-demographic characteristics, we find that compliance between women and men still differs in several outcomes. In particular, women behave more responsibly and conscientiously in terms of mask-wearing and safety measures than men with similar education, risk aversion, perception of danger,... Gender differences are however smaller, for instance in terms of testing participation. All characteristics equal, women and men have the same proactive risk avoidance behavior. Finally, women are less willing to get vaccinated, which we investigate further in the next section.

4. The impact of Vaxzevria suspensions and of EMA communication on vaccination intentions

In this Section, we place a particular emphasis on vaccination intentions, which was the most timely topic at the time in which the data was being collected, March 2021. Putting things in perspective, the start of the vaccination campaign in early 2021 was being challenged by vaccine hesitancy and antivax movements, despite months of lockdown and millions of deaths in 2020 (Williams, 2021). In early March 2021, concerns related to vaccines were further fueled when European media reported rare cases of blood clots among people who received Astrazeneca's Vaxzevria vaccine. This led European governments to implement a large and uncoordinated wave of precautionary suspensions. By March 15th, 18 countries had suspended Vaxzevria, pending an official statement by the European Medicines Agency (EMA), the EU drug regulator. As a response, the EMA made gave a press conference on March 18th stating that "the vaccine's proven efficacy in preventing hospitalization and death from COVID-19 outweighs the extremely small likelihood of developing" blood clots, and recommended the vaccine's use. Within a few hours, 15 governments reintroduced Vaxzevria.

Since our data was collected in this particular period, we seized this opportunity to study how these events affected vaccination intentions, and in particular whether the supranational health agency's communication was able to mitigate the surge of vaccine hesitancy. In a recent research article (Albanese, Fallucchi and Verheyden, 2021), we used a regression discontinuity design (RDD) which exploits the information of the precise time at which individuals responded to the survey. This method consists in comparing the intentions to be vaccinated between individuals who responded shortly *before* and shortly *after* the EMA's announcement, on March 18th at 17:00. Under the reasonable assumption that characteristics of respondents did not vary around this particular moment (e.g. antivax individuals did not choose to participate more or less in the survey after the EMA's statement), this method provides a causal estimation of the effect of the EMA's statement. In our research, we found an immediate and statistically significant effect of the EMA, which allowed to counterbalance the severely declining trust in vaccines observed among respondents in the period preceding the EMA's statement.

In this Section, we extend the analysis of the impact of the EMA on vaccine hesitancy by providing a specific focus on gender differences. Key results of this analysis are provided in Figure 2.5.A and 2.5.B, which describe the impact of the EMA statement on the willingness to bet vaccinated of men (2.5.A) and women (2.5.B). The lines around the cutoff of March 18th represent the evolution of vaccination intentions before and after the EMA's statement.

First, the negative slopes of the lines before March 18th in both figures mean that the willingness to be vaccinated of both women and men was severely declining in the days preceding the EMA' statement. However, the slope of men's line is steeper, suggesting that men were more impacted (compared to women) by the negative publicity induced by media reports and by the wave of suspensions across Europe.

Secondly, men's line after March 18th is both higher and flatter than the line before March 18th, meaning that the EMA statement had an immediate and statistically significant positive impact on men's vaccination intentions. A qualitatively similar interpretation can be made for women, though the post-EMA line has a downward slope, due to the stronger dispersion of the cloud of dots after March 18th. This suggests that the reassuring impact of the EMA was also stronger for men. While men returned to stable vaccination intention levels comparable to the pre-crisis period, this cannot be said for women. In the post-EMA period, the vaccination intentions of women are indeed significantly more dispersed and on average lower than men's.

Figure 2.5.A: the impact of the EMA statement on men's willingness to bet vaccinated
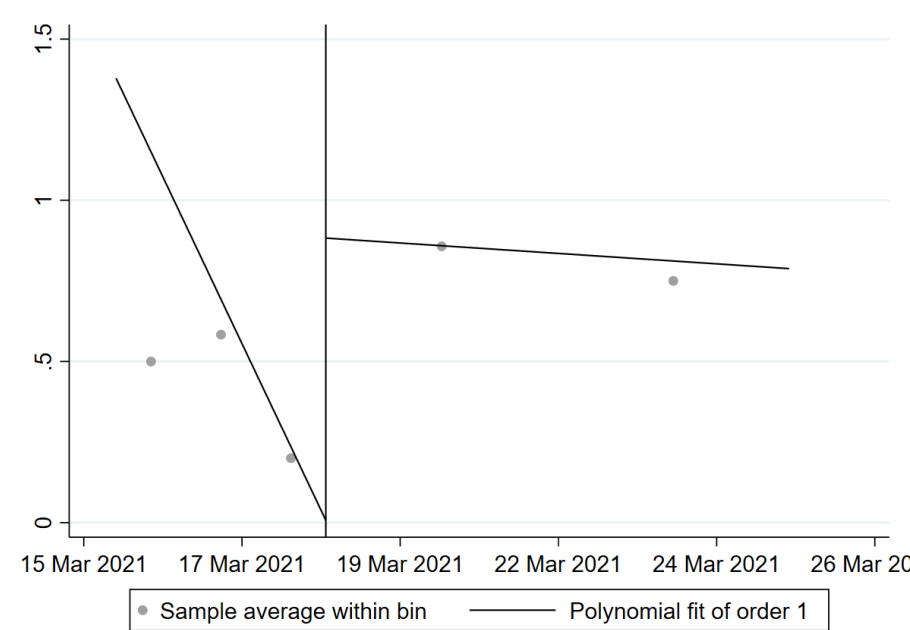
Figure 2.5.B: the impact of the EMA statement on women's willingness to bet vaccinated
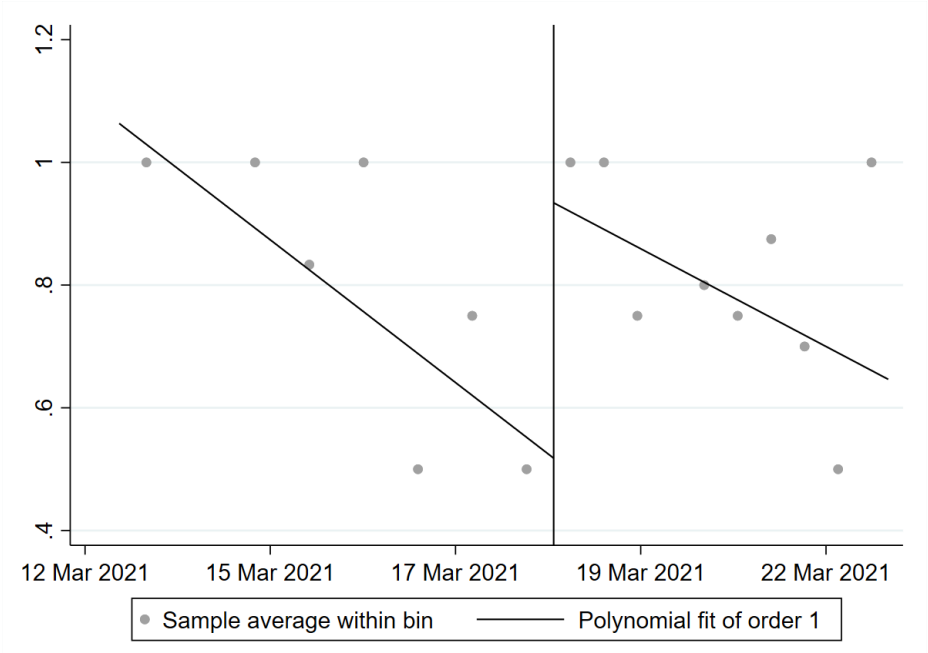
These results suggest that while women were initially less impacted by the wave of suspensions, their concerns might not have been totally alleviated by the EMA statement, as some women remained less willing to get vaccinated. A plausible explanation for these findings is that most blood clot cases reported in the media concern women, and women are more risk averse than men.

To conclude this Section, a cautionary remark is in order. Indeed, though these results are sensible, they should be interpreted as descriptive rather than causal. The main reason for this is that the sample size for each gender group is insufficient to draw robust conclusions with this methodology.

5. Conclusion

We review the differences between women and men in terms of compliance with COVID-19 measures on a sample of almost 700 individuals from Luxembourg and its neighboring regions. We exploit data from a survey administered online in March 2021 containing specific information on attitudes towards physical distancing, mask-wearing, testing, vaccination, and support and consciousness towards measures in general.

The majority of both women and men apply these measures. However, the proportion of women who comply is generally larger than men's, by 5 to 10 percentage points. This is particularly true for mask-wearing, consistency in the application of safety measures, proactive testing and general support of the government's actions.

Out of this 5 to 10 percentage-point difference in compliance rates, about 5 percentage points can be attributed to the fact that the average woman have different individual characteristics compared to the average man. Women are indeed more risk averse and more likely to perceive COVID-19 as dangerous, which captures a significant proportion of the gender difference. On the other hand, women's lower average educational attainments reduces the gender gap. Accounting for these factors allows us to make "all else equal" gender comparisons, meaning comparisons between women and

men with the same individual characteristics. These all else equal comparisons show that gender effects remain present in several domains, in particular conscientiousness in applying safety measures and wearing masks, and to a lesser extent participation in testing. In contrast, proactive risk avoidance through physical contacts and public places is identical between women and men with similar traits. Finally, the only dimension in which women are less involved than men pertains to vaccination intentions, which is 5 percentage points lower than men's. This last conclusion is confirmed in our analysis of the impacts of vaccine suspensions around Europe in early March 2021, and of the ensuing reassurances about their safety brought by the European Medicines Agency (EMA). While suspensions negatively impacted the intentions to get vaccinated of both women and men, the EMA was less effective at restoring trust among women. This is sensible, considering that (i) women are more risk averse than men in general and (ii) the ultrarare blood clots that caused the suspensions were exclusively reported on women.

These results suggest that women and men are not sensitive to COVID-19 and health policies in the same way, and therefore communication about the importance of these policies might gain to be gender-specific. For instance, men should be specifically alerted about the risks of COVID-19 and about the concrete benefits of policies, whereas women appear to be more naturally compliant with safety measures. On the other hand, efforts to inform and quantify objectively the risks of vaccination should be concentrated on women. Also, Chang *et al*. (2021) show that making such communication gender-specific might also be effective, as it appears that communications made by women to the attention of women stimulates vaccination intentions more than men-to-women communications.

References

Albanese, A., Fallucchi, F., and Verheyden, B. (2021) "Can a Supranational Medicines Agency Restore Trust After Vaccine Suspensions? The Case of Vaxzevria", IZA Discussion Paper, 14553.

Alsharawy, A., Spoon, R., Smith, A., and Ball, S. (2021) "Gender differences in fear and risk perception during the COVID-19 pandemic." Frontiers in psychology, 3104.

Algara, C., Fuller, S., Hare, C., and Kazemian, S. (2021). The interactive effects of scientific knowledge and gender on COVID-19 social distancing compliance. Social Science Quarterly, 102(1), 7-16.

Alshammary, F., Siddiqui, A. A., Amin, J., Ilyas, M., Rathore, H. A., Hassan, I., ... and Kamal, M. A. (2021) "Prevention knowledge and its practice towards COVID-19 among general population of Saudi Arabia: a gender-based perspective." Current pharmaceutical design, 27(13), 1642-1648.

Androsik, A. (2020) "Gendered understanding of ebola crisis in Sierra Leone. Lessons for COVID-19." Population and Economics, 4(2), 88–95. https://doi.org/10.3897/popecon. 4.e53301.

Baker, Alexander T., *et al.* (2021): "ChAdOx1 interacts with CAR and PF4 with implications for thrombosis with thrombocytopenia syndrome." Science advances 7.49 (2021): eabl8213.

LaPreze, Jennifer, and CPP CDCES. "The Johnson and Johnson COVID-19 Vaccine, Women, and VITT." Us Pharmacist HS2-HS6.

Barbieri, T., Basso, G. and Scicchitano, S. (2021) "Italian Workers at Risk During the COVID-19 Epidemic." Italian Economic Journal.

Chang, J, M Shah, R Pramanik and S Shah (2021), "Financial Incentives and Other Nudges Do Not Increase COVID-19 Vaccinations among the Vaccine Hesitant", NBER Working Paper 29403.

Clark, C., Davila, A., Regis, M., and Kraus, S. (2020). Predictors of COVID-19 voluntary compliance behaviors: An international investigation. Global transitions, 2, 76-82.

Galasso, V., V. Pons, P. Profeta, M. Becher, S. Brouard and M. Foucault (2020), "Gender differences in COVID-19 related attitudes and behavior: Evidence from a panel survey in eight OECD countries" Proceedings of the National Academy of Sciences of the United States of America 117(44): 27285–91.

Gee J., Marquez P., Su J., *et al.* (2021) "First Month of COVID-19 Vaccine Safety Monitoring — United States, December 14, 2020–January 13, 2021." MMWR Morb Mortal Wkly Rep 2021;70:283–288.

Green, M. S., Abdullah, R., Vered, S., and Nitzan, D. (2021) "A study of ethnic, gender and educational differences in attitudes toward COVID-19 vaccines in Israel–implications for vaccination implementation policies." Israel Journal of Health Policy Research, 10(1), 1-12.

Kowalik, Z., and Lewandowski, P. (2021). The gender gap in aversion to COVID-19 exposure: Evidence from professional tennis. PloS one, 16(3), e0249045.

Levkovich, I., and Shinan-Altman, S. (2021) "The impact of gender on emotional reactions, perceived susceptibility and perceived knowledge about COVID-19 among the Israeli public." International Health.

Lin, T., Harris, E. A., Heemskerk, A., Van Bavel, J. J., and Ebner, N. C. (2021) "A multi-national test on self-reported compliance with COVID-19 public health measures: The role of individual age and

gender demographics and countries' developmental status." Social Science and Medicine, 286, 114335.

Liu, N., Zhang, F., Wei, C., Jia, Y., Shang, Z., Sun, L., ... Liu, W. (2020) Prevalence and predictors of PTSS during COVID-19 outbreak in China hardest-hit areas: Gender differences matter. Psychiatry Research, 287, Article 112,921. https://doi.org/10. 1016/j.psychres.2020.112921.

McLaren, H. J., Wong, K. R., Nguyen, K. N., and Mahamadachchi, K. N. D. (2020) "Covid-19 and women's triple burden: Vignettes from Sri Lanka, Malaysia, Vietnam and Australia." Social Sciences, 9(5), 1–11. https://doi.org/10.3390/socsci9050087.

Menni, Cristina, *et al.* (2021) "Vaccine side-effects and SARS-CoV-2 infection after vaccination in users of the COVID Symptom Study app in the UK: a prospective observational study." The Lancet Infectious Diseases.

Paramita, W., Rostiani, R., Winahjoe, S., Wibowo, A., Virgosita, R., and Audita, H. (2021) "Explaining the voluntary compliance to COVID-19 measures: An extrapolation on the gender perspective." Global Journal of Flexible Systems Management, 22(1), 1-18.

Park, C. L., Russell, B. S., Fendrich, M., Finkelstein-Fox, L., Hutchison, M., and Becker, J. (2020). "Americans' COVID-19 stress, coping, and adherence to CDC guidelines." Journal of General Internal Medicine, 1–8. https://doi.org/10.1007/s11606-020- 05898-9.

Rodriguez-Besteiro, S., Tornero-Aguilera, J. F., Fernández-Lucas, J., and Clemente-Suárez, V. J. (2021) "Gender differences in the covid-19 pandemic risk perception, psychology and behaviors of spanish university students." International Journal of Environmental Research and Public Health, 18(8), 3908.

Rosha, B. C., Suryaputri, I. Y., Irawan, I. R., Arfines, P. P., and Triwinarto, A. (2021) "Factors Affecting Public Non-compliance With Large-scale Social Restrictions to Control COVID-19 Transmission in Greater Jakarta, Indonesia." Journal of Preventive Medicine and Public Health, 54(4), 221.

Wang, C. J., Ng, C. Y., and Brook, R. H. (2020) "Response to COVID-19 in Taiwan: big data analytics, new technology, and proactive testing." JAMA, 323(14), 1341–1342. https://doi.org/10.1001/jama.2020.3151.

Williams, L., Flowers, P., McLeod, J., Young, D., and Rollins, L. (2021) "Social patterning and stability of intention to accept a COVID-19 vaccine in Scotland: Will those most at risk accept a vaccine?." Vaccines, 9(1), 17.

Xiao, X., Xiao, J., Yao, J., Chen, Y., Saligan, L., Reynolds, N. R., and Wang, H. (2020) "The Role of Resilience and Gender in Relation to Infectious-Disease-Specific Health Literacy and Anxiety During the COVID-19 Pandemic." Neuropsychiatric Disease and Treatment, 16, 3011.

Appendix

Table A2.1: Descriptive statistics of individual characteristics, by gender

	(1) All Mean [SE]	N	(2) Woman Mean [SE]	N	(3) Man Mean [SE]	N	(2)-(3) t-test Difference
Sociodemographic characteristics							
Woman	0,67 [0,018]	689	1,00 [0,000]	461	0,00 [0,000]	228	NA
Not Luxembourgish	0,41 [0,019]	689	0,36 [0,022]	461	0,49 [0,033]	228	-0,122***
Single	0,30 [0,018]	689	0,29 [0,021]	461	0,33 [0,031]	228	-0,04
Has no higher education	0,45 [0,019]	689	0,48 [0,023]	461	0,39 [0,032]	228	0,091**
Not working	0,20 [0,015]	689	0,22 [0,019]	461	0,15 [0,024]	228	0,066**
Age under 35	0,13 [0,013]	689	0,13 [0,016]	461	0,12 [0,021]	228	0,01
Age above 50	0,44 [0,019]	689	0,41 [0,023]	461	0,48 [0,033]	228	-0,06
Behavioral traits							
Willingness to take risks	0,53 [0,009]	653	0,50 [0,012]	430	0,58 [0,016]	223	-0,078***
Self-determination	0,42 [0,009]	642	0,43 [0,011]	426	0,39 [0,016]	216	0,033*
Patience	0,68 [0,009]	643	0,68 [0,010]	429	0,67 [0,016]	214	0,02
Beliefs and belief formation							
Considers COVID-19 as dangerous	0,72 [0,012]	683	0,75 [0,014]	459	0,66 [0,023]	224	0,090***
TV / radio / newspapers	0,84 [0,014]	689	0,84 [0,017]	461	0,83 [0,025]	228	0,01
Online journals / social media	0,92 [0,010]	689	0,92 [0,013]	461	0,92 [0,018]	228	0,01
Does not fully trust the governm't	0,36 [0,018]	689	0,36 [0,022]	461	0,38 [0,032]	228	-0,02
Does not fully trust scientists	0,34 [0,015]	689	0,35 [0,019]	461	0,33 [0,026]	228	0,03
The value displayed for t-tests are the differences in the means across the groups.							
***, **, and * indicate significance at the 1, 5, and 10 percent critical level.							

Table A2.2: Summary statistics of attitudes towards COVID-19 measures, by gender

	(1) All Mean [SE]	N	(2) Woman Mean [SE]	N	(3) Man Mean [SE]	N	(2)-(3) t-test Difference
Considers wearing masks as a civic duty	77,86 [1,193]	682	81,21 [1,337]	456	71,09 [2,326]	226	10,12***
Always wears masks in public places	62,25 [1,416]	687	65,91 [1,650]	460	54,85 [2,619]	227	11,06***
Never forgets safety measures throughout the day	51,90 [1,405]	685	54,18 [1,705]	459	47,27 [2,455]	226	6,90**
Is as careful as in the beginning of the pandemic	65,94 [1,373]	684	68,70 [1,637]	459	60,30 [2,463]	225	8,40***
Supports the government's actions against the pandemic	69,64 [1,262]	685	72,80 [1,434]	459	63,20 [2,428]	226	9,60***
Participates in large scale testing campaign	85,78 [1,332]	689	87,64 [1,535]	461	82,02 [2,549]	228	5,62**
Gets tested in case of contact or feeling sick	64,08 [1,437]	689	66,81 [1,720]	461	58,55 [2,566]	228	8,26***
Avoids physical contacts	87,29 [1,007]	686	88,71 [1,138]	459	84,44 [1,980]	227	4,27**
Avoids public places	67,61 [1,381]	686	69,57 [1,613]	459	63,66 [2,587]	227	5,92**
Intends to get vaccinated	76,63 [1,225]	689	76,36 [1,471]	461	77,18 [2,207]	228	-0,82
The value displayed for t-tests are the differences in the means across the groups.							
***, **, and * indicate significance at the 1, 5, and 10 percent critical level.							

Table A2.3: Regression results (1): Avoiding physical contacts and public places

	Avoids physical contacts			Avoids public places		
	(1)	(2)	(3)	(4)	(5)	(6)
Woman	5,126**	3,111	0,088	7,453**	3,787	-0,508
	(2,38)	(1,33)	(0,04)	(2,58)	(1,22)	(-0,18)
Not Luxembourgish	0,961	0,213	1,206	5,314*	3,305	3,466
	(0,46)	(0,09)	(0,56)	(1,88)	(1,08)	(1,23)
Single	-2,845	-1,649	-2,220	-2,816	-3,863	-4,769
	(-1,27)	(-0,67)	(-0,98)	(-0,94)	(-1,19)	(-1,62)
Has no higher education	-4,87**	-6,71***	-4,43**	-7,76***	-10,1***	-7,59***
	(-2,35)	(-2,93)	(-2,06)	(-2,79)	(-3,33)	(-2,70)
Not working	0,0041	-0,202	-0,481	7,044*	7,136*	6,241*
	(0,00)	(-0,07)	(-0,17)	(1,93)	(1,79)	(1,73)
Age under 35	-6,01*	-5,59	-3,70	-13,8***	-13,1***	-11,2***
	(-1,87)	(-1,64)	(-1,17)	(-3,21)	(-2,90)	(-2,72)
Age above 50	5,227**	5,133**	0,932	9,75***	12,88***	7,167**
	(2,28)	(2,05)	(0,39)	(3,17)	(3,88)	(2,31)
Willingness to take risks		-21,00***	-16,70***		-29,5***	-22,7***
		(-4,50)	(-3,86)		(-4,76)	(-4,02)
Self-determination		-5,322	-3,367		5,773	6,899
		(-1,10)	(-0,75)		(0,90)	(1,17)
Patience		3,284	-0,120		11,51*	7,320
		(0,66)	(-0,03)		(1,74)	(1,20)
Considers COVID as dangerous			30,84***			42,85***
			(9,28)			(9,88)
TV / radio / newspapers			1,277			3,563
			(0,46)			(0,99)
Online journals / social media			8,262**			0,750
			(2,22)			(0,15)
Does not fully trust governm't			-3,459			-7,89***
			(-1,51)			(-2,64)
Does not fully trust scientists			-3,406			-2,610
			(-1,21)			(-0,71)
Constant	85,02***	97,86***	71,14***	60,94***	68,61***	41,39***
	(32,72)	(18,88)	(10,82)	(17,46)	(9,97)	(4,82)
R²	0,0335	0,0669	0,224	0,0746	0,122	0,286

Table A2.4: Regression results (2): Masks

	Considers wearing masks as a civic duty			Always wears masks in public places		
	(1)	(2)	(3)	(4)	(5)	(6)
Woman	12,1***	9,77***	6,239***	12,71***	9,476***	5,835*
	(4,84)	(3,65)	(2,78)	(4,24)	(2,91)	(1,90)
Not Luxembourgish	6,88***	6,483**	8,077***	9,723***	8,208**	9,616***
	(2,80)	(2,45)	(3,65)	(3,30)	(2,56)	(3,17)
Single	0,315	0,909	1,309	-0,331	-2,481	-2,454
	(0,12)	(0,32)	(0,56)	(-0,11)	(-0,73)	(-0,77)
Has no higher education	-8,00***	-7,27***	-2,58	-5,89**	-6,31**	-2,59
	(-3,32)	(-2,77)	(-1,17)	(-2,04)	(-1,98)	(-0,86)
Not working	1,015	1,663	0,446	6,695*	6,523	6,118
	(0,32)	(0,48)	(0,16)	(1,77)	(1,57)	(1,58)
Age under 35	-1,06	-3,42	-1,37	-1,77	-1,79	0,71
	(-0,28)	(-0,88)	(-0,42)	(-0,40)	(-0,38)	(0,16)
Age above 50	7,57***	6,670**	0,782	5,537*	6,516*	1,422
	(2,83)	(2,32)	(0,32)	(1,74)	(1,88)	(0,43)
Willingness to take risks		-10,81**	-4,840		-13,98**	-8,847
		(-2,02)	(-1,09)		(-2,16)	(-1,46)
Self-determination		1,924	3,623		5,194	6,424
		(0,35)	(0,78)		(0,78)	(1,02)
Patience		17,53***	6,925		15,81**	8,164
		(3,06)	(1,43)		(2,27)	(1,24)
Considers COVID as dangerous			36,57***			32,34***
			(10,69)			(6,93)
TV / radio / newspapers			8,183***			7,204*
			(2,90)			(1,86)
Online journals / social media			4,103			9,118*
			(1,07)			(1,72)
Does not fully trust governm't			-14,24***			-10,75***
			(-6,06)			(-3,34)
Does not fully trust scientists			-13,32***			-6,884*
			(-4,60)			(-1,74)
Constant	67,1***	62,08***	40,23***	49,06***	46,01***	18,71**
	(22,14)	(10,45)	(5,96)	(13,55)	(6,40)	(2,02)
R²	0,0655	0,0825	0,378	0,0531	0,0628	0,198

Table A2.5: Regression results (3)

	Never forgets safety measures throughout the day			Is as careful as in the beginning of the pandemic		
	(1)	(2)	(3)	(4)	(5)	(6)
Woman	8,03***	8,66***	7,44**	8,74***	7,97**	5,73*
	(2,67)	(2,66)	(2,26)	(3,00)	(2,52)	(1,85)
Not Luxembourgish	8,27***	9,46***	9,29***	0,668	1,705	1,770
	(2,80)	(2,95)	(2,86)	(0,23)	(0,55)	(0,58)
Single	-3,308	-2,663	-2,770	1,583	-0,147	-0,776
	(-1,06)	(-0,78)	(-0,81)	(0,52)	(-0,04)	(-0,24)
Has no higher education	-5,05*	-4,11	-3,72	-1,10	-2,51	-1,32
	(-1,75)	(-1,29)	(-1,14)	(-0,40)	(-0,81)	(-0,43)
Not working	6,434*	4,767	4,130	7,652**	8,947**	8,332**
	(1,69)	(1,14)	(0,99)	(2,08)	(2,21)	(2,13)
Age under 35	0,026	-0,897	-0,206	-6,660	-7,48	-6,12
	(0,01)	(-0,19)	(-0,04)	(-1,54)	(-1,63)	(-1,37)
Age above 50	3,600	4,747	2,999	8,585***	8,038**	4,164
	(1,12)	(1,36)	(0,84)	(2,77)	(2,38)	(1,23)
Willingness to take risks		1,087	2,738		-13,81**	-10,50*
		(0,17)	(0,42)		(-2,20)	(-1,71)
Self-determination		-11,51*	-11,35*		4,668	5,399
		(-1,70)	(-1,67)		(0,71)	(0,84)
Patience		3,515	0,958		2,092	-1,509
		(0,51)	(0,14)		(0,31)	(-0,23)
Considers COVID as dangerous			12,25**			23,99***
			(2,44)			(5,07)
TV / radio / newspapers			4,072			7,415*
			(0,98)			(1,91)
Online journals / social media			0,590			0,263
			(0,11)			(0,05)
Does not fully trust governm't			-3,054			-5,739*
			(-0,88)			(-1,77)
Does not fully trust scientists			-1,810			-2,723
			(-0,42)			(-0,68)
Constant	43,6***	43,66***	35,27***	55,44***	60,19***	43,00***
	(11,98)	(6,05)	(3,56)	(15,76)	(8,61)	(4,62)
R²	0,0311	0,0388	0,0563	0,0502	0,0607	0,128

Table A2.6: Regression results (4): Testing

	Participates in large scale testing campaign			Gets tested in case of contact or feeling sick		
	(1)	(2)	(3)	(4)	(5)	(6)
Woman	5,248*	4,741	2,122	8,145***	6,561**	3,543
	(1,85)	(1,57)	(0,72)	(2,68)	(2,03)	(1,12)
Not Luxembourgish	-11,4***	-11,6***	-11,0***	-9,19***	-9,70***	-9,96***
	(-4,10)	(-3,92)	(-3,76)	(-3,08)	(-3,04)	(-3,19)
Single	2,293	2,097	1,296	3,040	4,948	4,538
	(0,78)	(0,67)	(0,42)	(0,96)	(1,46)	(1,39)
Has no higher education	-8,40***	-6,96**	-4,84*	-10,7***	-7,93**	-6,43**
	(-3,08)	(-2,36)	(-1,66)	(-3,66)	(-2,51)	(-2,06)
Not working	-3,059	-4,730	-4,470	-4,415	-6,037	-7,165*
	(-0,85)	(-1,23)	(-1,19)	(-1,15)	(-1,46)	(-1,79)
Age under 35	3,603	2,353	3,531	0,743	3,180	4,041
	(0,85)	(0,54)	(0,82)	(0,16)	(0,67)	(0,88)
Age above 50	0,13	0,74	-2,76	-5,801*	-3,89	-7,81**
	(0,04)	(0,23)	(-0,86)	(-1,79)	(-1,13)	(-2,27)
Willingness to take risks		-16,4***	-12,6**		-24,1***	-18,6***
		(-2,72)	(-2,14)		(-3,73)	(-2,96)
Self-determination		-1,302	1,529		-0,271	1,390
		(-0,21)	(0,25)		(-0,04)	(0,21)
Patience		12,34*	7,956		20,48***	17,23**
		(1,92)	(1,25)		(2,96)	(2,54)
Considers COVID as dangerous			20,04***			28,62***
			(4,45)			(5,95)
TV / radio / newspapers			7,473**			4,541
			(2,00)			(1,14)
Online journals / social media			0,239			-6,580
			(0,05)			(-1,22)
Does not fully trust governm't			-4,730			-5,506*
			(-1,52)			(-1,66)
Does not fully trust scientists			-6,017			-3,239
			(-1,57)			(-0,79)
Constant	90,1***	91,51***	76,53***	69,58***	68,14***	55,27***
	(26,30)	(13,76)	(8,58)	(18,92)	(9,54)	(5,81)
R²	0,0427	0,0573	0,117	0,0520	0,0811	0,154

Table A2.7: Regression results (5)

	Supports the government's actions against COVID-19			Intends to get vaccinated		
	(1)	(2)	(3)	(4)	(5)	(6)
Woman	11,5***	8,491***	3,84	0,392	-1,534	-4,688**
	(4,36)	(2,97)	(1,58)	(0,15)	(-0,56)	(-1,99)
Not Luxembourgish	6,62**	4,713*	5,720**	-6,70***	-7,40***	-5,680**
	(2,54)	(1,67)	(2,39)	(-2,64)	(-2,72)	(-2,44)
Single	1,308	1,105	1,087	1,355	0,157	0,736
	(0,48)	(0,37)	(0,43)	(0,51)	(0,05)	(0,30)
Has no higher education	-9,7***	-9,45***	-5,49**	-12,7***	-12,0***	-7,84***
	(-3,82)	(-3,38)	(-2,29)	(-5,11)	(-4,46)	(-3,37)
Not working	4,829	3,093	2,160	-3,760	-4,126	-5,655*
	(1,44)	(0,84)	(0,70)	(-1,15)	(-1,17)	(-1,90)
Age under 35	-4,12	-4,57	-2,23	-4,71	-6,41	-4,43
	(-1,05)	(-1,10)	(-0,64)	(-1,22)	(-1,60)	(-1,30)
Age above 50	7,04**	7,428**	0,168	8,070***	7,223**	0,736
	(2,50)	(2,43)	(0,06)	(2,93)	(2,45)	(0,29)
Willingness to take risks		-19,15***	-11,77**		-7,098	-1,324
		(-3,35)	(-2,45)		(-1,29)	(-0,28)
Self-determination		0,716	1,835		-1,799	-0,739
		(0,12)	(0,37)		(-0,32)	(-0,15)
Patience		17,24***	8,635*		13,69**	4,056
		(2,82)	(1,66)		(2,33)	(0,80)
Considers COVID as dangerous			45,17***			37,82***
			(12,23)			(10,53)
TV / radio / newspapers			9,603***			10,06***
			(3,14)			(3,38)
Online journals / social media			-1,161			0,733
			(-0,28)			(0,18)
Does not fully trust governm't			-12,83***			-9,26***
			(-5,04)			(-3,75)
Does not fully trust scientists			-7,715**			-15,58***
			(-2,46)			(-5,10)
Constant	59,7***	61,0***	34,5***	82,23***	80,33***	58,11***
	(18,62)	(9,61)	(4,72)	(26,31)	(13,21)	(8,18)
R²	0,0691	0,0858	0,367	0,0574	0,0664	0,341

Chapter 3: The effects of COVID-19 on gender differences in individual and household behavior[12]

Using unique data from Luxembourg's COVID-19 Socio-Economic Survey (SEI), we here document, for men and women separately, how the pandemic affected several dimensions of individuals' lives beyond their health. Based on the findings from the literature described above, we here focus on gender differences along three domains: the labor market and time use, economic insecurity, and social interactions.

As for labor market outcomes, we first investigate whether (consistent with evidence from other European countries) women lost their job more often than men during the pandemic. We additionally consider the gendered nature of occupations, distinguishing those that are more male intensive (such as agriculture and industry) from the ones that are female-dominated (such as education and health) according to aggregate employment statistics. Based on this sectorial distinction, we then identify those workers that, while holding on to their jobs, were more likely to be in temporary unemployment or in some form of temporary leave (including the COVID-19 family leave). Last, for those who kept working, we ask whether any differences in time use emerged across gender that might have affected the extent of the gender gap in childcare and domestic chores. Our findings suggest that, in Luxembourg, women were more likely than men to lose their job during the pandemic. Women's attachment to the labor market declined also in other respects: those who were still employed during the pandemic were also more likely than men to be on temporary unemployment or other forms of temporary leave, especially when employed in male-dominated sectors. The extraordinary circumstances brought by the pandemic further exacerbated pre-existing gender inequalities in time use. The gender gap in unpaid work among employed men and women during the first wave of the pandemic was qualitatively larger than before the pandemic. While both employed men and women increased their participation to housework and childcare, women did so to a slightly greater extent (30 more minutes per day). Our findings suggest that men missed their chance of stepping up their contribution to unpaid work in a way that could have narrowed the gender gap in housework and childcare.

The second domain this chapter analyzes is linked to perceived feelings of economic insecurity. While we do not precisely observe individuals' personal finances in the survey due to respondents' reluctance, on average, to give out their exact income, we do have a variety of questions on opinions and concerns about their own financial situation and the Luxembourgish economy as a whole. Taken together, these questions can be seen as indicators of economic insecurity, a concept that Bossert and D'Ambrosio (2013, p. 1018) summarize as "the anxiety produced by the possible exposure to adverse economic events and by the anticipation of the difficulty to recover from them". Measures of economic insecurity, while reflecting quite closely individuals' objective financial situation, are additionally informative on the intensity of financial distress and its reverberations onto wellbeing and mental health. So, different from objective indicators of economic resources such as income or employment status, subjective measures of economic insecurity are fit to capture the psychological dimension linked to financial distress. While investigating the evolution of these dimensions during the pandemic, we focus on the protective role of being in a relationship: according to economic theory, if one partner is in financial distress, the other can adjust their labor force participation and/or working time to compensate for the income loss. We find that single men and women worry the same or more about their finances and the economy in 2021 (as compared to April 2020). For those in a couple, we

---

find evidence of an insurance effect: partnered men and women worry the same or less about their finances and the economy in 2021 (as compared to April 2020).

Last, we look at how the social lives of respondents changed during the pandemic, by studying the quality and quantity of their social interactions both with family members (their children and partners, if any) and friends, extended family and neighbors. In the spring of 2021, women in Luxembourg had a significantly lower amount of social interactions than men, the gender difference being larger among the single. This was confirmed by time-use data looking at how much time spent in leisurely activities was also spent with friends, with women reporting a more long-lasting decrease as compared to men. The increased social isolation for women – a group already displaying a higher risk of loneliness in normal times – could additionally lead to deleterious consequences on their mental health and wellbeing. In the family domain, quality time with children increased during the first lockdown in 2020, suggesting that the learning and social losses due to school closures could have at least in part been compensated by increased parental inputs.

1. Introduction

The COVID-19 pandemic represents an on-going challenge to health systems and economies all over the world. Governments of countries most heavily hit by the pandemic have had to come up with carefully balanced sets of measures and restrictions, with the objective of limiting the diffusion of the virus, while ensuring at least a certain degree of continuity of their countries' economic activity. In Luxembourg, the total number of COVID-19 cases since the beginning of the pandemic reached 103,766 at the end of 2021 – a considerable number when compared to the country's population size. While the evolution over time of the number of cases appears to confirm the effectiveness of social-distancing measures and lockdowns, individuals' lives and economic wellbeing were heavily influenced by both pandemic policies and the pandemic itself.

1.1 The effects of COVID-19 on labor market and time-use in developed countries

Pre-existing gender inequalities along a variety of socio-economic dimensions beg the question of whether the adverse consequences of the pandemic were disproportionately borne by women. Prior to the pandemic, women in developed economies were more often than men in low-paying and insecure jobs. Traditionally, women are also more likely to shoulder the burden of childcare and elder care, which is particularly relevant during a period of school closure and shielding of the elderly (Alon *et al.*, 2020). Recent evidence shows that women suffered the economic consequences of the COVID-19 pandemic more than men, in terms of employment, working hours, earnings and income. For example, Adams-Prassl *et al.* (2020) use German data to show that women were more likely to lose their job and have lower earnings during the first wave of the pandemic as compared to men. Belot *et al.* (2021) find similar gendered results on household income and the probability of losing one's job, using an online survey on individuals in East-Asia, the UK and the US. With longitudinal data on five European countries spanning from the early onset of the pandemic up to the end of 2021, recent work by Clark *et al.* (2022) shows that women, together with other vulnerable groups such as the poor and younger individuals, were more likely to experience household income losses as a result of more stringent lockdown-style measures. In the US, Cortes and Forsythe (2020) and Montenovo *et al.* (2022) show that COVID-19 had on average a negative impact on employment, that was larger for

women than for men. Similarly, Farré *et al.* (2021) show that in Spain, over the first months of lockdown, women had a higher likelihood of being employed and reporting lower working hours as compared to men. Last, Andrew *et al.* (2020) show that, in the UK, increased childcare demands during lockdown reduced mothers' paid work more strongly than fathers'.

With the pre-existing economic conditions in Luxembourg being similar to the countries analyzed by the emerging COVID-19 literature, the economic and labor market situation of men and women during the pandemic might have changed in the same way in Luxembourg. Nevertheless, Luxembourg's institutional and policy context entails specificities that might have affected gender differences in the labor market outcomes differently from other countries. One example that differentiates Luxembourg from the neighboring countries' policy landscape is the special leave for family reasons ("congé pour raisons familiales extraordinaire") that was instated with the closing of schools and childcare facilities around mid-March 2020. Initially planned to last until May 25th 2020, the policy was extended up to the end of April 2022 due to the extraordinary circumstances of the pandemic. This form of parental leave was targeted to working parents (either employed or self-employed) with at least one child below 13 years old. Only one parent (or spouse) at a time could benefit from the special leave for family reasons. Quite exceptionally with respect to other countries, parents who were working from home in Luxembourg could also take advantage of the leave for family reasons. About 30.000 employees benefited from this policy in March 2020 (a number constituting around 10% of the labor force in Luxembourg). The following policy questions are then of particular importance: were there any gender differences in the use of this special leave for family reasons? Were there any subgroups of eligible mothers and fathers more likely to benefit from the policy compared to other groups (be it socio-economic groups or groups created by different economy sectors)?

During the pandemic, childcare and other domestic chores have increased for many families, with childcare and home-production services being temporarily on a halt. Pre-existing gender inequalities in time use among might have thus deepened due to the increasing burden of unpaid work. Women's larger load of housework and childcare can be traditionally attributed to several mechanisms, including specialization, bargaining and gender norms. The former mechanism describes the situation when household members might find it more efficient to divide tasks and only spend their time in one set of activities. If the time men's spend in the labor market is more remunerative than that of women's (due, for instance, to the gender pay gap in many occupations), then men might be more likely to specialize in market work (with women, conversely, taking up the lion's share of housework and childcare). Bargaining also plays a role in gender differences within the household: with bargaining power being linked, among other things, to economic resources, men specializing into market work are also likely to hold a greater share of bargaining power and thus being able to unilaterally enforce family-life arrangements that favor them. Last, the allocation of care-work across household members can also be influenced by gender-stereotypical norms that are culturally embedded in society, with gender prescriptions such as "men work and women stay at home" oftentimes becoming integral parts of one's identity.

Empirically, there is mixed evidence on whether gender inequalities in housework and childcare increased, decreased or stayed constant during the pandemic. In the US, Zamarro and Prados (2021) show that women carried a heavier childcare load than men during the COVID-19 crisis, regardless of their employment status. Results on gender equality in unpaid work are very sensitive to the data and method used for Germany: Jessen *et al.* (2021) use nationally representative data to show that, during the pandemic, there was an increase in the share of households where the mother is the sole responsible for childcare and housework. Hank and Steinbach (2021), using the German Family Panel, find instead no changes in aggregate patterns of the division of housework and childcare

among German couples. They do additionally find evidence of a polarization of gender roles, with an increase in both traditional families and families with a complete role reversal between genders. In contrast, Kohlrausch and Zucco (2020) suggests that the share of couples in Germany in which fathers provide the majority of the childcare work has increased during the pandemic, mostly due to family arrangements in which mothers were employed in essential sectors and fathers could telework. Last, Naujoks *et al.* (2021) show that short-time work benefits for German men resulted in greater gender equality in childcare, especially among the less educated.

Looking at Italy, the UK and the US, Biroli *et al.* (2021) find that the proportion of shared childcare and household chores significantly increased during the pandemic's first lockdowns. While Farré *et al.* (2021) show an increase in women's housework and childcare load in Spain, they find similar evidence as Biroli *et al.* (2021) that time spent in grocery shopping increased for men – one of the only tasks that allowed going out during lockdowns. Surveying families in the UK with children below 12 years old, Sevilla and Smith (2020) document an average increase in the childcare load for women. They additionally show, however, that the gender gap in childcare declined in families where men were not working as compared to before the pandemic. With data from the UK Household Longitudinal Study, Zamberlan *et al.* (2021) find that, while both men and women who lost paid hours during the pandemic contributed more to unpaid work, the increase was disproportionately larger for women who were also the family's breadwinners. This, together with evidence on working women increasing their contribution to unpaid work, suggests that the COVID-19 crisis might have resulted for women into an increase of the intensity of "second shift" (Hochschild, 1989), that is the labor performed at home in addition to the paid work, with potential long-term consequences on their mental health and wellbeing.

1.2 Gender differences in social isolation

Gender gaps might have been enhanced during the pandemic also as a result of gender differences in compliance to social isolation norms. Women, who were already more likely than men to be at risk of loneliness and social isolation before the pandemic, were more likely to comply with restrictions and anti-COVID norms (see Chapter 2 of this report). Wickens *et al.* (2021) use data from a web-survey in Canada to show that women had a greater likelihood of being lonely than men, the difference being starker among extreme age groups (individuals below 30 years of age and those above 60 years old). With weekly data for more than 38,000 individuals in the UK, Bu *et al.* (2020) show that the first lockdown in the spring of 2020 loneliness increased disproportionately more for women and those with mental health conditions, among other groups. Loneliness due to social-distancing policies is a risk factor for mental ill-health, as shown by Palgi *et al.* (2020), with women suffering more than men from depressive symptoms and anxiety. These findings highlight that loneliness in times of crisis can bear a significant psychiatric toll.

2. Data

We here use data from the Socio-Economic Impacts (SEI) of COVID-19 online survey, run by the Luxembourg Institute of Socio-Economic Research (LISER) and the University of Luxembourg. The subject pool consisted of Luxembourgish residents and cross-border workers, who were interviewed at two points in time during the pandemic. The first survey wave was conducted between the end of May and early July 2020, while the second wave was conducted around in the spring of 2021 (between March and May). In the latter wave participants were either wave-1 participants who agreed to be contacted again for a follow-up or new participants. In each wave, the survey covered the following four randomly-assigned modules: living and working conditions, daily activities and mobility, health

and health behaviors, and time use and interactions in the household. Most questions were similar across the two survey wave, allowing for a longitudinal appraisal of the evolution of several of the dimensions covered in the survey.

In this Chapter, we focus on questions from the module on living and working conditions and the module on time use and interactions in the household. Surveyed individuals were asked questions about these dimensions both referred to the current time period (June 2020 for wave-1 participants and the spring of 2021 for wave-2 participants) and about some past periods that participants were asked to recollect. In particular, two periods of interest on which respondents provided retrospective information were February 2020 (before the onset of the pandemic) and April 2020 (corresponding to the period of the first lockdown in Luxembourg).

The survey was conducted as an opt-in online survey and a nation-wide recruitment campaign was advertised on online newspapers, social media and the internet. Given the non-probabilistic sampling strategy (it was ultimately up to individuals to decide whether or not to take part to the survey), respondents' characteristics at baseline do not perfectly mirror those of the population of Luxembourg: women were more likely to respond than men (75% women), younger and older age groups were less likely to be in the survey. See Appendix Table A3.1 for a description of the sample's characteristics as compared to the population's. In order to make results generalizable to the Luxembourgish population, calibration weights balancing the sample's characteristics in terms of gender, age, and education are used for all the analyzes conducted in this Chapter. The final sample, after excluding records with implausible or missing answers and cross-border workers, consists of 2451 respondents to wave 1 and 1819 non-overlapping respondents in wave 2.

3. Results

3.1 The labor market

3.1.1 Gender differences in employment and unemployment

We here investigate what were the labor market consequences of the pandemic and whether they differed by gender. We do so first by looking at the number of people who were either employed or self-employed at three different moments between years 2020 and 2021. As respondents of the SEI survey were asked about their employment status at the time of the interview, we only have information on labor force participation during the pandemic (in June 2020 for Wave 1 respondents and in the spring of 2021 for Wave 2 respondents). In order to assess how the employment status changed during the COVID-19 crisis as compared to normal times, we rely on the question "did you have a job in February 2020?" to retrieve whether respondents were in the labor force before the pandemic.

Figure 3.1 illustrates the average share of those who were employed or self-employed over time, for men and women separately, with 90% confidence intervals reported on top of each mean. While the employment probability for men slightly decreased over time, there were no statistically meaningful changes for this group. The number of women in the labor force, however, was significantly lower in April 2020 as compared to before the pandemic (a reduction of 7 percentage points), with a partial recovery over 2021 (+ 4 percentage points).

*Figure 3.1: Changes in employment status during the pandemic*
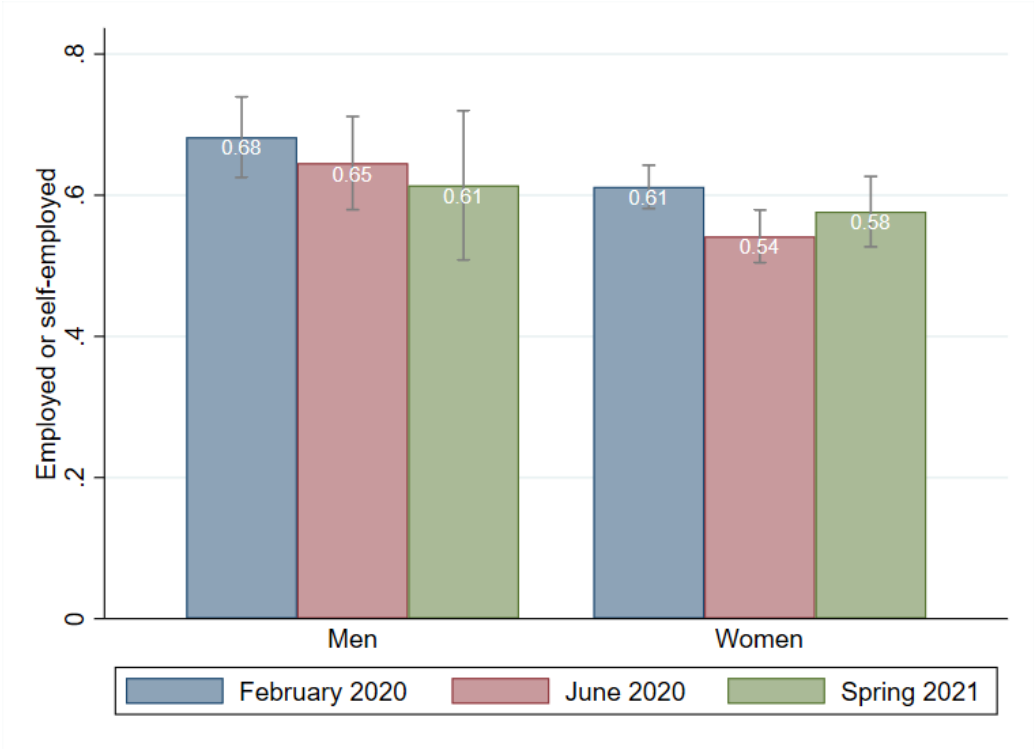
Notes: bars represent averages. Spikes are for 90% confidence intervals of the reported means.

Figure 3.1, while documenting that women lost their job more often than men at the beginning of the pandemic, is far from a complete picture of the labor market changes observed in Luxembourg since the COVID-19 crisis. A series of measures, such as temporary unemployment and the COVID-19 family leave, were adopted by the government over the past two years, aimed at counterbalancing the adverse economic effects of the COVID-19 crisis. Thanks to these measures, individuals who might have otherwise exited the labor force could hold on to their job. However, while continuing to receive a stable (although, in most cases, lower) labor income stream, working hours went to zero for many of these individuals, with likely consequences on their livelihoods, time use and wellbeing.

Many of those employed have benefitted of larger means to relocate their working tasks during the day, mostly due to the accelerated introduction of the smart working regulation. More flexibility in relocation of working hours may have mitigated the risk of voluntary unemployment or the demand for short-term leaves. Whether such modifications have had a long-lived effect on the working schedule organization is an important dimension of analysis, with impacts potentially differing across males and females. We investigate the gender dimension of the intensive and extensive margins of labor supply in Luxembourg.

Figure 3.2: Working conditions and gender
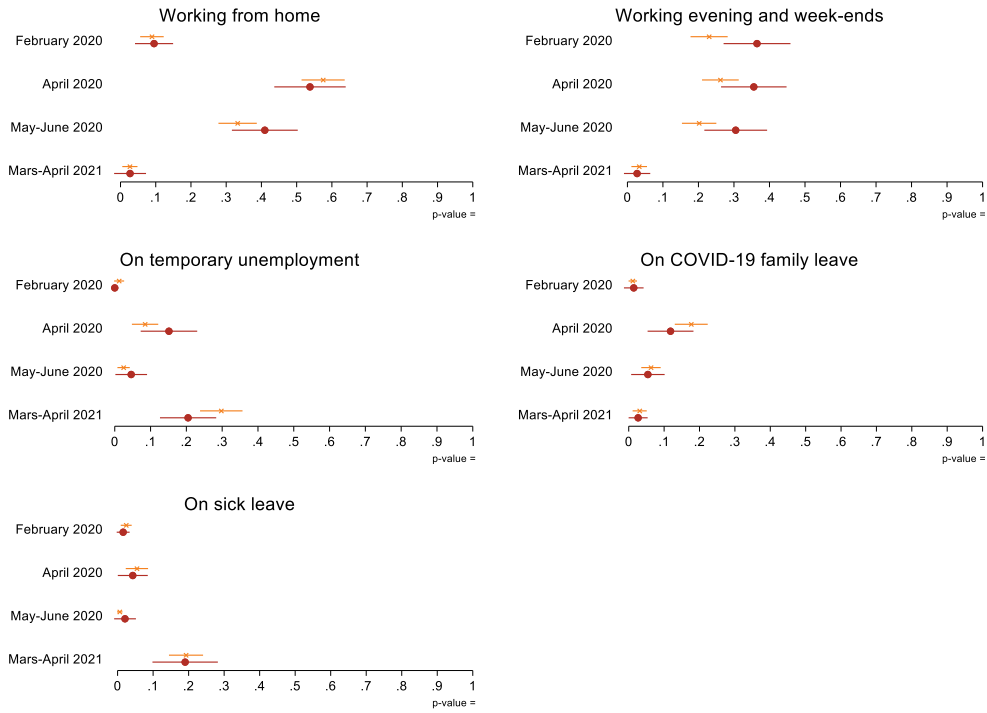
Notes: Share of women (orange line) and men (red line) answering "yes" to each of the questions Q249 "Have you been working from home" (panel 1); "Have you been working evenings and week-ends" (panel 2); "Have you been on temporary unemployment" (panel 3); "Have you been on COVID-19 family leave" (panel 4); "Have you been on sick leave" (panel 5). Each panel accounts for different periods: periods Feb. 2020 to May-June 2020 are from Wave 1 data, period March-April 2021 are from Wave 2 data. Dots correspond to point estimates in the data. Horizontal lines correspond to the confidence interval of the estimate, a measure of statistical reliability of the statistic reported (for instance, if the confidence interval of an estimate is large enough to include the 0 on the horizontal scale, then the statistics cannot be claimed to be different from zero at a 5% confidence level).

Figure 3.2 portraits the evolution of intensive and extensive margins of labor supply by gender across the duration of the pandemics. The first dimension pertains the possibility of working from home. Teleworking is feasible only in some occupations and sectors. While teleworking has been largely employed as a mean to maintain employment and productivity capacity during the lockdown period, the relaxation of such measures has led most of the economy to reduce teleworking.

Right before the lockdown measures were undertaken, less than 10% of sampled workers were engaged in a form of teleworking. Teleworking rose quickly to the standard during the peak of the pandemic, with about 50% of sampled workers teleworking as of April 2020. Teleworking has been slowly abandoned over 2020 and the proportion of workers engaged in such activities boiled down to 10% of the total as of April 2021. Within this dimension, we never observe significant differences between male and females, indicating that the distress caused by the pandemics in terms of organization did not affect individuals of different genders in different ways, on average.

The second dimension concerns the intensive margins of labor supply. The second panel of Figure 3.2 captures whether respondents were working longer hours or working during weekends. In Wave 1, on average, 30% of workers report to have worked additional hours before and during the onset of the pandemic, as of June 2020. Male workers tend to work significantly longer hours than female workers.

The incidence of extra work has dropped significantly over 2020, as well as the gender divide. Such change has most likely reflected the need to relocate housing and childcare tasks within the family, yielding a more balanced picture in 2021 than what it was before the pandemic. As a consequence of the reduction of gender differences in extra time worked, the earnings gaps may have also reduced, all else equal.

The pandemic has affected extensive margins of labor supply as well. During the lockdown period, about 15% of the respondents declares to be temporarily unemployed, the figure drifting down to the same level as of February 2020 after lockdown measures were raised. Most likely, unemployment spells reflected the consequences of lockdown measures on some activities. Such measures affected male workers with larger intensity. Over 2021, the situation has evolved. In April 2021, the share of those experiencing short unemployment spells has increased substantially in the sample, more rapidly among females. Estimates as of April 2021 differ from the pre-pandemic situation, reflecting the medium term consequences of the changes of the labor market observed over the last year.

Families have other means to contrast the constraints raised by the pandemics in terms of time use. For instance, by increasing demand of parental leaves. This option was made available by the Luxembourgish government as a measure to improve the work-childcare balance during the pandemic. The COVID-19 related parental leaves provide only a temporary instrument for income replacement. Our surveys show that demand for these leaves has increased when mobility restrictions were put in place, whereas adoption of it has felt afterwards. Women took advantage of this measure with larger intensity than males.

Data confirm that sick leaves have also increased slightly during the first wave of the pandemics, with equal incidence among males and females. The demand for sick leaves has peaked in April 2021, again signaling no differences between males and females.

3.1.2 Robustness of gender differences in working condition

The pattern of gender differences portrayed by our data may be driven by confounding factors. We address first gender differences in terms of intensive margins of labor supply for employed respondents. To so do, we employ regression analysis to recover the predictive means of the dependent variable for males and females. Such means are conditional on the characteristics of the family of the respondents (married status, childness) and on her human capital characteristics such as the sector in which the person is employed, the age and the level of education. We run separate regressions for different time periods, reflecting the timing of our survey.
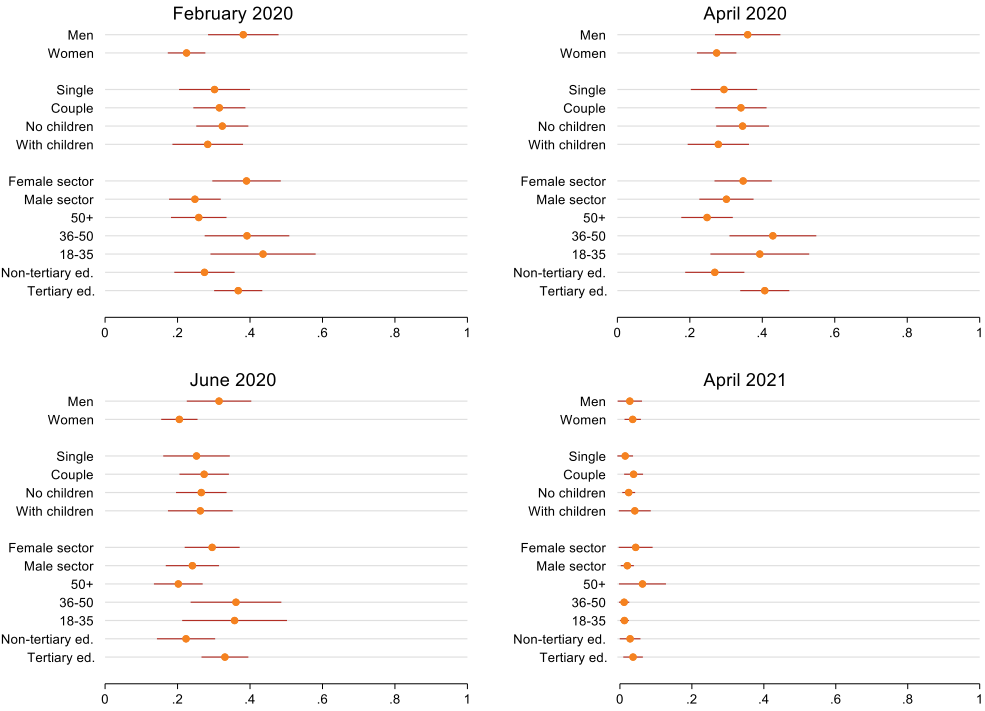
Figure 3.3: Gender gaps in "working from home": predictive means
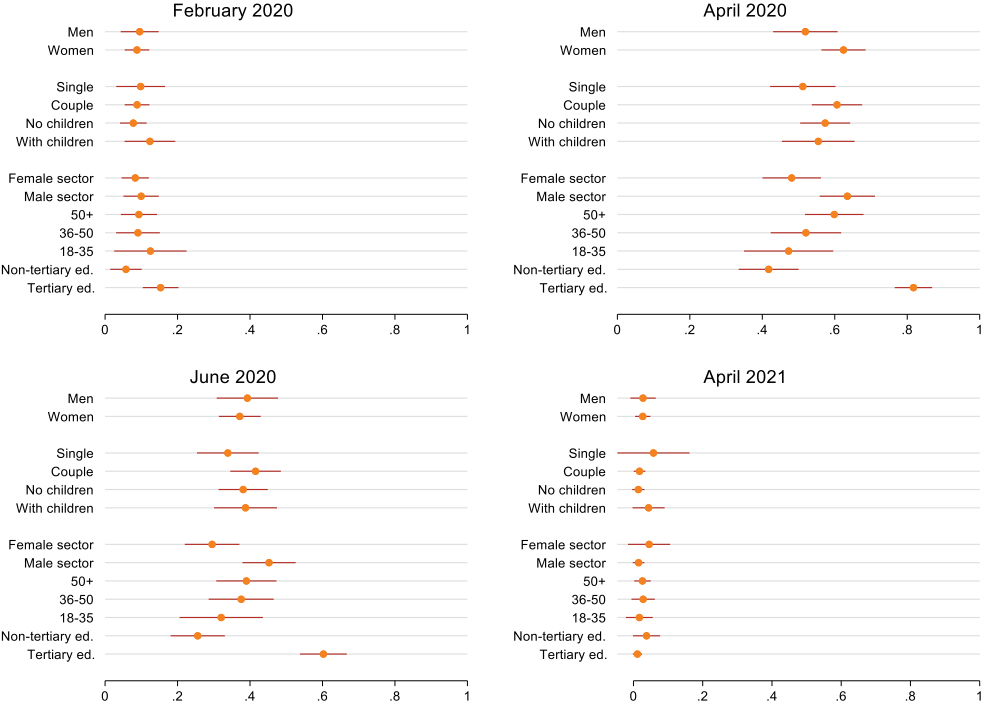
Notes: Share of women (orange line) and men (red line) answering "yes" to each of the questions Q249 "Have you been working from home" Each panel accounts for different periods: periods Feb. 2020 to May-June 2020 are from Wave 1 data, period March-April 2021 are from Wave 2 data. Dots correspond to point estimates in the data. Horizontal lines correspond to the confidence interval of the estimate, a measure of statistical reliability of the statistic reported (for instance, if the confidence interval of an estimate is large enough to include the 0 on the horizontal scale, then the statistics cannot be claimed to be different from zero at a 5% confidence level).

We first investigate gender differences in the possibility of "working from home". Predictive means are reported in Figure 3.3. The dots plotted in the figure correspond to the predicted probability that a given respondent works from home when all characteristics except one are set to their average. The graph confirms a sharp rise in teleworking in Spring 2020 compared to February 2020. The change is more substantial for workers with high education and for those employed in male-dominated sectors compared to female-dominated ones. While teleworking increases significantly in Spring 2020, the intensity of teleworking reduces to the pre-COVID-19 crisis in Spring 2021, highlighting the temporary nature of the new working arrangement. As the figure shows, we never detect differences in teleworking arrangements across genders.

Figure 3.4: Gender gaps in "working evenings and week-ends": predictive means

Note: Share of women (orange line) and men (red line) answering "yes" to each of the questions Q249 "Have you been working evenings and week-ends" Each panel accounts for different periods: periods Feb. 2020 to May-June 2020 are from Wave 1 data, period March-April 2021 are from Wave 2 data. Dots correspond to point estimates in the data. Horizontal lines correspond to the confidence interval of the estimate, a measure of statistical reliability of the statistic reported (for instance, if the confidence interval of an estimate is large enough to include the 0 on the horizontal scale, then the statistics cannot be claimed to be different from zero at a 5% confidence level).

Figure 3.4 shows evidence of changes in the relocation of working hours towards the week-end. Conditional on family and human capital characteristics, the load of the shift falls more heavily on women than males: while males display a significantly higher probability of working on week-ends compared to women on February 2020, the gender differences tend to disappear during Spring 2020. We observe a reduction in the probability of working during the week end in Spring 2021 and no evidence of gender differences in this dimensions.

Figure 3.4 does not highlight gender differences in short term unemployment and leaves requests. We do not report these figure, but discuss two key robust findings. First, we do not find evidence of gender differences after controlling for family and human capital characteristics for all measures of unemployment/short term leaves. Second, we find evidence, holding across all estimating models, about significant differences in the occurrence of unemployment or in the demand of temporary leaves across groups of respondents in male-dominated and in female-dominated sectors. It thus possible that gender differences emerge within each type of sectors, as we investigate in the rest of the section.

3.1.3 Gender differences and unemployment

Occupational sorting not being independent of gender, some economic sectors have a larger share of female or male workers than others. In these gendered occupational contexts, workers belonging to the minority gender might face discrimination and/or be more easily deemed as redundant. Consequently, with many male-dominated sectors such as manufacturing and construction being more likely to close during the pandemic, the adverse economic effects of the pandemic might have disproportionately weighted on women employed in male-dominated sectors. So who are those who, while keeping their job, were more likely not to work during the pandemic, due to some form of temporary leave scheme? Does their gender composition change according to the sector of activity?

For subsamples based on these two features (gender and sector of activity), Figure 3.5 displays the predictive means coming from logistic regressions of the probability of being in temporary unemployment on period indicators and individual characteristics (namely). Each dot in the plots is to be interpreted as the average temporary unemployment probability for those with a given characteristic (e.g. for those with children), keeping everything else constant. Looking at time indicators in the top two panels of Figure 3.5 (namely, men and women in male-dominated sectors), women always display a larger probability to be in temporary unemployment as compared to men. Although both groups experience an increase in temporary unemployment in April 2020 as compared to February, the increase is larger for women. Additionally, while men's likelihood of being in temporary unemployment goes back to the pre-pandemic levels as soon as in June 2020, women in male dominated sectors systematically maintain higher temporary unemployment rates up to 2021.

The age risk-profile also differs by gender in male-dominated sectors: men are more at risk on average when they are older; women's likelihood to be in temporary unemployment follows instead a u-shaped pattern in age, with those between 30 and 44 years of age being the least at risk. Differences by gender are mostly concentrated among the least educated, with men and women with at least some tertiary education degree displaying on average the same predicted probability of being in temporary unemployment.
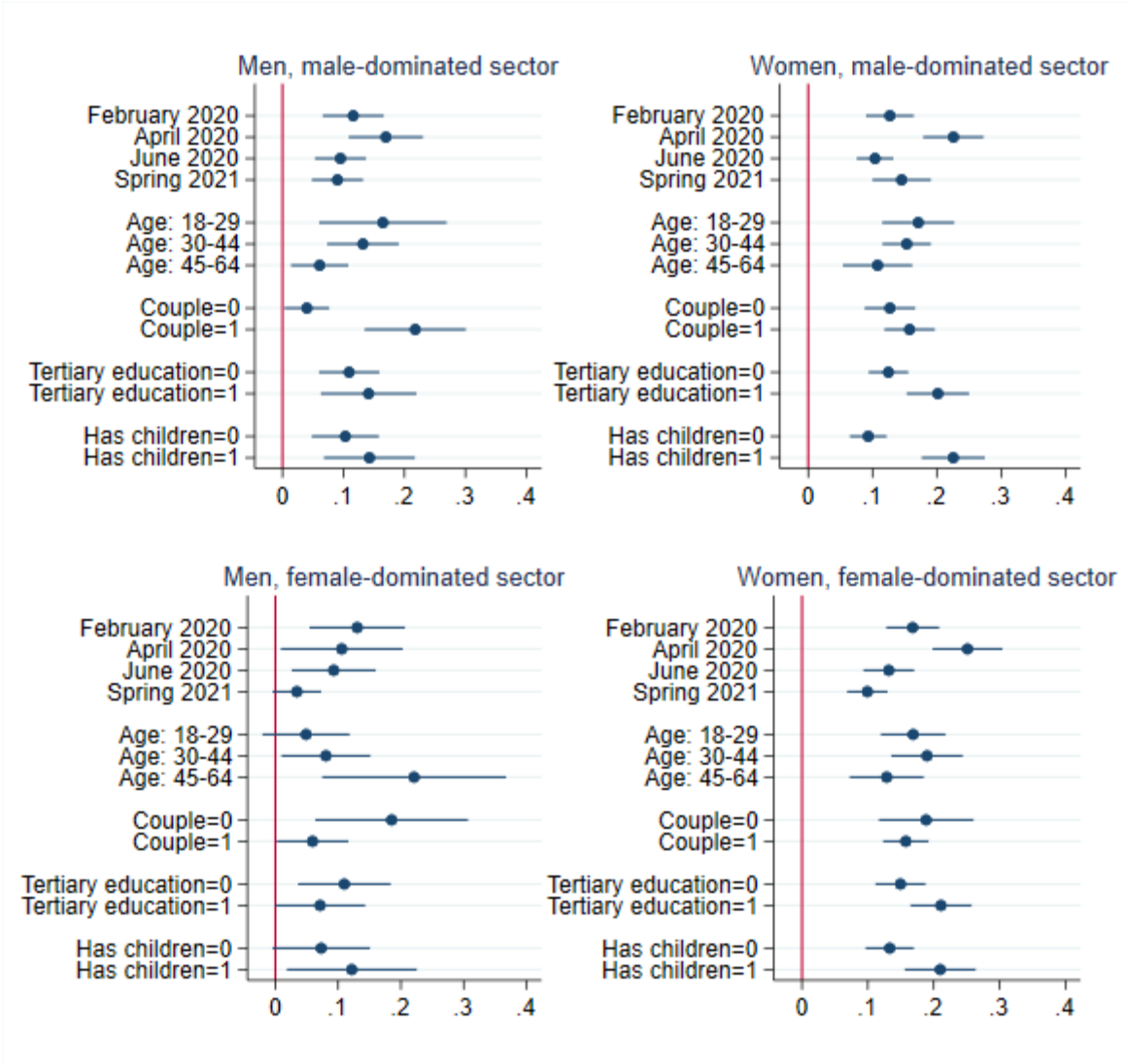
Figure 3.5: Temporary unemployment by gender and sector: predictive means
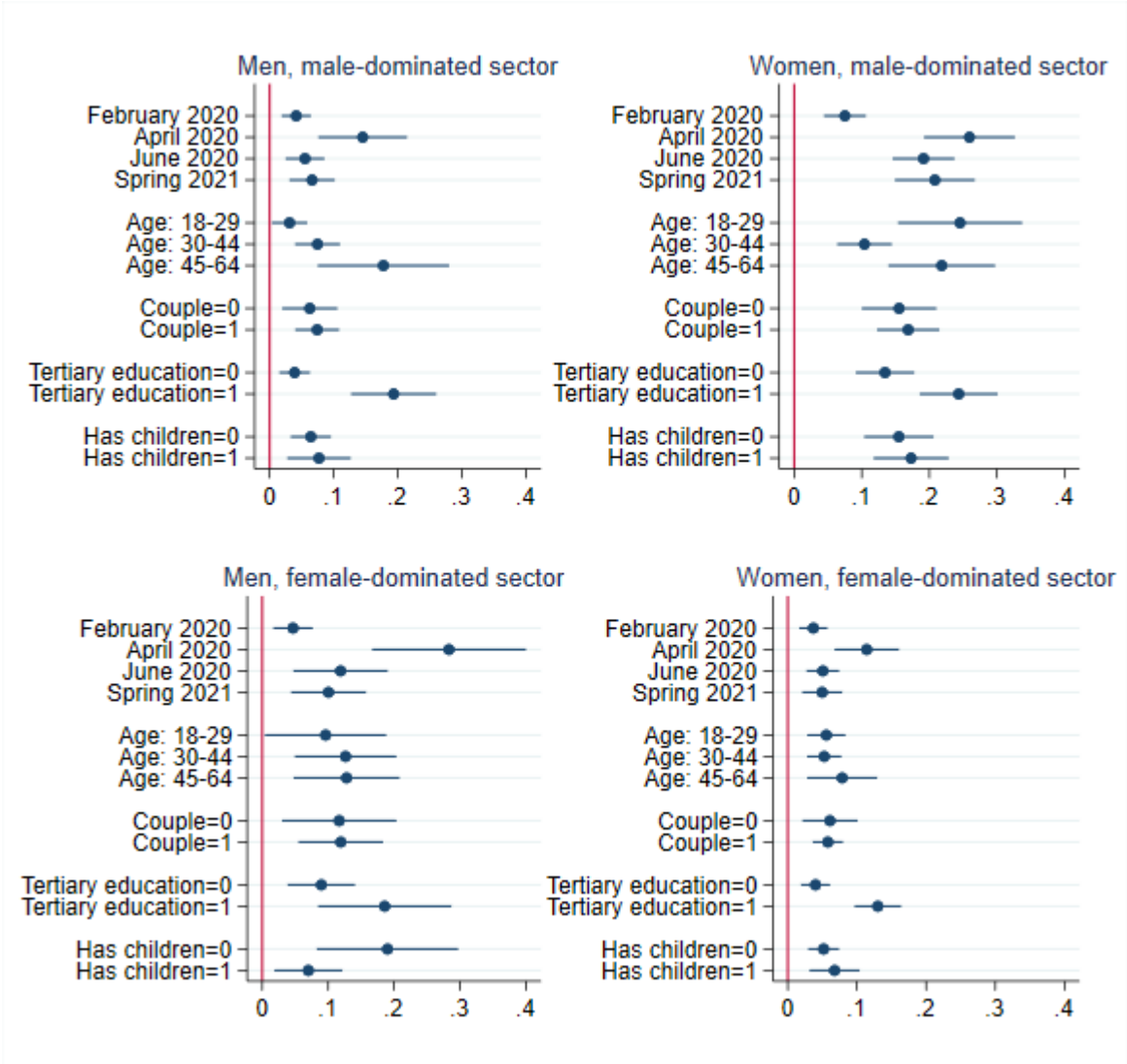
Notes: *dots in the graph are predictive means derived from logistic regressions of the probability of being in temporary unemployment on time dummies, age categories, education level (tertiary education or less) and dummies for being in a cohabiting relationship and for having children. Standard errors were clustered at the individual level and the sample includes only individuals who are employed. Each dot shows the average outcome predicted from the regression when assuming all respondents have the characteristic shown on the line, but keeping their other characteristics unchanged. Differences in average outcome predictions across levels of the same variable quantify differences in responses, net of the effect of the other variables, namely "average partial effects". The horizontal solid lines intersecting the means are for 90% confidence intervals.*

Moving onto female-dominated sectors, men appear to have experienced a higher likelihood of being in temporary unemployment during the pandemic, as compared to women. Together with evidence from male-dominated sectors, this suggests that individuals working in a sector that is dominated by the opposite gender might be more likely to be made redundant, perhaps due to lower bargaining power or to skill mismatch. Gender differences in the risk of being in temporary unemployment in female-dominated sectors however disappear when considering only men and women with children.

Notes: dots in the graph are predictive means derived from logistic regressions of the probability of being either on COVID-19 leave for family reasons or on sick leave on time dummies, age categories, education level (tertiary education or less) and dummies for being in a cohabiting relationship and for having children. Standard errors were clustered at the individual level and the sample includes only individuals who are employed. Each dot shows the average outcome predicted from the regression when assuming all respondents have the characteristic shown on the line, but keeping their other characteristics unchanged. Differences in average outcome predictions across levels of the same variable quantify differences in responses, net of the effect of the other variables, namely "average partial effects". The horizontal solid lines intersecting the means are for 90% confidence intervals.

Using the same structure as Figure 3.5, Figure 3.6 looks at gender differences in the probability of being in either sick leave or COVID-19 leave for family reasons by sector of activity.[13] Regardless of the sector, the figure shows that women in April 2020 used COVID-19 leave for family reasons and sick leave more often than men. Different from temporary unemployment, the increase appears to have been a short-term one, with predicted temporary leaves in June 2020 and the spring of 2021 being for all groups at most as high as before the pandemic. Unsurprisingly, women with children are significantly more likely than those without children to take either COVID-19 leave for family reasons or

---

[13] Given the relatively small number of individuals reporting in each period being in either form of temporary leave, we here decided to aggregate the two together in order to maximise statistical power.

sick leave, regardless of their sector of activity. No significant difference is instead found for men based on whether or not they have children, suggesting that results for men might be mostly driven by sick leaves rather than leaves for family reasons.

3.1.4 Gender differences in organizing time at home and at work

Having looked at those who lost their job and those who, while still having a job, were not working, we now turn to analyzing a different group: those who were still employed during the pandemic and did not take any form of temporary leaves due to COVID-19. There are at least two reasons why gender differences within this group might be important. First, when looking at employed individuals only, there should be less reasons to observe gender differences in paid and unpaid work, as women and men should be equally likely to be spending their time in similar activities (assuming there are no gender differences on contractual working hours). Hence differences that might emerge are more likely to be driven by stereotypical gender norms rather than individual preferences, as such, can be labelled as forms of gender inequality. Second, differences within this group can describe the "second shift" phenomenon in Luxembourg and how it evolved during the pandemic, thus being informative on the potential negative spill-overs onto other life domains that have been shown to be affected (such as mental health and couple stability).

Figure 3.7 plots the average number of hours spent by men and women in paid and unpaid work from February 2020 to the spring of 2021. By 'paid work' we here mean the time spent in remunerated economic activities, working either from home or outside of home; 'unpaid work', on the other hand, refers to the set of non-remunerated care and domestic activities (in our data, this is the sum of the time spent in housework and childcare). The left panel of Figure 3.7 shows that, from February to June 2020, men's working time increased by about 40 minutes per day, somewhat stabilizing to this higher level also during 2021. The figure additionally provides qualitative evidence of a moderate increase in working time for women as well, albeit a non-statistically-significant one. Moving on to the right panel of Figure 3.7,it is clear that the onset of the pandemic is associated with a sharp increase in the time spent in unpaid work. The magnitude of the increase is somewhat larger for women (+1.4 hours per day) than it is for men (+0.9 hours per day), although the difference is not statistically meaningful. This suggests that during the pandemic not only the gender gap in housework and childcare did not decrease, but there is qualitative evidence that it might have increased during the first months of the pandemic. Additionally, the average level of unpaid work reported by women in the spring of 2021 is still significantly larger than it was before the pandemic (+1 hour per day), whereas men's settled back to its pre-pandemic levels.
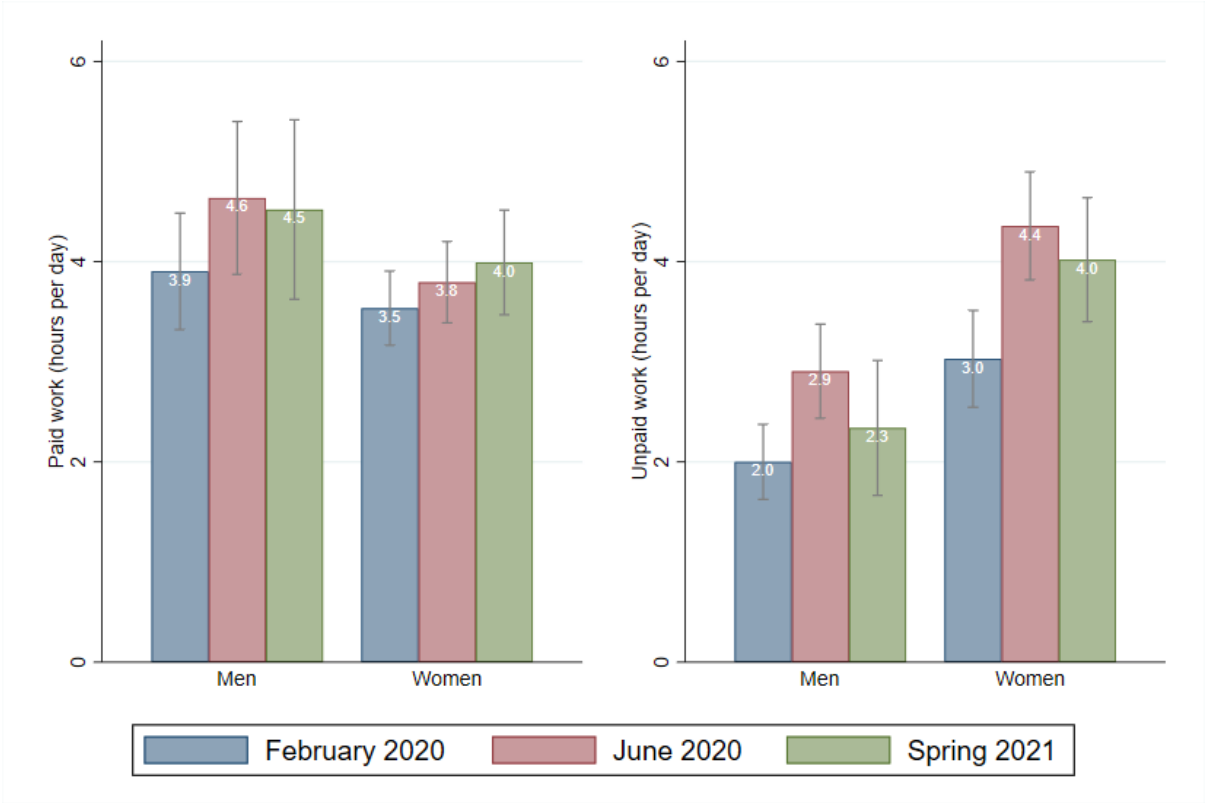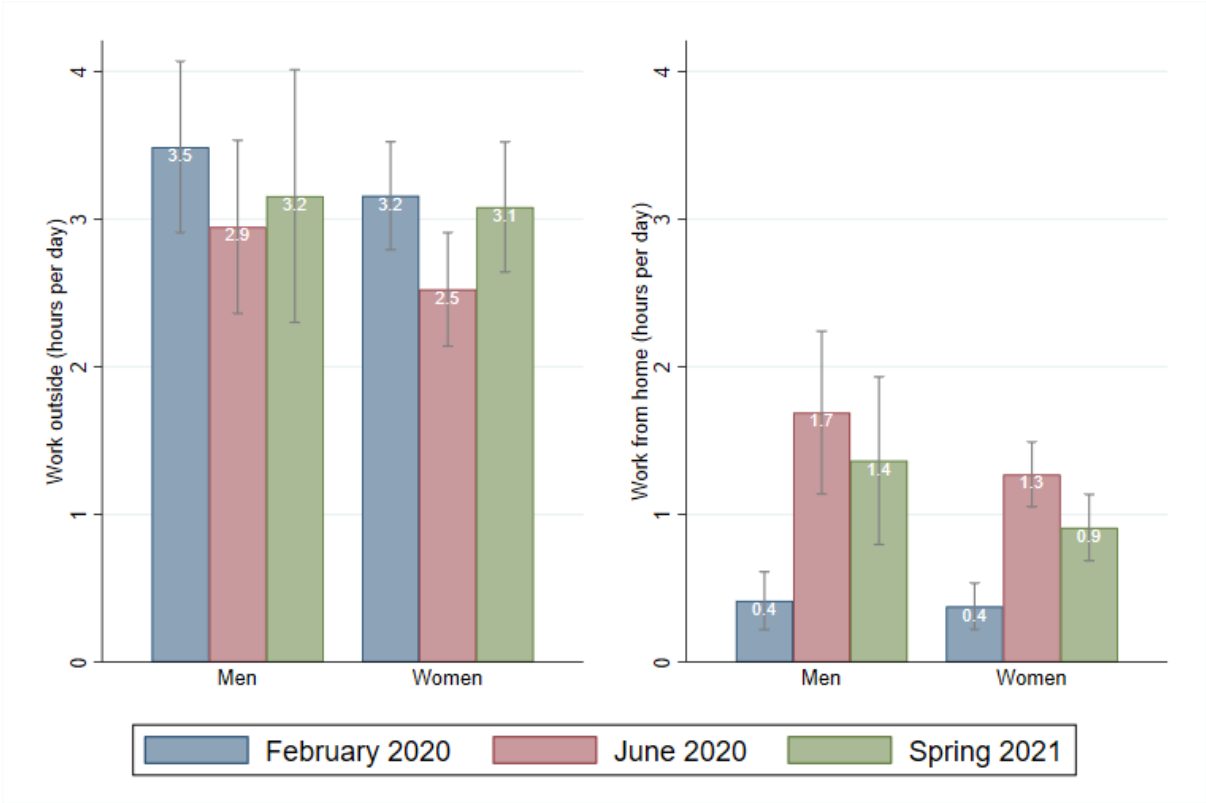
Notes: bars represent averages. Spikes are for 90% confidence intervals of the reported means.

Figures 3.8 and 3.9 further dig into the composition of time use across gender, by disaggregating paid work into teleworking and working outside and unpaid work into housework and childcare. Results from Figure 3.8 show that, unsurprisingly, the number of hours worked outside decreased for all groups in the first months of the pandemic, with a recovery in 2021 that marked a comeback to normal levels. The amount of time spent working from home, on the other hand, increased during the COVID-19 crisis, with an average daily increase of 1.3 hours for men and 0.9 hours for women in June 2020 as compared to before the pandemic. The small decrease in working from home observed in the spring of 2021 as compared to the first COVID-19 wave in 2020 is not large enough to mark a return to normality and explains the average increase in working hours observed in Figure 3.7. The increase in working hours driven by teleworking suggests that the pandemic had a long-lasting impact on the work-family balance, with boundaries between work and personal life becoming less distinct when work is moved to the household.

Figure 3.8: Time spent working outside and working from home (employed individuals only)

Notes: bars represent averages. Spikes are for 90% confidence intervals of the reported means.

Figure 3.9 explores whether the gendered trends in unpaid work for men and women who also have a job are particularly driven by one of its two components, namely housework or childcare. In the survey, the former is defined as follows: "household chores (repairs on or around the house, car repairs, garden / yard work, shopping, appointments with government agencies, cleaning, laundry, cooking, car washing, but not care for children, for example)". The latter is instead defined as: "activities with own children (such as washing, dressing, playing, reading, taking child to see doctor, taking child to school/hobby activities, home teaching, etc.)". Beyond the average gender gap in housework (employed women always perform more housework than employed men), the left panel of Figure 3.7 shows that both men and women spent on average an extra 30 minutes per day in household chores. This increase was however a persistent one only for women, while men in the spring of 2021 went back to their pre-pandemic contribution to housework. Moving on to childcare, on the right panel of the figure, we find again that at all time points employed women in Luxembourg spend more time per day in activities with their own children than men do. Looking at the trends in childcare over time, there is some evidence the larger demand of family-provided childcare due to school closures and confinement measures was unequally shared by men and women. The increase in the provision of childcare in June 2020 was double for employed women than it was for employed men, with a slight, non-significant decline for women in the spring of 2021. The average numbers are larger when considering a sample of employed individuals with children, as those without children do not attenuate results with their mass of reported "zeroes" (Appendix Figure A3.1). Figure A3.1 shows that employed women with children spent between 60 and 95 extra minutes per day in activities with their children during the pandemic, while for men the increase was of 50 minutes only.

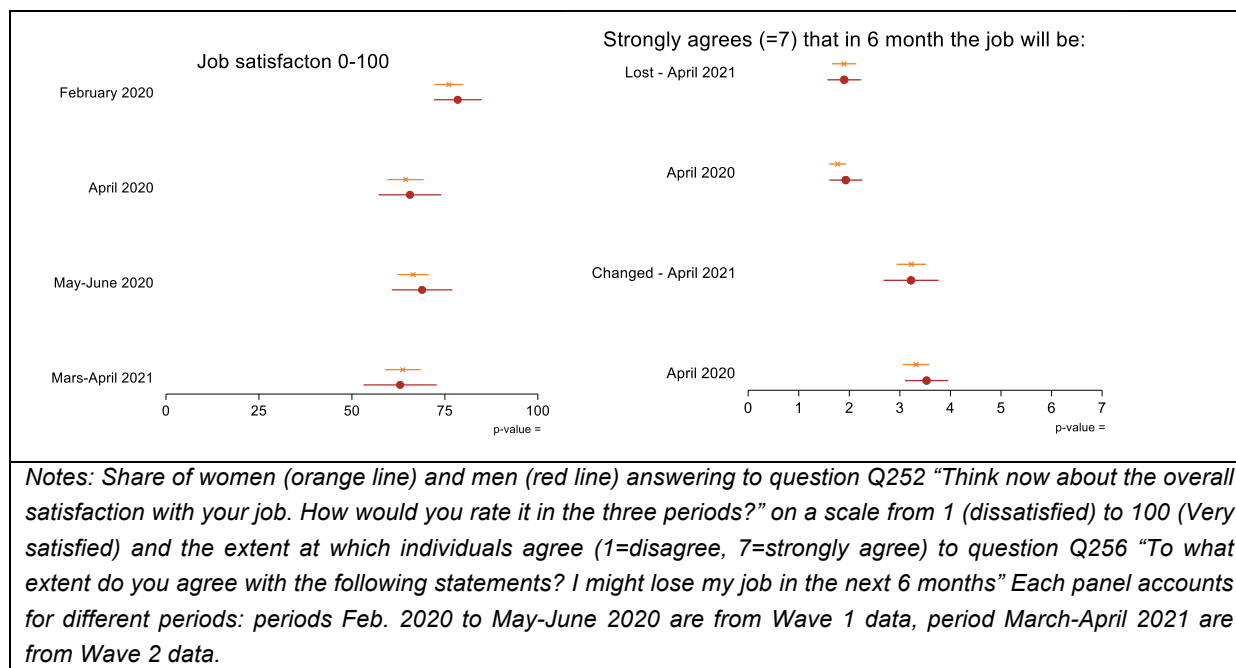*Figure 3.9: Time spent in housework and childcare (employed individuals only)*
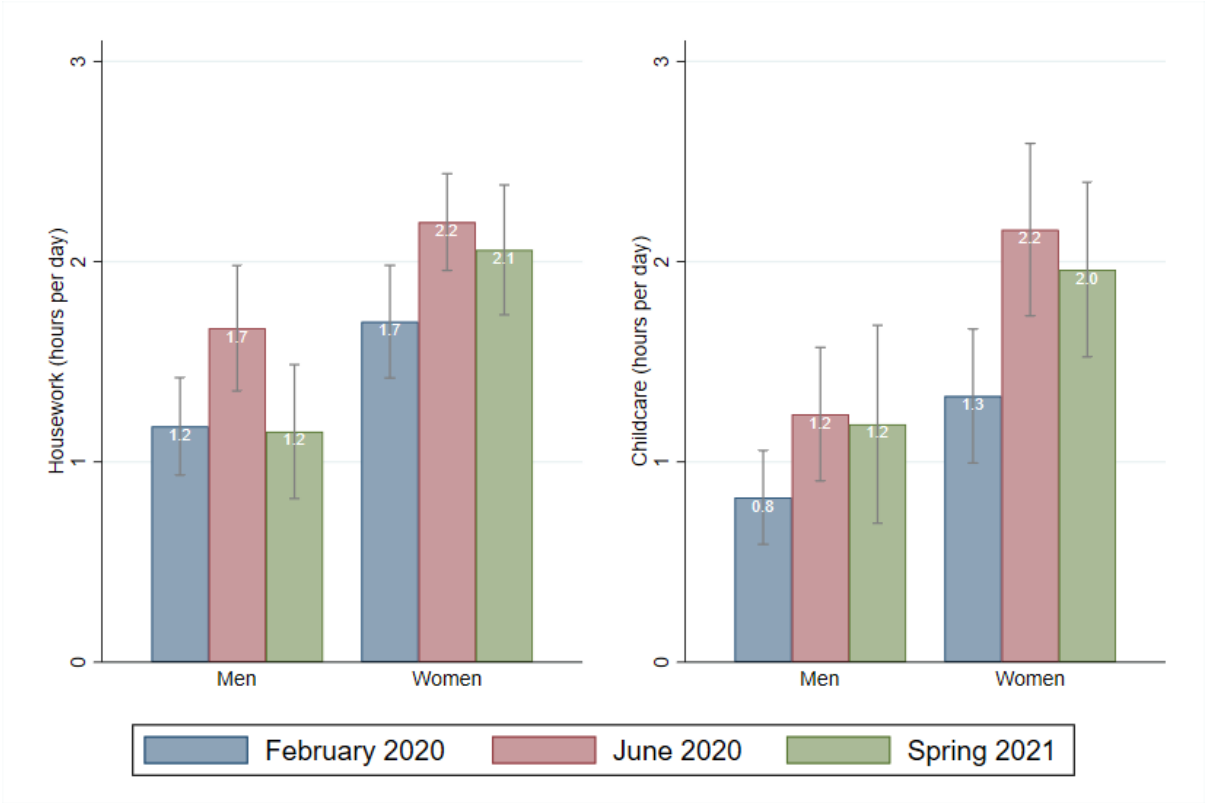
Notes: bars represent averages. Spikes are for 90% confidence intervals of the reported means.

3.1.5 Gender differences in satisfaction with working conditions

We also investigate the way the pandemics has affected job satisfaction and attitudes towards the job market. In Figure 3.10 we report (panel 1) job satisfaction on a scale 1-100, with 100 identifying complete satisfaction. Job satisfaction entails an overarching assessment of the job position held by the respondents, including monetary (such as wages) and non-monetary dimensions. As expected, job satisfaction if high (since it incorporates the selection of workers to jobs), about 76 points in the pre-pandemic period. Interestingly, job satisfaction decreases over the 2020, down to about 65 points on average in April 2021. There are no differences across gender groups. Lower job satisfaction reflects a discontent of the worker that may reflect negative attitudes towards increasing volatility and job uncertainty. As the second panel of Figure 3.10 shows, 20% of respondent fear to lose their job within 6 months. As a consequence of job dissatisfaction, a high proportion of workers, 35%, believe they will change their job in 6 months. Overall, we do not detect changes in this probability from April 2020 to April 2021, implying that such effects may have little to do with lockdown and mobility restriction policies and more with features of the changed labor market. We never detect differences across genders.

Figure 3.10: Job satisfaction and gender

Notes: Share of women (orange line) and men (red line) answering to question Q252 "Think now about the overall satisfaction with your job. How would you rate it in the three periods?" on a scale from 1 (dissatisfied) to 100 (Very satisfied) and the extent at which individuals agree (1=disagree, 7=strongly agree) to question Q256 "To what extent do you agree with the following statements? I might lose my job in the next 6 months" Each panel accounts for different periods: periods Feb. 2020 to May-June 2020 are from Wave 1 data, period March-April 2021 are from Wave 2 data.

We have also reproduced estimates of the gender gap in job satisfaction and job stability indicators using conditional models that controls for family and human capital characteristics. We do not find evidence of gender differences in any of the response variables, supporting the robustness of the descriptive statistics reported above.

3.2 Subjective financial situation

In one of the survey modules, respondents were asked a series of questions about their worries and opinions about some economic aspects of their lives, capturing feelings of economic insecurity. Questions in this module covered concerns about several dimension, including respondents' own finances, as well as their views on the future of the economy as a whole. The first three questions we consider here are all introduced by "How concerned have you recently been about", followed by each of the following dimensions separately: "The economy in general", "The evolution of share prices and other forms of investment", and "Your own financial situation". Responses were recorded on a five-point scale, with values ranging from 1 ("Not at all concerned") to 5 ("Extremely concerned").

About their personal finances, respondents were additionally asked "How well would you say you are managing financially these days?", with potential answers being "I am living comfortably", "I am doing alright", "I am just getting by", "I am finding it quite difficult", and "I am finding it very difficult". Given the average economic wellbeing in Luxembourg and the relative scarcity of individuals with very difficult financial situations, we here dichotomize the variable into an indicator for having at least some difficulties getting by, by aggregating the last three response categories. Respondents were then asked about their expectations about the future, with the question "Looking ahead, how do you think you will be financially a year from now?", with answers being "Better than now", "Worse than now", or "About the same". Here again we build a binary indicator equal to one for those reporting their future financial situation to be "Worse than now" and zero otherwise. Last, individuals in the survey were also asked another question on their perception of the future of the country, namely "A year from now, the

economic condition of the country Luxembourg will be:", with the following ordinal response categories: "Better", "About the same", and "Worse".

When considering economic variables at the individual level, it is essential to put them in context by analyzing family structure in parallel. Typically, economic models of the household assume that individuals who live together pool economic resources; as such, individual income no longer represents the full set of resources a person has access to. Additionally, the presence of children in the household will affect the availability of resources per capita. We here focus on the economic insurance role provided by having a partner. There is a large literature in economics showing that marriage offers financial stability and consumption smoothing, via risk sharing (Hess, 2004; Kotlikoff and Spivak, 1981; Stevenson and Wolfers, 2007) or social insurance (Persson, 2020). We here test for any evidence of the protective role of being in a partnership against the economic consequences of the COVID-19 pandemic, by estimating the following linear regression model via Ordinary Least Squares (OLS):

$$Y_{ig} = \beta_g t_{2021} + \gamma_g t_{2021} \times Couple_{ig} + \delta_g X_{ig} + \varepsilon_{ig}, \quad g = \{f; m\} \qquad (1)$$

Where Y_{ig} is the outcome of interest (that is, one of the measures of subjective economic insecurity) for individual i of gender g. In order to have a consistent interpretation across the different dimensions, all outcomes are coded so that higher values reflect greater feelings of economic insecurity. Non-binary outcomes (that is, the three concern questions and the question on the economic condition of Luxembourg next year) are standardized in the estimation sample of 1,159 observations, so that their mean is equal to 0 and their standard deviation is equal to 1. t_{2021} is a binary indicator being equal to one for those observed in spring 2021 and zero for those observed in June 2020. $Couple_{ig}$ is equal to one if respondent i of gender g is in a cohabiting relationship and zero otherwise and its interaction with t_{2021} identifies the effect on Y_{ig} of being in the spring of 2021 for those in a couple, as compared to those who are single. X_{ig} is a vector of individual controls, including $Couple_{ig}$; the remaining control variables are age, age-squared and binary indicators for education levels, household sizes, employment, and the presence of children in the household. All observations are weighted using nationally representative sampling weights.

The effect of being in the spring of 2021, as compared to June 2020, for single individuals can be isolated via the coefficient β_g. The same effect for those in a cohabiting relationship is instead given by the sum between β_g and γ_g, seen as γ_g captures the difference in the effect of being in 2021 for those in a relationship as compared to the single. For each gender separately, Figure 3.11 displays the estimated values of β_g ("Single (Spring 2021)") and of $\beta_g + \gamma_g$ ("Couple (Spring 2021)") for the six different economic insecurity outcomes. See Appendix Table A3.2 for the exact values of the estimated β_g and γ_g for all outcomes.

Results from Figure 3.11 confirm that, even during the pandemic, being in a relationship had a protective role against feelings of economic insecurity. Regardless of gender, single individuals in the spring of 2021 were at least as worried as they were in June 2020 about any dimension of economic insecurity. Those in a relationship, on the contrary, were at most as worried in 2021 as they were during the first months of the pandemic – their concerns being on average lower along several dimensions. For women, the relationship premium appears more strongly in their concern about the economy, the concern about their own financial situation, and the concern about Luxembourg's economic condition next year. The picture is a slightly different one for men, for whom the relationship premium mostly appears along more general concerns about the economy as a whole, rather than about their own financial situation. Single men are however more likely than those in a couple to say

that their financial situation next year will be worse than their current one. Given the average 3-year age different between single and partnered men, this could be capturing uncertainty about the future labor market conditions that might be disproportionately borne by younger men, who are more likely to have a temporary-contract job.

Figure 3.11: Economic insecurity from 2021 to 2020, by gender and couple: net effects
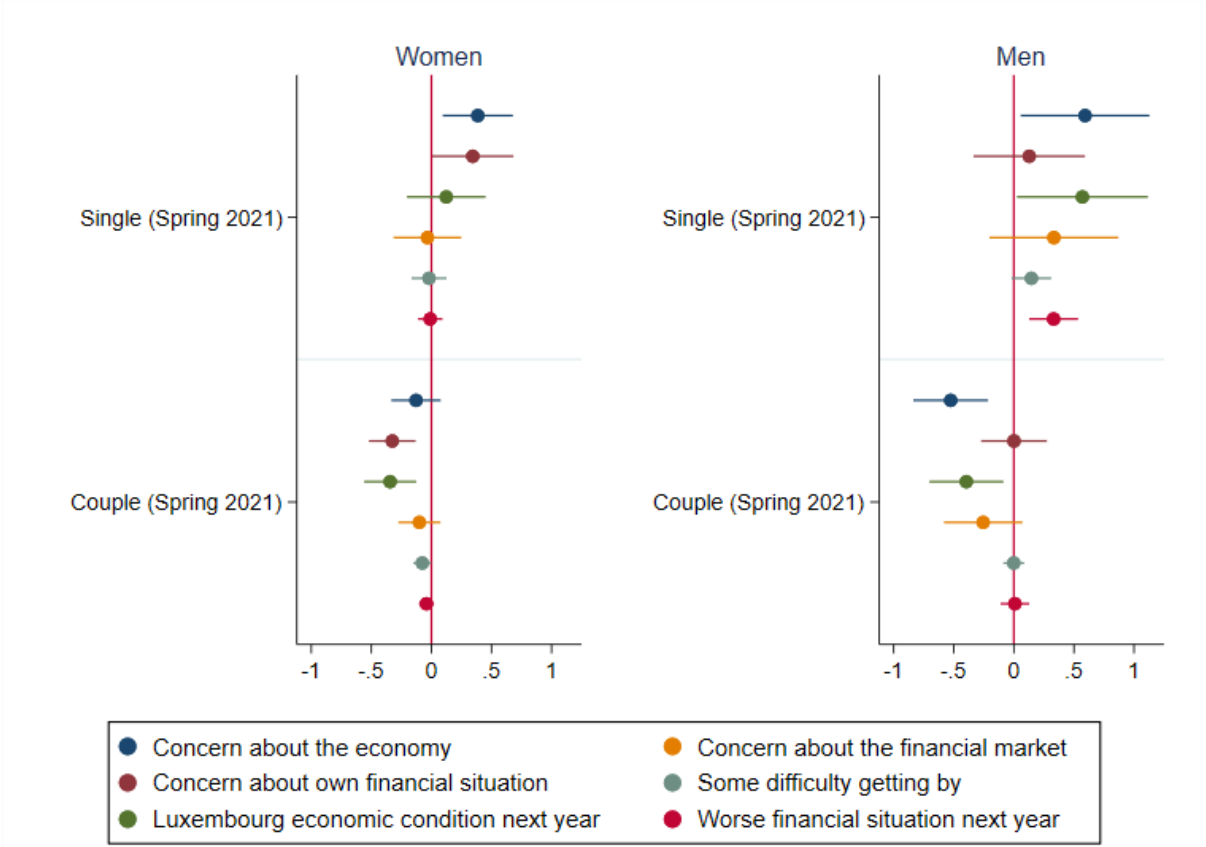
Notes: Sample size is 1159 observations. Dots are estimated net effects from equation (1), for each of the outcomes reported in the legend. Non-binary outcomes are standardized in the estimation sample so that their mean is 0 and their standard deviation is 1. In the left panel, equation (1) is estimated on women only ($g = f$), while in the right panel it is estimated on men ($g = m$). The label "Single (Spring 2021)" refers to the estimated β_g, while "Couple (Spring 2021)" refers to the estimated $\beta_g + \gamma_g$. Horizontal spikes are for 90% robust confidence intervals.

3.3 Social interactions (outside and within the household)

We now investigate how the social lives of individuals in Luxembourg were affected during the pandemic. While restrictions put in place by the government such as limitations of public events and curfews reduced the average level of social interactions in the attempt to minimize COVID-19 infections, it is less clear whether some groups were particularly more affected than others. First, compliance with social distancing measures and social isolation was not independent of gender, with women being more likely to follow restrictions more closely (as shown in Chapter 2 of this report). Second, those living alone being more at risk of loneliness and social isolation, they might have

greater expected benefits from deviating from social-isolation norms, as compared to individuals living in the company of other family members.

The SEI questionnaire included several questions capturing social contact and interactions of the respondents. In both waves, individuals in the survey were asked how many times per week did they participate in the following out-of-home activities: visiting family or friends; visiting neighbors. Additionally, they were asked how many times per week did you usually invite somebody (e.g., friends, family, neighbors) to their home. Answers to the three questions were all recorded on a 1 ("Never") to 5 ("4 or more times a week") scale. In each wave respondents were asked these question referred to two different time points: in Wave 1, the periods were February 2020 and April 2020; in Wave 2, the periods were again February 2020 and the moment of the interview, that is around spring 2021. To get a summary measure of the degree of social interactions in the lives of respondents, we here build an indicator for visiting or receiving friends, family or neighbors at least once per week. The shares of those meeting someone at least once a week over time, by gender and relationship status, are displayed in Figure 3.12.

Results in Figure 3.12 show similar initial levels of social interactions across groups in February 2020, prior to the pandemic. Unsurprisingly, the share of those meeting someone at least once per week declined (by 65% on average) during the first wave of COVID-19 in Luxembourg in April 2020. The situation in the spring of 2021 reveals more heterogeneous behaviors across groups: the number of single men meeting someone at least once a week went back to normal, reaching the same value as in February 2020; for all other groups, however, the share of those having some degree of social interactions increased only slightly, with 40% of those who used to meet friends, neighbors and family regularly before the pandemic having less than one social interaction per week in 2021.

Figure 3.12: Seeing friends, family or neighbors at least once a week

The findings displayed in Figure 3.12 are robust to the introduction of individual controls such as age, education, employment status and family size, suggesting that differences between groups are not driven by these observable characteristics (results shown in Appendix Table A3.3). What is then driving the difference between men and women? Chapter 2 of this report shows that women are more likely than men to comply with social-distancing measures and mask-wearing. This is consistent with the literature in economics reporting that women are on average more risk-averse than men (Charness and Gneezy, 2012; Jianakoplos and Bernasek, 1998). The perceived health risk deriving from social interactions during the pandemic might thus be larger for women than it is for men, especially in periods of fewer restrictions, when individual preferences can play a larger role on observed behavior. Looking at questions on concerns about their health and the health of family members and close friends, we find that women in the spring of 2021 are significantly more worried about these dimensions than men (results shown in Appendix Table A3.4). These results suggest that single women might be returning more slowly to their pre-pandemic levels of social interactions, due to their higher degree of concern about their own health and the health of their dear ones.

Other than the frequency of visiting or receiving friends, neighbors and family, individuals in the sample were asked some specifics question about the quality and sharedness of the time they reported spending in various activities. In particular, they were asked to report how much of the time they spent in leisurely activities was spent with friends (both online and off-line) and how much was spent with the partner. They were additionally asked about the time spent in childcare: on top of the number of hours spent in child activities with their partner, individuals reported how many of the hours spent with their children were also pleasant, leisurely or fulfilling.

Table 3.1 reports OLS-estimated coefficients from a linear regression model of the time spent in leisurely activities on time indicators and individual controls (for more details, please refer to the notes at the bottom of Table 3.1). Results from the first two columns of the Table show that, compared to pre-pandemic levels, in June 2020 the amount of leisure time per week spent with friends both online and offline declined by 1.4 hours for women and 2.3 hours for men. This suggests that virtual interactions did not fully compensate for the loss of in-person interactions with friends. While men's leisure time with friends declined more than women's in June 2020, the reduction was a short-lived one: in the spring of 2021 no significant difference persists in the amount of leisure time spent with friends as compared to before the pandemic. For women, on the contrary, there has been a longer-term reduction in the leisure time shared with friends – the negative effect persisting also in the spring of 2021. Results from the first two columns of Table 3.1 outline a story that is consistent with Figure 3.12, suggesting that taking virtual interaction into account does not change the gender unbalance in social interactions observed in 2021.

While leisure time with friends declined on average, we find no change in the time spent in leisure activities with the partner during the pandemic as compared to February 2020 (columns 3 and 4 of Table 3.1). This suggests that the increase in the time spent at home did not translate into a larger amount of shared leisure, but rather into more time in paid and unpaid work (as previously shown in Figure 3.7).

Table 3.1: Time per week spent in leisure activities over time, by type and gender

	Leisure time			
	With friends		With partner	
	Women	Men ■	Women	Men
	(1)	(2)	(3)	(4)
June 2020	-1.403[*]	-2.348[***]	0.330	0.832
	(0.810)	(0.884)	(1.083)	(1.532)
Spring 2021	-2.061[**]	-0.520	2.624	-1.336
	(0.923)	(2.233)	(1.723)	(2.536)
Observations	1259	467	1262	468
Adjusted R-squared	0.021	0.105	0.167	0.389

Notes: Robust standard errors (clustered at the individual level) in parentheses. The reference period for the time dummies is February 2020. Observations are weighted using nationally representative sampling weights. All regressions control for age, age-squared and dummies for education levels, household size, and the presence of children in the household. All respondents in the estimation sample are partnered (in a cohabiting relationship). Standard significance thresholds are indicated as follows: [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$.

Similar to Table 3.1, Table 3.2 shows the evolution over time of the (weekly) hours spent in childcare activities together with the partner and hours in child activities that are pleasant, leisurely or fulfilling ("quality time" in the Table). Columns 1 and 2 show that both men and women experienced a similar increase in the amount of quality time spent with their children in June 2020, as compared to before the pandemic. This comes as no surprise, given that the amount of time spent with children increased overall during the pandemic. The increase is however a temporary one: in the spring of 2021, the weekly amount of quality time with the children is back at the pre-pandemic levels (if not to lower levels, as qualitatively indicated by the non-significant point-estimates). When it comes to the amount of childcare that is also spent with the partner, one difference emerges by gender: while women do not report any significant change in the number of weekly childcare hours that are spent with the partner, this value appears to have increased for men in June 2020 as compared to before the pandemic. Assuming that, for heterosexual couples, the behavior of respondents of each gender is comparable to that of the opposite-gender respondents' partners, in principle we should observe no differences here, as the shared childcare in couples reported by women should be on average the same shared childcare in couples reported by men. The difference we observe might then be driven by sample selection: men who participated to the survey might have unobservable characteristics that make them more likely to participate to shared childcare, that are not taken into account by our sampling weights. Another possible explanation could be a different conception, by gender, of what constitutes "childcare activities": men, who on average spend less time with their children, might have a broader notion of childcare that includes activities women might attribute to different domains.

Table 3.2: Time per week spent in childcare activities over time, by type and gender

	Time with children			
	Quality time		With partner	
	Women	Men	Women	Men
	(1)	(2)	(3)	(4)
June 2020	4.070**	3.762*	1.387	3.638**
	(1.625)	(2.107)	(1.756)	(1.580)
Spring 2021	-4.584	-1.336	-3.041	2.524
	(2.839)	(3.253)	(2.314)	(2.589)
Observations	610	197	610	197
Adjusted R-squared	0.153	0.209	0.122	0.185

Notes: Robust standard errors (clustered at the individual level) in parentheses. The reference period for the time dummies is February 2020. Observations are weighted using nationally representative sampling weights. All regressions control for age, age-squared and dummies for education levels, household size, and the presence of children in the household. All respondents in the estimation sample are partnered (in a cohabiting relationship) and have at least one child. Standard significance thresholds are indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4. Conclusions

In this Chapter, we investigate the evolution of gender inequalities in the labor market and in individual behaviors during the pandemic. We first show that the number of women who were neither employed nor self-employed increased over the first few months of the pandemic, in contrast to men's employment rate which instead stayed constant. We then show that women were more likely than men to make use of temporary unemployment and work leaves, especially when in male-dominated sectors of activity. Looking at time use, employed individuals spent longer hours in paid work during the pandemic, due to the increase in teleworking. The contribution to unpaid work activities such as childcare and housework, while increasing for everyone during the pandemic, was qualitatively larger for women. Moving onto individual's perceptions of their own financial situation and of the economy, we show that those without a partner were more likely to feel economically insecure than those with a partner – the single's concerns in the spring of 2021 being higher than they were in June 2020. We last tackled gender inequalities in social interactions: while social interactions decreased for everyone in the first wave of the pandemic, in the spring of 2021 women still reported lower levels of interactions with friends, family and neighbors as compared to men, the difference being more pronounced among the single. Last, we find evidence of an increase in quality time with children, suggesting that the extra time spent at home at the beginning of the pandemic might have had beneficial effects on child human capital, potentially offsetting the adverse effects on learning, social interactions and attention due to the distance-learning.

In our data we find that, during the first wave of the COVID-19 pandemic in 2020, women had a slightly larger take-up rate than men for this form of COVID-19 parental leave, the gender gap being more pronounced in male-dominated sectors of activity. Differences in the take-up rate of parental leave across gender, however, disappeared over the course of 2021. The larger increase in this form

of family leave for women is consistent with the literature in economics showing that, when elective, measures promoting a better family-life work balance are disproportionately used by women, with the perverse effect of segregating them even more into forms of unpaid work. In countries where women traditionally have a lower attachment to the labor market than men, these forms of flexible work arrangements might thus, on one hand, further distance women from the labor market (e.g. via missed experience and networking opportunities) while, on the other hand, enhancing gender disparities in childcare arrangements. Such form of gendered specialization in childcare (and likely housework) can exacerbate gender inequalities within the household, with the potential of affecting wellbeing, mental health and the couple's stability. Additionally, children's enhanced exposure to gender-stereotypical roles within the household due school closures can further intensify the cultural transmission of traditional gender norms onto the next generation, with persistent social and economic costs on the long term (Menta and Lepinteur, 2021).

There is a vast body of literature documenting gender inequalities in normal times. What the pandemic has highlighted on top of that knowledge is that women and, in general, more vulnerable groups such as the young and the poor, are those who have suffered the most the economic and social consequences of the health crisis and its policy responses. Because of their lower attachment to the labor market, these groups are more likely to leave the labor force or to downward-adjust their working time when faced with labor demand shocks and a larger need for home-production. Designing policies that are aware of these criticalities and that can limit or offset the potential negative spill-overs onto more vulnerable groups is of fundamental importance to prevent new crises to set back decades of social progress.

Additional evidence on concerns about health and social cohesion in our data suggest that women's mental charge over these dimensions was higher than men's during the pandemic. Due to the concurrence of risk factors, such as increasing worries and uncertainty and higher social isolation, assessing the mental health consequences of the pandemic appears of great policy relevance, particularly for women.

References

Adams-Prassl, A., Boneva, T., Golin, M., and Rauh, C. (2020). "Inequality in the impact of the coronavirus shock: Evidence from real time surveys." *Journal of Public Economics*, 189, 104245.

Alon, T., Doepke, M., Olmstead-Rumsey, J., and Tertilt, M. (2020). "The impact of the coronavirus pandemic on gender equality." *Covid Economics Vetted and Real-Time Papers*, *4*, 62-85.

Andrew, A., Cattan, S., Costa Dias, M, Farquharson, C., Kraftman, L., Krutikova, S., Phimister, A., and Sevilla, A. (2020). "How are mothers and fathers balancing work and family under lockdown?" IFS Briefing Note No. 290.

Belot, M., Choi, S., Tripodi, E., van den Broek-Altenburg, E., Jamison, J. C., and Papageorge, N. W. (2021). "Unequal consequences of Covid 19: representative evidence from six countries." *Review of Economics of the Household, 19*, 769-783.

Biroli, P., Bosworth, S., Della Giusta, M., Di Girolamo, A., Jaworska, S., and Vollen, J. (2021). "Family life in lockdown." *Frontiers in Psychology*, *12*, 687570.

Bossert, W., and D'Ambrosio, C. (2013). "Measuring economic insecurity". *International Economic Review*, *54*, 1017-1030.

Bu, F., Steptoe, A., and Fancourt, D. (2020). "Who is lonely in lockdown? Cross-cohort analyzes of predictors of loneliness before and during the COVID-19 pandemic." *Public Health*, *186*, 31-34.

Charness, G. and Gneezy, U. (2012). "Strong evidence for gender differences in risk taking." *Journal of Economic Behavior and Organization*, *83*, 50–58.

Clark, A. E., D'Ambrosio, C., Lepinteur, A., and Menta, G. (2022). "Pandemic policy and individual income changes across Europe." *Mimeo*.

Cortes, G. M., and Forsythe, E. (2020). "The heterogeneous labor market impacts of the Covid-19 pandemic." Upjohn Institute Working Paper No. 20-327.

Farré, L., Fawaz, Y., González, L., and Graves, J. (2021). "Gender inequality in paid and unpaid work during COVID-19 times." *Review of Income and Wealth*, forthcoming.

Hank, K., and Steinbach, A. (2021). "The virus changed everything, didn't it? Couples' division of housework and childcare before and during the Corona crisis." *Journal of Family Research*, *33*, 99-114.

Hess, G. D. (2004). "Marriage and consumption insurance: What's love got to do with it?" *Journal of Political Economy*, *112*, 290-318.

Hochschild, A. (1989). *The Second Shift*. New York, New York: Avon Books.

Jessen, J., Spiess, C. K., Waights, S., and Wrohlich, K. (2021). "Sharing the caring? The gender division of care work during the Covid-19 pandemic in Germany." IZA Discussion Paper No. 14457.

Jianakoplos, N. A., and Bernasek, A. (1998). "Are women more risk averse?" *Economic inquiry*, *36*, 620-630.

Kohlrausch, B., and Zucco, A. (2020). "Die Corona-Krise trifft Frauen doppelt: Weniger Erwerbseinkommen und mehr Sorgearbeit." WSI Policy Brief No. 40.

Kotlikoff, L. J., and Spivak, A. (1981). "The family as an incomplete annuities market." *Journal of Political Economy*, *89*, 372-391.

Menta, G., and Lepinteur, A. (2021). "Boys don't cry (or do the dishes): Family size and the housework gender gap." *Journal of Economic Behavior and Organization*, *186*, 164-188.

Montenovo, L., Jiang, X., Rojas, F. L., Schmutte, I. M., Simon, K. I., Weinberg, B. A., and Wing, C. (2022). "Determinants of disparities in covid-19 job losses." *Demography*, forthcoming.

Naujoks, T., Kreyenfeld, M., and Dummert, S. (2021). "The division of child care during the coronavirus crisis in Germany: How did short-time work affect fathers' engagement?" *Journal of Family Research*, 10.20377/jfr-717.

Palgi, Y., Shrira, A., Ring, L., Bodner, E., Avidor, S., Bergman, Y., Cohen-Fridel, S., Keisari, S., and Hoffman, Y. (2020). "The loneliness pandemic: Loneliness and other concomitants of depression, anxiety and their comorbidity during the COVID-19 outbreak." *Journal of Affective Disorders*, *275*, 109-111.

Persson, P. (2020). "Social insurance and the marriage market." *Journal of Political Economy*, *128*, 252-300.

Sevilla, A., Smith, S. (2020). "Baby steps: the gender division of childcare during the COVID-19 pandemic." *Oxford Review of Economic Policy*, *36*, S169–S186.

Stevenson, B., and Wolfers, J. (2007). "Marriage and divorce: Changes and their driving forces." *Journal of Economic Perspectives*, *21*, 27-52.

Wickens, C. M., McDonald, A. J., Elton-Marshall, T., Wells, S., Nigatu, Y. T., Jankowicz, D., and Hamilton, H. A. (2021). "Loneliness in the COVID-19 pandemic: associations with age, gender and their interaction." *Journal of Psychiatric Research*, *136*, 103-108.

Zamarro, G., and Prados, M. J. (2021). "Gender differences in couples' division of childcare, work and mental health during COVID-19." *Review of Economics of the Household*, *19*, 11-40.

Zamberlan, A., Gioachin, F., and Gritti, D. (2021). "Work less, help out more? The persistence of gender inequality in housework and childcare during UK COVID-19." *Research in Social Stratification and Mobility*, *73*, 100583.

Appendix

Figure A3.1: Time spent in housework and childcare (employed individuals with children only)
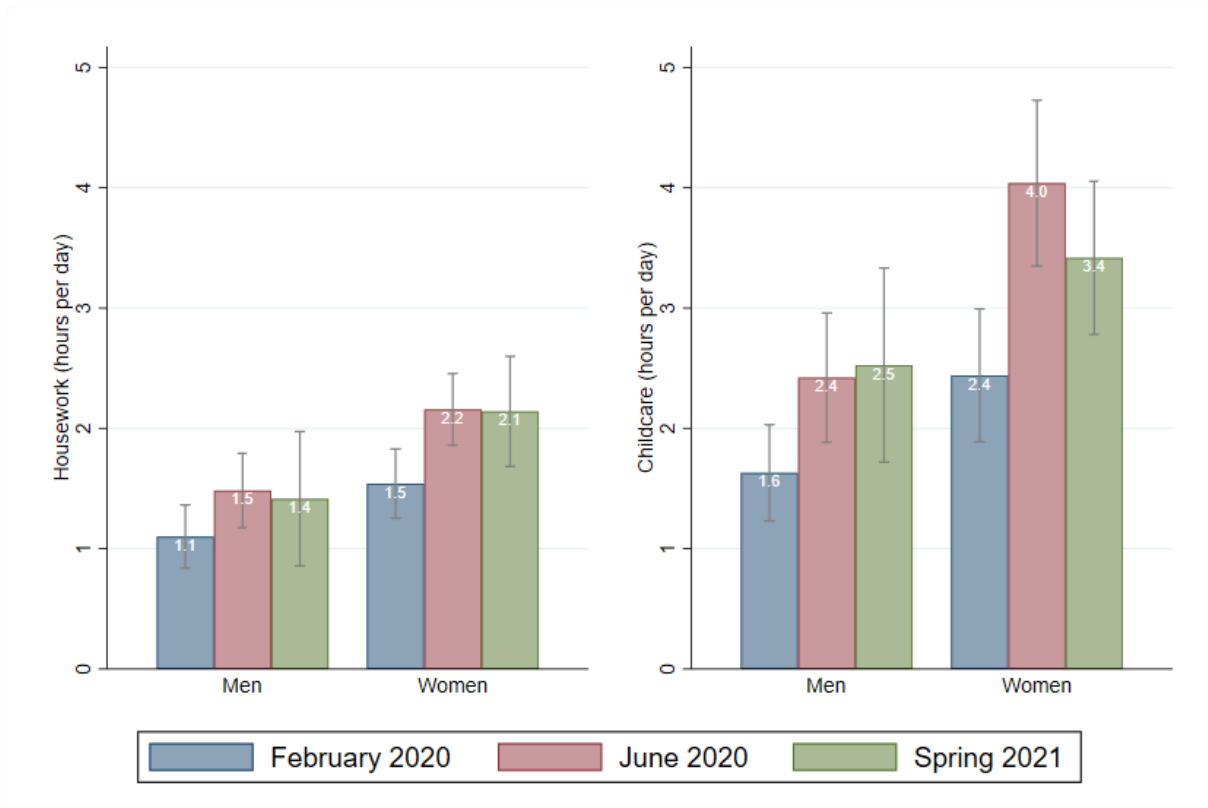
Notes: bars represent averages. Spikes are for 90% confidence intervals of the reported means.

Table A3.1: Descriptive statistics

	Sample survey 1	Sample survey 2	**Sample survey 1 + 2**	Population
GENDER				
Male	27.3%	22.5%	25.3%	50.3%
Female	72.7% N=2451	77.5% N=1819	74.7% N=4270	49.7%
AGE				
17-24 years	3.1%	1.6%	2.5%	11.5%
25-29 years	6.1%	4.8%	5.5%	9.3%
30-39 years	25.0%	22.8%	24.1%	19.2%
40-49 years	29.6%	27.1%	28.5%	18.2%
50-59 years	23.1%	24.7%	23.8%	17.5%
60-64 years	7.7%	10.4%	8.8%	6.7%
65+ years	5.4% N=2451	8.7% N=1769	6.8% N=4220	17.7%
EDUCATION				
Primary education	1.5%	1%	1.3%	12.60%
Lower secondary education	6.9%	7.3%	7.1%	15.73%
Upper secondary education	22.1%	22.1%	22.1%	34.90%
Post-secondary but non-tertiary education	9.9%	9.7%	9.8%	2.08%
Tertiary education, short-cycle	10.8%	11.4%	11%	34.69%
Bachelor level or equivalent	16.8%	16.4%	16.7%	
Master level or equivalent	28.5%	29.1%	28.7%	
Doctoral level or equivalent	3.5% Tertiary : 59.6% N=2451	3% Tertiary : 59.9% N=1796	3.3% Tertiary : 59.7% N=4247	
EMPLOYMENT STATUS				
Not Employed	29.8%	32.7%	31%	46.41%
Employed	70.2% N=2451	67.3% N=1819	69% N=4270	53.59%

Table A3.2: Subjective indicators of economic insecurity, by gender and relationship status

	Worry economy (1)	Worry finances (2)	Economy next year (3)	Worry fin. mkt. (4)	Difficult to get by (5)	Worse next year (6)
Panel A. Women						
Spring 2021	0.386**	0.344*	0.124	-0.033	-0.019	-0.010
	(0.177)	(0.206)	(0.199)	(0.171)	(0.088)	(0.062)
Couple × Spring 2021	-0.514**	-0.670***	-0.467*	-0.067	-0.057	-0.031
	(0.211)	(0.237)	(0.240)	(0.202)	(0.098)	(0.069)
Observations	846	846	846	846	846	846
Adjusted R-squared	0.053	0.105	0.049	0.023	0.165	0.016
Panel B. Men						
Spring 2021	0.593*	0.129	0.571*	0.333	0.146	0.331***
	(0.325)	(0.281)	(0.330)	(0.325)	(0.100)	(0.124)
Couple × Spring 2021	-1.119***	-0.127	-0.966**	-0.589	-0.147	-0.322**
	(0.371)	(0.326)	(0.379)	(0.381)	(0.114)	(0.144)
Observations	313	313	313	313	313	313
Adjusted R-squared	0.142	0.156	0.154	0.148	0.263	0.164

Notes: Robust standard errors in parentheses. The reference period for the time dummy is June 2020. Observations are weighted using nationally representative sampling weights. All regressions control for age, age-squared and dummies for education levels, household size, employment, being in a cohabiting relationship ("Couple") and the presence of children in the household. Standard significance thresholds are indicated as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3.3: Social interactions during the pandemic, by gender

	Women (1)	Men (2)
April 2020	-0.444[***]	-0.489[***]
	(0.054)	(0.094)
Spring 2021	-0.242[***]	0.033
	(0.066)	(0.097)
Couple × April 2020	-0.090	0.080
	(0.065)	(0.109)
Couple × Spring 2021	-0.054	-0.363[***]
	(0.079)	(0.120)
Observations	1960	660
Adjusted R-squared	0.214	0.211

Notes: Robust standard errors (clustered at the individual level) in parentheses. The reference period for the time dummies is February 2020. Observations are weighted using nationally representative sampling weights. All regressions control for age, age-squared and dummies for education levels, household size, employment, being in a cohabiting relationship ("Couple") and the presence of children in the household. Standard significance thresholds are indicated as follows: [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$.

Table A3.4: Concerns about health during the pandemic, by gender

	Worry about own health		Worry about the health of close ones	
	Women (1)	Men (2)	Women (3)	Men (4)
Spring 2021	0.600[***]	0.000	0.341[*]	-0.287
	(0.213)	(0.350)	(0.181)	(0.275)
Couple × Spring 2021	-0.100	0.170	0.035	0.042
	(0.257)	(0.428)	(0.230)	(0.363)
Observations	878	321	878	319
Adjusted R-squared	0.103	0.100	0.048	0.123

Notes: Robust standard errors in parentheses. The reference period for the time dummy is June 2020. The outcomes are coded on a 1 ("Not at all concerned") to 5 ("Extremely concerned") scale. Observations are weighted using nationally representative sampling weights. All regressions control for age, age-squared and dummies for education levels, household size, employment, being in a cohabiting relationship ("Couple") and the presence of children in the household. Standard significance thresholds are indicated as follows: [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$.

Conclusions and perspectives[14]

With its high income per capita, generous welfare state and high ratio of critical care beds per capita, Luxembourg was a priori well-endowed to cope with the health and socio-economic shocks induced by COVID-19. These specificities however do not appear to have mitigated the pandemic's impact on gender inequalities in a better way than other European countries. Men and women have been contaminated in similar proportions but men have been (much) more frequently affected by severe and fatal forms of the disease. Women's employment has been affected more than men's during periods of lockdown. The increase in child care responsibilities during school closures fell disproportionately on women's shoulders.

Our analyses show that for a large part, the inequality in outcomes between men and women does not directly depend on gender per se, but from the prevalence among women of pre-existing "risk factors", such as lower education or less stable working conditions compared to men. This report highlights the critical role played by underlying gender differences in terms of demographic, social and behavioral factors to explain the effects of the COVID-19 pandemic on gender inequalities.

The "Equality of Opportunity" (EOp) literature provides a useful framework to analyze the results presented in this report. The key notion of EOp is that a particular outcome – a person's living conditions, health, etc. – results from the combination of (i) her *circumstances* defined as "those aspects of one's environment (including, perhaps, one's biological characteristics) that are beyond one's control, but that also influence the outcomes of interest" and of (ii) *efforts* broadly reflecting individual decisions and behaviour (see Roemer and Trannoy 2015)[15]. Inequalities across people in the outcome arising from differences in circumstances are seen as unfair. According to the EOp "compensation principle", these ought to be eliminated. On the contrary, those inequalities in final outcomes that result from actions or decisions under individuals' control should deserve less attention, becoming completely irrelevant from an ethical point of view whenever they originate from pure effort. EOp theory, which basically distinguishes between "fair" inequalities (those due to effort and merit) and "unfair/bad" inequalities (those due to external and involuntary reasons), rests on a hypothetical "cut" between individual responsibility and external circumstances. However, circumstances also influence individual behaviours and attitudes. A flourishing literature has built several arguments to overcome the simplification.

Our results can be very naturally interpreted through this lens. As documented in our study, the main circumstances leading to a different exposure to the COVID-19 along the gender dimension are age and family type, including the presence of children. These circumstances are interrelated and define groups of the population which differ in achievements and outcomes. For instance, gender differences across men and women are mild in the aggregate population. Nevertheless, the presence of children in the household is an important factor driving contamination risks among adults, as the infection rates are higher in households with children for both men and women, although the risk is proportionally higher for women than for males. The data also suggest that, among single adults with children, infection rates are much higher among women than men. This pattern echoes gender differences in the time spent in childcare illustrated in chapter 3. There are other important dimensions besides family composition and gender, determined before the pandemic, that may explain outcomes, such as

---

[14] Authors: F. Andreoli, G. Menta, E. Peluso, P. Van Kerm, B. Verheyden

[15] Roemer, John E., and Alain Trannoy. 2016. "Equality of Opportunity: Theory and Measurement." *Journal of Economic Literature*, 54 (4): 1288-1332.

age, family type and education. This complementary information helps us to understand several important issues.

First, we are able to verify whether gender inequalities due to circumstances are significantly reduced or amplified by differences in behavior. More precisely, in some cases there are behavioral differences based on gender that can "compensate" for unfavorable circumstances (for example, greater compliance with the adoption of safety measures for mothers with children, who run greater risks of contamination). However, in other cases, observed behavioral differences may contribute to aggravate the effects of unfavorable circumstances (e.g. when elderly males - who are more exposed to disease risk - behave less cautiously than women, or when we observe that women with children, who face more risks of contamination, participate less in the test campaign). Once we have been able to assess the nature of the link between circumstances and behaviors, the second logical step consists in identifying the main channels through which this link operates. Two factors seem to play an important role in our framework. The first one is *awareness*: the fact that members of a given type of individuals know their real exposure to risk and advantages/disadvantages. The higher degree of prudence and compliance with social distancing rules among the elderly is a good example of a virtuous response to correct information towards their risks. Similarly, the higher degree of hesitancy of women towards vaccination compared to males during the spring 2021 is another example of the information channel as a crucial driver of the behavior of certain types of individuals. The second factor is *freedom:* Even if members of one group are aware of their disadvantaged conditions, some constraints may hamper them from applying appropriate behaviors in order to reduce their unfavorable conditions. The best example is perhaps the aforementioned case of working mothers; women in this position suffer limitations in their liberty of optimizing their behaviours vis-à-vis testing and social isolation, being forced to comply with their maternal duties.

The EOp literature offers innovative lenses to interpret the role of public policies too. Public intervention is hardly capable of affecting the distribution of circumstances (dimensions such as age and gender cannot be redistributed or randomized across the population). It is, however, capable of influencing the way some socio-economic circumstances (as the family composition) influence behavior, by acting at the two channels pointed out above. Policies can rise awareness by improving the quality of information and offering a correct view of the risks associated to people's characteristics (the quality of media and the messages conveyed by TV radio and newspapers seem to be crucial, as documented in Chapter 2). Policies can also improve on the freedom dimension, by increasing the capabilities of the most disadvantaged groups by allowing them to apply the most appropriate behaviours. Free public transportation, simplified access to testing, free disposal of masks, are examples of these policies.

Some policies, intended to promote equal opportunity, may have unintended consequences on many individual outcomes during the pandemic period, such as parental leave. Socio-economic discrepancies coming from the employment conditions, combined with the family structure are the most apparent: data from the Luxembourg's COVID-19 Socio-Economic Survey show that, during the first wave of the COVID-19 pandemic in 2020, working women were more likely than men to be on the COVID-19 parental leave, the gender gap being more pronounced in male-dominated sectors of activity. The larger increase in this form of family leave for women is coherent with evidence from other studies, showing that non-compulsory measures promoting a better family-life work balance are disproportionately used by women. Parental leave policies might have the unintended effect of segregating women even more into forms of unpaid work, thus exacerbating the pre-existing gender inequalities within the household. Worryingly, children's enhanced exposure to gender-stereotypical roles at home due school closures could intensify the transmission of traditional gender norms onto

the next generation, with persistent social and economic costs in the long term. Are we sure that these measures increase women freedom?

Overall, the pandemic has highlighted that women and more vulnerable groups, such as the young and the poor, are those who have suffered the most the economic and social consequences of the health crisis and its policy responses. Because of their traditionally lower attachment to the labour market, these groups are the most likely to leave the labour force or to downward-adjust their working time in times of crisis. Designing policies that are aware of these mechanisms and that can limit or offset the potential negative effects onto more vulnerable groups is of fundamental importance to avoid that new crises to set back decades of social progress.

Additional evidence on concerns about health and social cohesion in the Luxembourgish survey suggest that women's mental charge over these dimensions was higher than men's during the pandemic. Due to the concurrence of risk factors, such as increasing worries and uncertainty and higher social isolation, assessing the mental health consequences of the pandemic appears of great policy relevance, particularly so for women.

LUXEMBOURG INSTITUTE OF
SOCIO-ECONOMIC RESEARCH

11, Porte des Sciences
Campus Belval
L-4366 Esch-sur-Alzette

T +352 58 58 55-1

www.liser.lu