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LIFE SATISFACTION CHANGES AND ADAPTATION IN THE COVID-19 PANDEMIC: EVIDENCE FROM SINGAPORE

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We provide novel evidence on how COVID-19 affected overall life satisfaction using a monthly longitudinal survey of middle-aged and older Singaporeans. We study how the subjective well-being of individuals evolves over the course of 18 months including the outbreak of the pandemic, the implementation of the lockdown and the spike of cases due to the delta variant in a country where COVID-19 is controlled in a sustained manner. Using an event-study design framework, we find large declines in overall life satisfaction in the lead-up to and following the lockdown. Fifteen months after the outbreak of the pandemic, and 13 months out from the end of lockdown, individuals have nearly, though not fully, adapted to living with the virus. We find greater negative well-being impacts of COVID-19 among individuals who report a drop in household income during the COVID-19 outbreak compared to those who do not report any income loss. However, we find little evidence of heterogeneity in the dynamics of the recovery in well-being by individuals' underlying health status, marital status and education. On personality types, people who are high in neuroticism experience larger dips in well-being during the lockdown, and adapt to living with COVID-19 at a slower rate.

Keywords: COVID-19; pandemic; life satisfaction; subjective well-being; individual-level monthly panel data.

1. Introduction

The COVID-19 pandemic has had a profound impact on human lives. Many governments have implemented social distancing rules in the early phases of the pandemic in attempt to curb the spread of the virus. These interventions, which include national lockdowns,

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closure of nonessential workplaces and schools, and limiting of daily movement and social gatherings, have disrupted day-to-day activities. The spikes of the COVID-19 cases due to the delta and omicron variants forced many countries considered highly successful in containing the spread of the virus to reintroduce tough measures to restrict movement and social interactions.

Although these measures are targeted at minimizing deaths and adverse health impacts from contracting COVID-19 (Flaxman *et al.*, 2020; Hsiang *et al.*, 2020), many policy-makers and researchers are concerned about other potential consequences on human well-being. Specifically, the economic repercussions have been dire, with the collapse of economic activity pushing many economies into recession. Several studies have documented significant declines in spending and labor market outcomes measured by employment and wages (Baker *et al.*, 2020; Chen *et al.*, 2020; Forsythe *et al.*, 2020; Kim *et al.*, 2022). In addition to economic costs, these social distancing measures can have negative impacts on cognitive well-being and mental health by increasing anxiety, depression, stress and other negative emotions (Brooks *et al.*, 2020; Holmes *et al.*, 2020). As such, there are urgent calls to consider the impact of COVID-19 on people's psychological well-being.

In this paper, we study the impact of COVID-19 on the well-being of middle-aged and older Singaporeans. COVID-19 can affect well-being through the following channels: (i) trauma and isolation and (ii) economic losses. For the former channel, the literature has focused on the well-being effects through large-scale human and natural disasters. For example, Galea *et al.* (2002), Neria *et al.* (2007) and Clark *et al.* (2020) document that the September 11 World Trade Center terrorist attacks, Hurricane Ike and the 2013 Boston marathon bombing, respectively, increased the incidence of depression, post-traumatic stress disorders, and a broad range of mental and behavioral disorders, and reduced subjective well-being (SWB). Hawryluck *et al.* (2004) and Liu *et al.* (2012) show that the severe acute respiratory syndrome in 2003 resulted in poorer mental health among individuals subjected to quarantine, with effects persisting up to three years onward. For the latter channel, the literature examined the impact of recessions and business cycles on well-being. Extensive research has shown that economic downturns are harmful for health (Janke *et al.*, 2020), mental health (Engelberg and Parsons, 2016; Avdic *et al.*, 2020) and life satisfaction (Di Tella *et al.*, 2003; Luechinger *et al.*, 2010).[1] However, these economic shocks have not been accompanied by a global health crisis and social isolation and, thus, it is likely that the well-being impact of COVID-19 would differ from that of recessions.

Unsurprisingly, a rapidly emerging international literature suggests that the relationship between COVID-19 and lockdown measures and well-being is not straightforward. Studies find that the pandemic has had negative effects on mental health in the UK, Japan and New Zealand, and has resulted in a high frequency of internet searches for terms associated with mental health in Europe and the US (Banks and Xu, 2020; Sibley *et al.*, 2020; Brodeur *et al.*, 2021; Yamamura and Tsutsui, 2021, 2022). Other studies find that, while well-being and mental health dipped following the initial spread of the pandemic, the implementation

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[1] We acknowledge that Ruhm (2000) shows that recessions can be potentially good for health.

of lockdowns has resulted in improvements. For example, Foa *et al.* (2020) document a worsening of mood states (e.g., the experience of happiness, sadness and loneliness) and life satisfaction following the COVID-19 outbreak in the UK, with both these well-being measures returning close to their pre-pandemic baseline levels a month after the lockdown. These findings are consistent with evidence from Switzerland and France (Brülhart and Lalive, 2020; Recchi *et al.*, 2020).

Classical theories on the science of happiness and well-being postulate that external factors and major life events, such as marriage, disability and death of a loved one, should only have short-term effects on people's SWB (see Luhmann and Intelisano, 2018 for a review). People adapt to changes in their life circumstances through a process of *hedonic adaptation* (Frederick and Loewenstein, 1999). While individuals' SWB can fluctuate in the short term, one's level of well-being often returns to a baseline or *set point* (Lykken and Tellegen, 1996). A currently active area of research is the attempt to understand whether people differ in the degree to which they adapt to changes in their lives, and whether these differences are explained by individuals' circumstances such as changes in an economic situation through unemployment and income loss, and personality traits (e.g., Diener *et al.*, 2006; Clark *et al.*, 2008). The existing body of evidence has arrived at largely mixed results (Luhmann and Intelisano, 2018). On the subject of the COVID-19 pandemic, a study of affective well-being in a sample of German subjects examined if well-being is affected differently depending on individuals' personality traits and finds that individuals with higher neuroticism expressed more negative perceptions to COVID-19 restriction while those with high openness to experience have more positive perceptions (Schmiedeberg and Thönnissen, 2021).

In this study, we provide novel evidence of how COVID-19 affected life satisfaction over the first 18 months after its outbreak, using monthly longitudinal data of a nationally representative sample of middle-aged and older Singaporeans aged 55–75. The experience of Singapore, which is one of a few countries that has successfully managed the COVID-19 pandemic, offers important insights into the effects of the pandemic on SWB. In response to rapidly escalating COVID-19 cases, a nationwide partial lockdown was imposed for two months from April to June 2020. After the ending of the lockdown in June 2020, the number of new COVID-19 cases gradually declined, reaching close to zero in November 2020 and has remained low until the increase in the middle of 2021 due to the delta variant. The country's success is in stark contrast with the situation in other parts of the world, which experienced subsequent waves of infections. The Singapore experience permits us to study not only how the overall well-being of individuals is affected by the implementation of the lockdown, but also examine the short- and mid-term dynamics of recovery in well-being in the context of a post-lockdown environment where COVID-19 is controlled in a sustained manner.

Our study uses data from the Singapore Life Panel (SLP). The SLP offers a number of advantages over existing data collections when studying the well-being impact of COVID-19. The SLP has information on life satisfaction measures collected on a monthly basis prior to and during the pandemic. This is critical for assessing how individuals' life satisfaction has evolved over the pandemic timeframe. There are a number of new

longitudinal studies collecting information on mental health and well-being (e.g., COVID-19 Social Study by researchers at University College London), but these began only after the pandemic started. Existing cohort studies, such as the Understanding Society in the United Kingdom and the German Socio-Economic Panel, have added new questions to collect information relating to COVID-19, although data immediately prior to the pandemic outbreak are not often available due to the infrequent nature of the survey collection. In addition, because the SLP is an internet-based survey, participation has not been interrupted by the pandemic as with the experience of face-to-face surveys.

Detailed information on the characteristics of individuals and households in the SLP allows us to examine heterogeneity in the impact of the pandemic on individuals' SWB along with a number of dimensions. In particular, the rich data on individuals' economic circumstances permit us to study well-being changes among individuals who experience a loss of income versus those who do not. By doing so, we are able to evaluate the relative importance of the impact of economic and noneconomic factors on well-being. We also assess if the initial effect of the lockdown, and the rate of adaptation to life under the pandemic, differ by personality traits. Singapore's experience with the pandemic, coupled with rich longitudinal data from the SLP, provides ideal conditions for a study of whether individuals adapt to 'living with COVID-19'. Strict restrictions imposed under the lockdown of April 2020 were gradually eased in phases over the course of the year into a new "COVID normal" phase of life by the beginning of 2021. While most day-to-day activities had resumed, a host of restrictions, including mask wearing, social distancing and significant curtailment of international travel remained, with the threat of the pandemic close to people's minds as the virus rages on in many parts of the world. The SLP is an ideal dataset for a study of hedonic adaptation to COVID-19 given that SWB is measured monthly from the same individual, both prior to and after the pandemic started. However, we acknowledge that our empirical analyses are mainly descriptive and limited in investigating the causal determinants of the life satisfaction changes during the COVID-19 pandemic and their relative importance.

The remainder of this paper is structured as follows: Section 2 provides an overview of the COVID-19 situation in Singapore. Section 3 presents our data and Section 4 discusses our empirical strategy. Section 5 discusses the results and we conclude in Section 6.

2. Background on COVID-19 in Singapore

As of August 23, 2021, Singapore (total population of 5.7 million) recorded 66,478 COVID-19 positive cases. Figure A.1 Panels (A) and (B) show the trends of confirmed COVID-19 cases and deaths, respectively. The first COVID-19 case in Singapore was confirmed on January 23, 2020. After confirming a few more cases, the government implemented border restrictions, meticulous contact tracing and self-quarantine procedures. Despite the government's extensive efforts, the number of confirmed cases exploded in April 2020 due to undetected contagion in the high-density dormitories of low-wage migrant workers. As a result, the Singapore government imposed a set of nationwide partial lockdown policies, called the circuit breaker (CB), from April 7 to June 1, 2020.

During the CB period, citizens were not allowed to have social gatherings, and workers in services deemed nonessential by the government were required to work from home. Schools were also closed. Only services considered essential, such as healthcare (excluding nonurgent care), transportation, restaurants (delivery and take-away orders) and groceries, could operate during this period. To mitigate the economic shocks caused by the COVID-19 pandemic, the Singapore government provided several income support measures similar to those of the US CARES Act, such as direct wage subsidies, cash transfers and unemployment benefits (Kim *et al.*, 2022).

The measures imposed under the CB were gradually relaxed from June 2020 onwards under a three-phase approach. Under Phase 1, which occurred from June 2 to June 18, 2020, workers in settings where the risk of transmission is low were allowed back onsite, and selected nonessential services (e.g., hairdressing, vehicle repairs) were allowed to resume. For schools, in-person learning resumed for students of graduating cohorts while other cohorts are required to alternate between home- and school-based learning. Social and family interactions remained significantly curtailed, with households allowed a maximum of two familial visitors a day.

Restrictions on social, economic and leisure activities were further relaxed under Phase 2 which was in place for over six months from June 19 to December 27, 2020. Social gatherings were permitted with a cap of five people and schools were fully reopened. Businesses (e.g., retail and restaurants), religious organizations and social and community institutions (e.g., libraries and clubs) were allowed to resume operations but are required to adhere to capacity restrictions. The third phase (Phase 3) came into effect on December 28, 2020. This phase marks a 'new normal' phase of life in Singapore with the resumption of all day-to-day activities, although there remained some restrictions on capacity limits and gathering sizes, as well as the continuing need for masks and social distancing. Vaccination for COVID-19 commenced in early January 2021 and by the end of June 2021, 37% of the Singapore population was fully vaccinated, while 57% had received at least one dose of the vaccine.

The number of new COVID-19 infections has remained low since the lockdown was lifted in April 2020. From May 2021, restrictions were re-imposed as new infections, including a novel strain of the virus, emerged in the community which was likely brought in by overseas travelers. Restrictions under Phase 2 were re-imposed on May 2, followed by further tightening measures introduced from mid-May to July 2021. A unique aspect of the COVID-19 pandemic in Singapore is the country's low-mortality rate. The COVID-19 case-fatality rate has been about 0.07% (49 deaths). This is likely because most confirmed cases in Singapore for much of 2020 have been among migrant workers from developing countries, who are mostly young and healthy.

3. Data

The SLP is a nationally representative monthly longitudinal survey of Singapore residents mainly aged 50–70 years at the time of the survey's commencement in July 2015 (now aged 55–75). We use the survey data from July 2017 to June 2021. Survey response rates

are high since the survey commenced and through the period of the pandemic (waves 54–72). After the initial drop in the number of respondents from the original baseline cohort (wave 0), the sample is remarkably stable with around 7500 respondents completing the survey each month (Figure A.2).

Since the severity of the pandemic has quickly evolved, the high-frequency nature of the data enables us to investigate how the pandemic relates to changes in individuals' life satisfaction. The outcome variables we study are overall life satisfaction, which is measured through the following question: "Taking all things together, how satisfied are you with your life as a whole these days?" Respondents rate their overall life satisfaction on a five-point scale from "very dissatisfied", "dissatisfied", "neither satisfied nor dissatisfied", "satisfied" and "very satisfied". We treat this as a cardinal variable, assigning a value of one to "very dissatisfied" and five to "very satisfied". The SLP also provides information regarding domain-specific life satisfaction measured via the question: "How satisfied are you with your (i) social contacts and family life, (ii) overall economic situation, (iii) daily activities and job (if working), (iv) total household income and (v) health?" As with overall life satisfaction, respondents provide their responses to domain-specific life satisfaction on a five-point scale. In August 2020, the SLP survey was refreshed and some domain-specific satisfaction questions were no longer asked in the same form except for satisfaction with the overall economic situation.[2] Therefore, in our baseline analyses, we mainly focus on tracking respondents' overall life satisfaction and utilize information on domain-specific life satisfaction for supplementary analysis in the Appendix.

To account for the ordinal nature of life satisfaction variables, as a robustness check, we use a heteroskedastic ordered probit method, following Chen *et al.* (2019). In addition, we use a binary indicator variable for whether a respondent's response to the life satisfaction question is "satisfied" or "very satisfied".

We control for individuals' time-invariant characteristics by including individual-fixed effects in the regression analysis. Additionally, we control for time-varying characteristics such as age, age squared, marital status (married or not) and the number of household members. However, we do not include other time-varying characteristics, such as income and employment status, because these variables can potentially be affected by COVID-19. Table 1 presents the summary statistics of our study sample as of January 2020. On average, our sample respondents are 63.2 years old; 41% and 35% have completed secondary and tertiary education, respectively; 87% are ethnic Chinese, and 79% are married. The average number of children is 2.92, and the average household size is 2.56.

In wave 49 (July 2019) of the survey, personality traits were assessed using a 44-item version of the Big Five Inventory (John *et al.*, 1991). Respondents were asked to indicate how well each of the 44 adjectives describes them and indicates their response on a five-point scale, from 1 (*disagree strongly*) to 5 (*agree strongly*). We followed the scoring

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[2]For example, the questions on life satisfaction with regard to total household income and daily activities were dropped. The other domain-specific life satisfaction questions were significantly revised. For example, the life satisfaction question regarding social contacts and family life was divided into three separate questions regarding (1) marriage, (2) children and (3) friends and relatives. These revised questions were transformed to a six-point Likert scale instead of a five-point scale.

Table 1. Summary Statistics

Variables	Mean (SD)
Individual characteristics	
Age	63.2 (6.48)
Completed secondary education	0.41 (0.49)
Completed tertiary education	0.35 (0.48)
Ethnic Chinese	0.87 (0.34)
Married	0.79 (0.41)
Number of children	2.92 (1.15)
Household size	2.56 (1.39)
Big 5 personality traits	
Extraversion	3.06 (0.54)
Agreeableness	3.74 (0.61)
Conscientiousness	3.61 (0.60)
Neuroticism	2.79 (0.64)
Openness	3.12 (0.51)
Life satisfaction measures	
Overall life satisfaction	3.48 (0.76)
Social contacts and family life satisfaction	3.55 (0.72)
Overall economic satisfaction	3.23 (0.85)
Total household income satisfaction	3.23 (0.85)
Daily life and job satisfaction	3.42 (0.78)
Health satisfaction	3.38 (0.84)
Observations	7815

Notes: Statistics are calculated based on the January 2020 SLP wave. The Big 5 personality traits are measured in July 2019.

approach outlined in John *et al.* (2008) by reverse coding the appropriate items and calculating the average of the scores for each Big Five domain. Scores were calculated such that a higher score reflects a higher level of a given personality domain. The internal reliability scores (Cronbach's alphas) in the full sample are 0.69 for extraversion, 0.82 for agreeableness, 0.81 for conscientiousness, 0.79 for neuroticism and 0.79 for openness. These are satisfactory high (>0.7) for the sample of older Singaporeans in the SLP. Table 1 shows the mean and standard deviation (SD) of Big 5 personality traits. Average scores range from 2.8 to 3.7 with the SDs of 0.5–0.6.

4. Empirical Strategy

To study the impact of the COVID-19 outbreak on life satisfaction, we first estimate changes in life satisfaction measures between July 2019 and June 2021. We use January 2020 as the reference month, as Singapore's first case was confirmed on January 23, 2020. To implement this research design, we estimate the following event-study design

specification:

$$y_{i,t} = \beta_0 + \sum_{k \neq \text{Jan}} \beta_k \text{Month}_k + X'_{i,t}\gamma + \omega_t + \lambda_i + \epsilon_{i,t}, \tag{1}$$

where $y_{i,t}$ represents the self-reported measure of life satisfaction of individual i in month t. Month$_k$s are dummy variables indicating whether the survey month is k other than January 2020. $X_{i,t}$ includes the above-mentioned control variables. ω_t represents wave dummies. λ_i denotes individual time-invariant fixed effects. β_ks are the parameters of interest, which capture the impact of COVID-19 on life satisfaction in each month evaluated against the average of the life satisfaction measure in January 2020. For statistical inference, we calculate standard errors clustered at the individual level.

The key identification assumption of the event-study design approach is that COVID-19 is the primary factor causing changes in life satisfaction measures. To indirectly test this assumption, we examine if the parameters β_ks, where k refers to the months prior to January 2020, are close to zero in magnitude and statistically insignificant. To strengthen our causal interpretation, we also estimate Equation (1) using data from July 2017 to June 2019 to investigate whether there were significant changes in life satisfaction before COVID-19 occurred. In addition, we examine the presence of a parallel trend between July 2019–January 2020 and July 2017–January 2019 to test the validity of the key identification assumption. Lastly, as a sensitivity check, we estimate the well-being analysis using a difference-in-differences (DiD) framework. This approach permits us to formally test the presence of differential pre-trends.

5. Results

5.1. *Effects of COVID-19 on SWB*

Figure 1 presents the trends in overall life satisfaction of older Singaporeans. To demonstrate the effect of COVID-19 on individuals' well-being, we show the average well-being score for each month from July 2019 to June 2021, given by full black dots. Assessing the presence of pre-trends, we note that in the eight months (from July 2019 to February 2020) leading up to the imposition of the lockdown, while there are month-to-month fluctuations in well-being, mean well-being overall is relatively flat.[3] We also show individuals' well-being scores observed in the pre-COVID-19 period, from July 2017 to June 2019, for comparison (hollow dots). Here, we find a gradual downward trend in overall life satisfaction over the 24 months in the pre-COVID-19 period. The decline is small, with the magnitude of reduction being less than 5% of one SD of life satisfaction score (Table 1).

From March 2020 onwards, mean overall life satisfaction score fell sharply compared with levels in the preceding months. Life satisfaction is the lowest in April and May 2020, following the implementation of the nationwide lockdown on April 6. Overall life satisfaction begins to gradually recover once the eight-week lockdown is lifted on June 2 and

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[3] This is confirmed in Figure 2, where one observes that the coefficient estimates (in black) for the months of July 2019 to December 2020 are not significantly different (at 95% level) from that in January 2020.
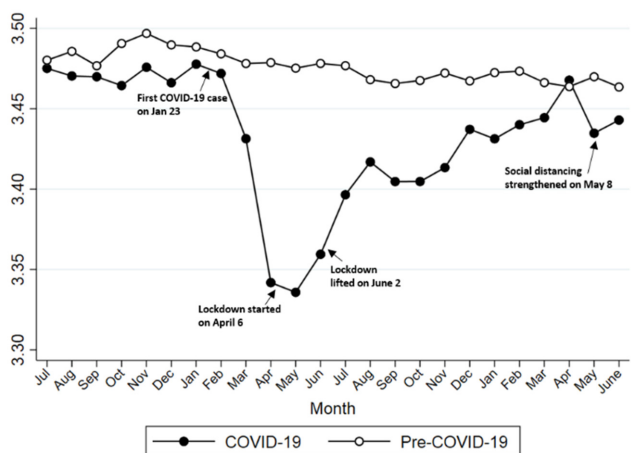
Notes: COVID-19 denotes the period from July 2019 to June 2021. Pre-COVID-19 denotes the period from July 2017 to June 2019.

Figure 1. Trends of Overall Life Satisfaction

continues to recover as restrictions are relaxed over the months that followed. The dynamic patterns observed between 2020 and 2021 starkly contrast with the overall life satisfaction trends two years prior to the COVID-19 outbreak, represented by the line with hollow dots. We observe similar patterns to Figure 1 when using a binary indicator that self-reported overall life satisfaction is either satisfied or very satisfied as an alternative dependent variable (see Figure A.3).

The end of December 2020 marked a new 'COVID normal' phase of life with the initiation of Phase 3 restrictions where day-to-day activities fully resumed, albeit with some restrictions including mask wearing, social distancing and border control. In the following four months, individuals' well-being improved and reverted to its pre-pandemic level in April 2021. However, the overall life satisfaction fell again as the government reintroduced stronger social distancing measures on May 2, 2021 following the sudden increase in the number of new infections due to the delta variant.

In Figure 2, we present the event-study design estimates of the effects of COVID-19 on overall life satisfaction using Equation (1). It shows the estimated change in overall life satisfaction from July 2019 to June 2021 (black squares) and July 2017 to June 2019 (red circles), respectively. These changes are evaluated against the difference in January 2020 and 2018, respectively, with 95% confidence intervals. The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period. Consistent with the general patterns shown in Figure 1, the black squares indicate that COVID-19 has resulted in a significant drop in overall life satisfaction levels. Mean overall life satisfaction score first fell by 0.05 points in March 2020, followed by sharp drops of 0.14 points in April and May that year. The magnitude of the drops in April and May 2020 corresponds to 0.18 of a SD of the life satisfaction score observed in January 2020. Following the end of the lockdown, life satisfaction sharply increased between June and
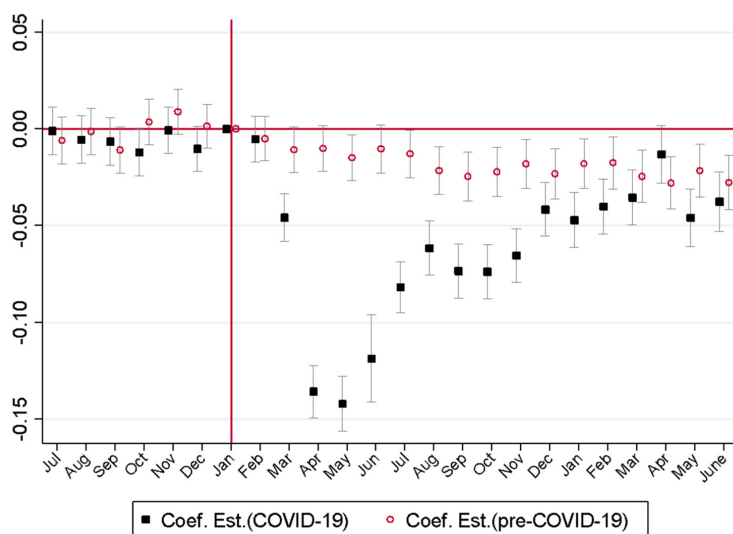
Notes: Black dots (red circles) represent coefficient estimates of the change in the corresponding life satisfaction measure evaluated against January 2020 (2018) using Equation (1) for the periods of July 2019–June 2021 (July 2017–June 2019). The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period. Caps indicate 95% confidence intervals.

Figure 2. (Color online) Effects of COVID-19 on Life Satisfaction with Overall Life

August, but still remains about 0.08 points lower compared with the average score of overall life satisfaction in January 2020.

In the months that followed, individuals' well-being gradually recovered, to a level marginally below its pre-pandemic level in April 2021. The results indicate that older Singaporeans have nearly fully adapted to living with the virus 17 months after its emergence. With the reintroduction of social distancing measures in May 2021, the overall life satisfaction decreased by 0.05 and 0.04 points in May and June 2021, respectively (Table 2).

To assess if our empirical framework supports a causal interpretation, we plot in Figure 2 the event study estimates for the pre-pandemic period of July 2017 to June 2019. These estimates, given by the red circles, show that there had not been sharp changes in overall life satisfaction over this period, which supports our causal interpretation. As an additional sensitivity check, we re-estimated the analysis on overall life satisfaction using a DiD framework. The DiD estimates in Figure A.4 indicate that the pre-trends are indeed parallel. Furthermore, we obtain estimates of changes in well-being that are of quantitatively similar magnitudes compared with those from the event-study framework.

In Panels (A)–(E) of Figure A.5, we present the estimated effects of COVID-19 on domain-specific life satisfaction. We show the domains of (i) overall economic situation, (ii) daily activities and job (if working), (iii) social contacts and family life, (iv) health and (v) total household income, as dependent variables. Our results reveal that most domain-specific life satisfaction measures demonstrate similar patterns compared with overall life

satisfaction up to July. For example, satisfaction with social contacts and with daily activities both drop by approximately 0.17 points, with the magnitude of the drops corresponding to 0.23 and 0.22 of the SD of their respective scores in January 2020. Compared with the other domains, satisfaction with household income appears the least affected, dropping by 0.10 points in May 2020 (0.12 SD).

As shown in Panel (A), individuals' satisfaction with their economic situation continues to improve from August onwards. By December 2020, six months from the end of lockdown, individuals' satisfaction with their economic situation had reverted to its pre-pandemic levels. It is notable that satisfaction with one's economic situation reverted to, and even exceeded its baseline level after the ceasing of lockdown, while overall life satisfaction remained persistently lower.

Although the COVID-19 pandemic has resulted in widespread mortality and morbidity worldwide, we find little evidence that the pandemic decreased individuals' satisfaction with health (Panel (D), Figure A.5). This result is consistent with the effect on self-reported health status as shown in Figure A.6. Although health satisfaction data are not available after July 2020, we expect that satisfaction with health would remain similarly unaffected as the pandemic draws out. This is because satisfaction with health tracks individuals' self-reported health status closely and the latter has not been significantly affected by the pandemic. These findings may reflect both the low COVID-19 fatality rate (0.07%) and the low rate of community transmission in Singapore. Hence, the perceived health risk among those who have not been infected might also be low. Taken together, our results indicate that changes in overall life satisfaction during the peak period in April and May 2020 are likely due to changes in social activities and economic situations. However, the persistently lower level of overall life satisfaction five months out from the end of lockdown indicates that social distancing measures, which have been less stringent following the end of the lockdown, continue to negatively affect the well-being of older Singaporeans.

To account for the ordinal nature of the original life satisfaction variable, we re-estimate Equation (1) using the heteroskedastic ordered probit model following the recommendation of Chen *et al.* (2020). These regression results reported in Table A.1 are similar to those in Table 2, implying that the baseline results are robust to an alternative estimation method. In addition, we use binary indicators that self-reported overall life and domain-specific satisfaction are either satisfied or very satisfied. Figure A.7 shows that the patterns of event-study estimates and statistical inferences remain robust when using the alternative dependent variable.

5.2. *Heterogeneous effects*

We further investigate if COVID-19 negatively affects the well-being of specific subgroups in our sample. The results showing the heterogeneous effects of COVID-19 on overall life satisfaction are reported in Figure 3, with the regression results reported in Table A.2. The vertical line indicates January 2020.

Table 2. Effects of COVID-19 on Life Satisfaction Measures

Dep. Vars.:	(1) Overall Life Satisfaction	(2) Overall Economic Satisfaction	(3) Total Household Income Satisfaction	(4) Daily Life and Job Satisfaction	(5) Social Contacts and Family Life Satisfaction	(6) Health Satisfaction
Jul-19	0.003	0.004	0.007	0.008	−0.004	0.001
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Aug-19	−0.001	−0.004	0.006	0.009	−0.001	0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Sep-19	−0.004	−0.008	−0.006	0.002	−0.005	0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Oct-19	−0.008	−0.008	0.001	0.001	−0.003	−0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Nov-19	0.007	−0.002	0.003	0.006	0.004	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Dec-19	−0.006	−0.007	−0.003	−0.006	−0.007	−0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Jan-20 (reference period)						
Feb-20	−0.002	−0.009	0.002	−0.007	0.001	0.012**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Mar-20	−0.044***	−0.056***	−0.023***	−0.046***	−0.036***	−0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Apr-20	−0.136***	−0.133***	−0.075***	−0.130***	−0.121***	0.004
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
May-20	−0.140***	−0.141***	−0.096***	−0.176***	−0.172***	0.005
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)
Jun-20	−0.112***	−0.116***	−0.080***	−0.142***	−0.143***	0.014**
	(0.009)	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)
Jul-20	−0.080***	−0.092***	−0.058***	−0.094***	−0.078***	−0.008
	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Aug-20	−0.061***	−0.033***				
	(0.007)	(0.007)				
Sep-20	−0.071***	−0.036***				
	(0.007)	(0.007)				
Oct-20	−0.070***	−0.014*				
	(0.007)	(0.007)				
Nov-20	−0.066***	−0.007				
	(0.007)	(0.007)				
Dec-20	−0.041***	0.010				
	(0.007)	(0.007)				
Jan-21	−0.047***	0.017**				
	(0.007)	(0.007)				

Table 2. (*Continued*)

Dep. Vars.:	(1) Overall Life Satisfaction	(2) Overall Economic Satisfaction	(3) Total Household Income Satisfaction	(4) Daily Life and Job Satisfaction	(5) Social Contacts and Family Life Satisfaction	(6) Health Satisfaction
Feb-21	−0.041***	0.024***				
	(0.007)	(0.007)				
Mar-21	−0.035***	0.040***				
	(0.007)	(0.007)				
Apr-21	−0.015**	0.058***				
	(0.007)	(0.007)				
May-21	−0.045***	0.026***				
	(0.007)	(0.007)				
Jun-21	−0.037***	0.033***				
	(0.007)	(0.007)				
Observations	177,704	181,465	99,624	99,641	99,674	99,678
R-squared	0.759	0.789	0.827	0.761	0.763	0.819

Notes: Standard errors clustered at the individual level are reported in parentheses. Individual fixed effects are included. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

By income loss

The consequences of the COVID-19 pandemic on individuals' well-being are expected to be profound and multi-faceted due to isolation and disruptions arising from the lockdown, as well as concerns surrounding economic loss and health risks. Existing studies also have shown strong, positive associations between economic resources and well-being (Deaton, 2008), but the hedonic adaptation literature also argues that individuals upward adjust their expectations with improved economic circumstances (Brickman and Campbell, 1971). As such, we assess if households that experienced a loss of income during the COVID-19 outbreak suffer a larger drop in well-being compared with households that do not suffer a loss of income. To do this, we identify households that experience income loss as those whose monthly income in April 2020, the peak month of COVID-19, is less than that in January 2020.

Panel (A) of Figure 3 indicates that individuals who reported a drop in household income experience a decline in overall life satisfaction almost twice as large as those who do not report any income loss. It presents that in May 2020, a month into the lockdown, overall life satisfaction scores decreased by 0.19 points in the former group compared with 0.11 in the latter group. It also shows significant differences in the trajectories of the recovery of satisfaction as the pandemic persists. Although overall life satisfaction scores of both groups have rebounded after the end of lockdown, the gap in overall life satisfaction between the two groups has been persistent.
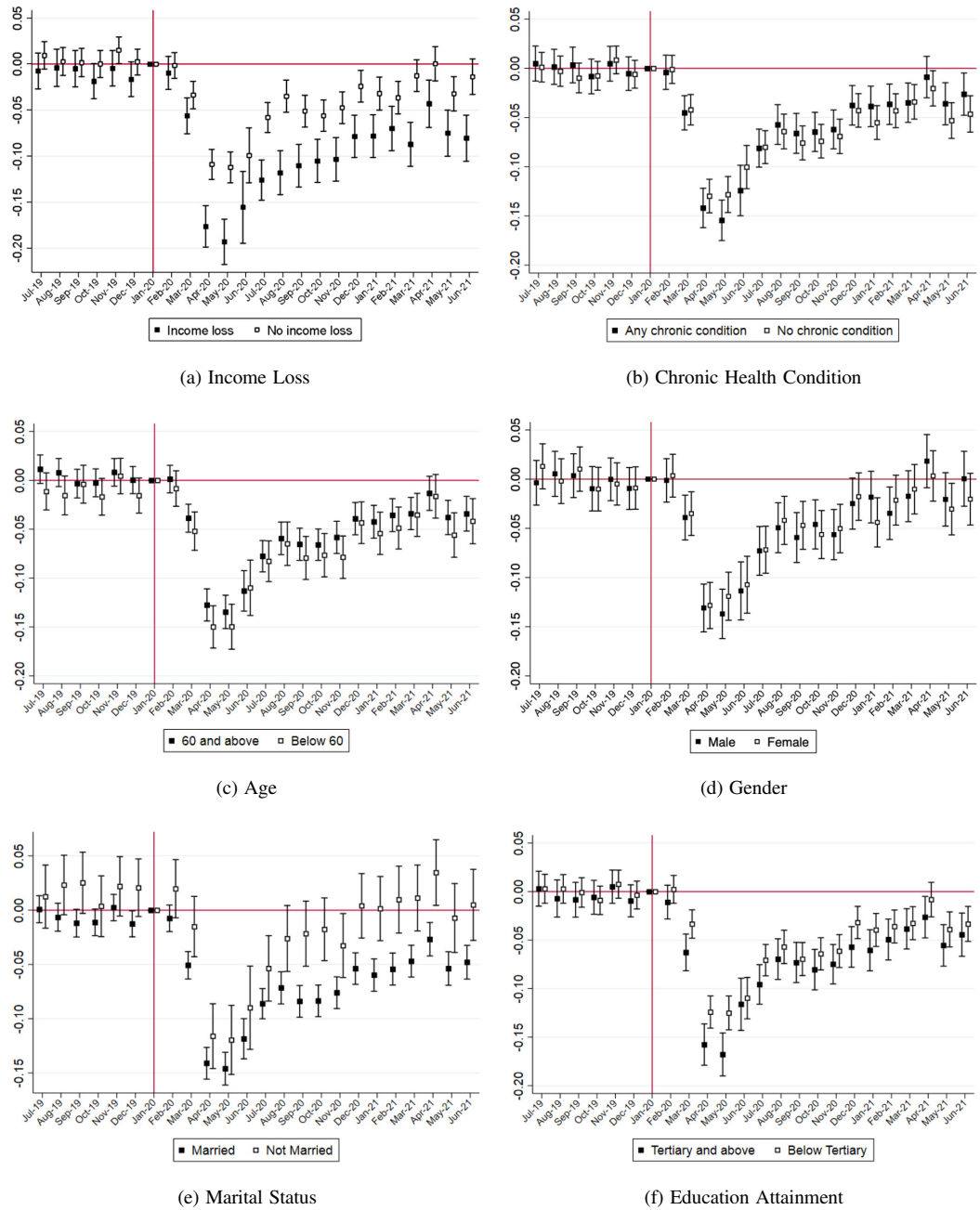
(a) Income Loss

(b) Chronic Health Condition

(c) Age

(d) Gender

(e) Marital Status

(f) Education Attainment

Notes: Squares represent coefficient estimates of the change in the overall life satisfaction score evaluated against January 2020 using Equation (1) for the period of July 2019–June 2021. The vertical line indicates January 2020. Caps indicate 95% confidence intervals.

Figure 3. Heterogeneous Effects of COVID-19 on Overall Life Satisfaction

By other characteristics

COVID-19 has induced serious health risks and social distancing measures could have caused significant challenges to interpersonal relationships. We assess if the dynamics of well-being changes vary by individuals' health status and age (proxies for the underlying health conditions), and marital status and education attainment (proxies for interpersonal relationships).[4]

First, individuals with underlying health conditions are known to be especially vulnerable to the virus. To examine the role of this potential risk, we assess if COVID-19 negatively affects the well-being of individuals in poorer health more than healthier individuals. As a measure of individuals' pre-pandemic health conditions, we construct a dummy variable indicating whether a person has any chronic health conditions (diabetes, heart problems, arthritis, hypertension, psychiatric problems, cancer or stroke) between January 2018 and January 2020. Panel (B) of Figure 3 indicates that there is no evidence that individuals with chronic health conditions suffer a larger drop in well-being.[5] The results remain similar when using age as an alternative proxy for the underlying health condition (Panel (C)). We find little evidence of heterogeneity by age groups (relatively younger individuals versus relatively older individuals).[6] We also do not find heterogeneous trends by gender in Panel (D).

Second, COVID-19 presents challenges to interpersonal relationships resulting from external stressors such as economic strain and job losses, resulting in poorer relationship quality and stability (Pietromonaco and Overall, 2021). We examine if COVID-19 affects married and unmarried individuals differently. Panel (E) shows that the overall life satisfaction of both married and unmarried individuals is similar, but unmarried ones recover more quickly. However, most respondents are married in the SLP data and, thus, most estimates for unmarried individuals are not precisely estimated. In the analyses by education attainment, Panel (F) indicates that individuals with less than tertiary education report a smaller dip in well-being during the initial lockdown compared to those with higher education levels. The dynamics of well-being recovery, on the whole, do not vary by education though well-being levels of individuals with below tertiary education exceeded their baseline levels by April 2021.

Collectively, our heterogeneity analyses suggest that the adverse economic shocks following the pandemic could be one of the main drivers of the drop in the self-reported well-being of middle-aged and older Singaporeans. It is noteworthy that life satisfaction levels also decrease among those who do not experience a drop in income, suggesting that other reasons, such as increased anxiety and stress associated with the curtailment of

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[4] We assess heterogeneity in SWB impact by education attainment to capture, in part, changes in employment circumstances such as the ability of respondents to continue working through the phases of the initial lockdown and subsequent restrictions.

[5] We also attempt to assess if there is a differential impact among individuals who report having been told they have psychiatric problems compared with those who have not. We have not presented these results as the number of individuals with psychiatric problems is too small (roughly 1% of the sample) resulting in estimates with large standard errors.

[6] We also consider alternative age cutoffs (65 and 70) but do not find evidence of heterogeneous patterns. We suspect that the lack of heterogeneous impacts by age, compared to existing studies from other countries, is partially due to the fact that the SLP is a cohort-based panel survey focusing on relatively narrow age bands.

movement and disruption in daily activities, play a large role in the decline in life satisfaction from the pandemic.

5.3. *Changes in SWB and personality traits*

We assess if the initial effect of the April 2020 lockdown, and the rate of well-being adaptation to life under the pandemic over the ensuing 18 months, differ by personality traits. To do this, we standardize the scores of each five personality traits by subtracting its sample mean value and dividing by the sample SD. We use the standardized scores to categorize our sample into four levels of each personality trait: *low* (−2 SD from the mean), *moderately low* (−1 SD), *moderately high* (+1 SD) and *high* (+2 SD), following the approach by Boyce and Wood (2011). We estimate Equation (1) for subsamples defined by each of the four levels of the five personality traits.

Figure 4 presents the event-study estimates of COVID-19 on overall life satisfaction by the personality traits (regression estimates in Table A.3). Each panel refers to a personality
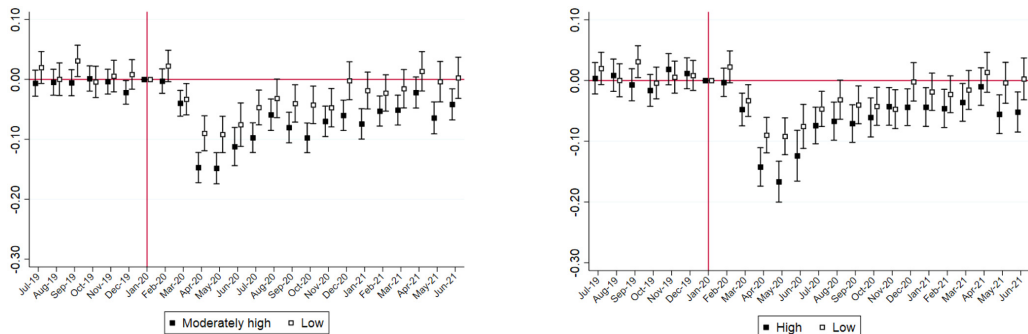

(a) Neuroticism

(b) Extraversion
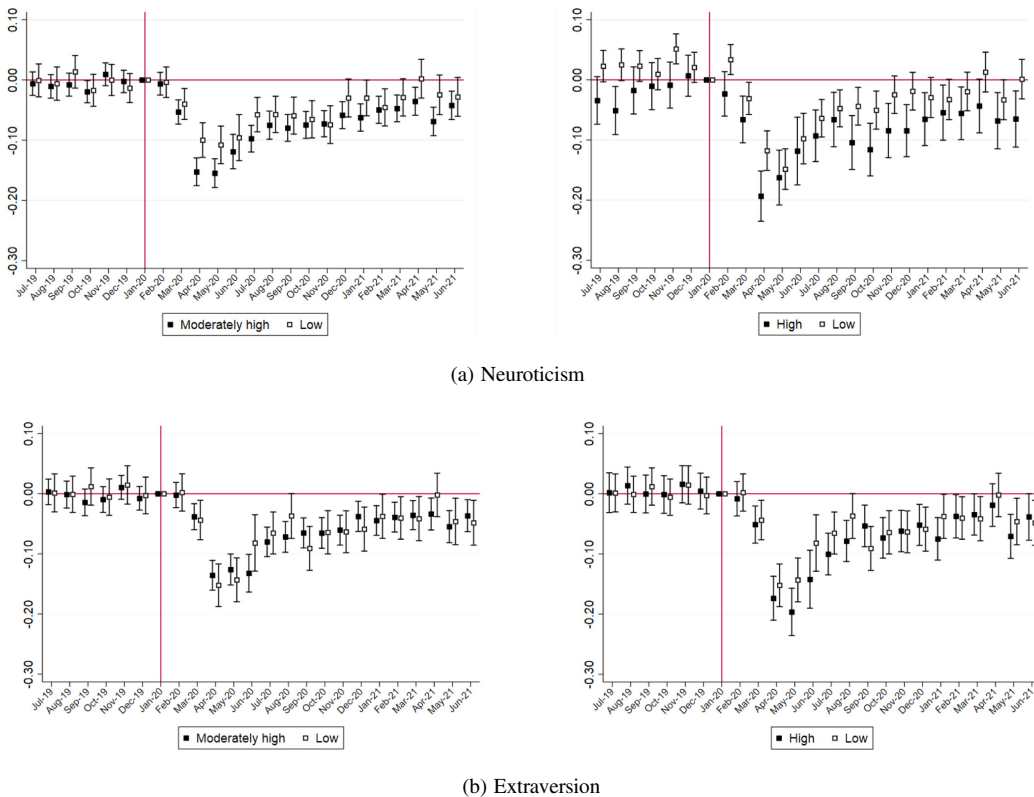
Notes: Moderately high and high levels of personality score refer to scores one and two SDs above the mean while a low level refers to a score of two SDs below the mean. Squares represent coefficient estimates of the change in the overall life satisfaction score evaluated against January 2020 using Equation (1) for the period of July 2019–June 2021. The vertical line indicates January 2020. Caps indicate 95% confidence intervals.
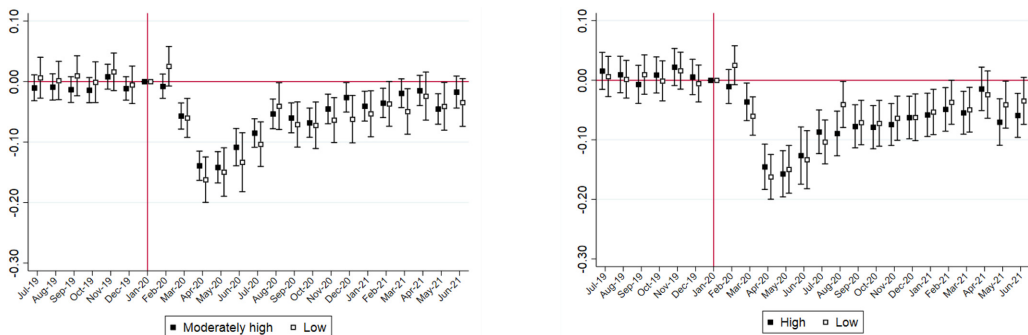
Figure 4. Changes in Overall Life Satisfaction and Personality Traits
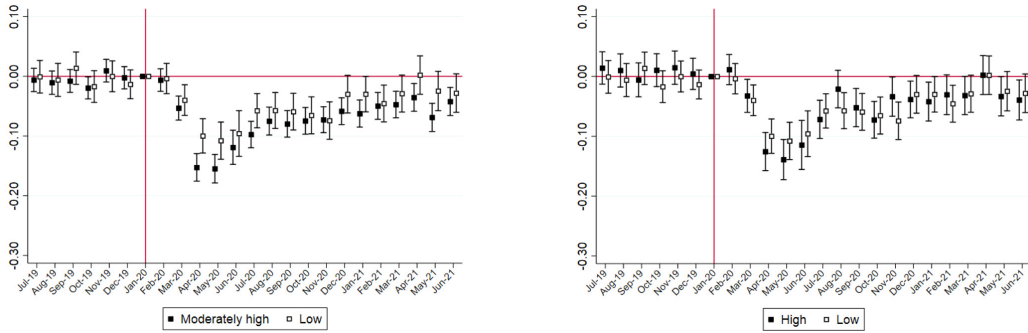
(c) Agreeableness

(d) Conscientiousness

(e) Openness

Figure 4. (*Continued*)

trait, from neuroticism in Panel (A) to openness in Panel (E). To allow comparisons across individuals with different personality levels, we compare the estimates from individuals with a low-personality score with those of a moderately high level and with those of a high level on the left and right panels, respectively. Two key patterns emerged from our analyses. We find that the magnitude of the drop in overall life satisfaction from the initial lockdown differs by individuals' personality traits. People who are high in neuroticism, moderately high and high conscientiousness and moderately high in agreeableness

experience a large dip in life satisfaction in the immediate months following the lockdown compared with those with the low level of personality traits.

However, the rate of adaptation to the pandemic is similar across personality types, with the exception of individuals with high neuroticism (right column in Panel (A) of Figure 4). While life satisfaction for these individuals gradually improved after the lockdown, well-being remained below its pre-pandemic level throughout 2021, whereas individuals with low neuroticism have fully adapted to the pandemic by April 2021. With the new restrictions imposed following the surge in cases in May 2021, people with high neuroticism and conscientiousness begin to demonstrate marginally larger dips in well-being compared with those with low-level traits.

6. Conclusion

How is people's SWB affected by COVID-19 lockdowns in Singapore? Do older Singaporeans adapt to living with COVID-19 in a country that has successfully managed the pandemic by balancing health and economic risks? We answer these questions using a unique, nationally representative longitudinal survey of older Singaporeans whose well-being is measured monthly prior to and over 18 months from the start of the pandemic. Using an event-study design that compares the same individuals before and after the pandemic across months, we document a large decline in overall life satisfaction during the imposition of a nationwide lockdown in April and May 2020. The magnitude of the drop in well-being from the lockdown is large, and the size of the declines is comparable to a drop in life satisfaction due to the occurrence of a major life event such as a major health shock or the death of a loved one (Luhmann *et al.*, 2012; Kettlewell *et al.*, 2020). Strict social distancing rules in Singapore had a large, adverse impact on individuals' well-being despite the country's success in keeping case-fatality rates among the lowest in the world.

We find that older Singaporeans have nearly, though not fully, adapted to a new "COVID normal" phase of life 18 months out from when the virus first emerged. Why and how does the adaptation to COVID-19 happen? It is possible that individuals adapt to the pandemic, much in the same way as they have found to have adapted to the occurrence of ill health and disability, marriage dissolution and unemployment, though the rate and degree of adaptation vary across different types of life events (Luhmann and Intelisano, 2018). One potential reason why adaptation occurs is that over time people would pay less attention to the changes in their lives and daily activities brought about by the pandemic: to be confronted with the health risks, the need for masks, of limiting one's interactions with family and friends, not being able to travel internationally. These restrictions, when first imposed, would have induced a strong emotional response as we have seen manifested in the large drops in well-being during the initial lockdown. Attention to these changes would have dissipated over time as people learn to live with the virus (Schkade and Kahneman, 1998; Wilson and Gilbert, 2008; Powdthavee, 2009).

How does the experience of senior Singaporeans compare with that internationally? In a longitudinal study of adults aged 50 years and older in 11 European countries using the

Survey of Health, Ageing and Retirement data, Van Winkle *et al.* (2021) observe that respondents were less likely to have reported experiencing feelings of depression in 2020 compared to 2017. The timing of the data collection was offered as an explanation for the surprising finding: respondents were interviewed in the summer of 2020, after lockdowns and restrictions were lifted in most European countries and hence the results could be driven by the relief felt by survey respondents following months of strict restrictions. Notwithstanding the frequency and timing of the two datasets, differences in welfare regimes, economic support measures and cultural contexts could also potentially account for the contrast between the European experience with that of Singapore. Two studies examining the effect of COVID-19 on life satisfaction among older individuals find that life satisfaction has remained stable or increased slightly in the early phases of the pandemic in Sweden and toward the end of the first wave in Germany (Wettstein *et al.*, 2021; Kivi *et al.*, 2021). Like ours, these studies find that COVID-19 has had heterogeneous effects, specifically effects that vary by respondents' level of worry, self-rated health and perceived standard of living.

Studies have shown that women's mental health and well-being have been more significantly impacted compared with men — see Thibaut and van Wijngaarden-Cremers (2020) for a recent review — as women bear a disproportionate share of the responsibility for child-rearing, managing their children's home-based learning and family caregiving on top of (remote) work commitments. Our study reveals that the well-being of senior women is not more affected by COVID-19 compared with men. One likely explanation for the difference is that our sample comprises older women who, on the whole, are less likely to be active in the labor force and hence are protected from uncertainties arising from work and income. Older women also play a different caregiving role, to elderly parents rather than young and school-going children.

Our findings on the presence of heterogeneous effects can guide policymaking in the design of nonpharmaceutical interventions, such as the scope, extent and timing of lockdown measures, to minimize the consequences of lockdowns on citizen well-being as well as on the economy (Layard *et al.*, 2020). A significant decline in overall life satisfaction among individuals who report a drop in household income highlights the importance of measures that offer economic support for households and businesses to assist in coping with the economic challenges brought about by the COVID-19 crisis. We also find that well-being is adversely affected even for individuals who manage to maintain their income during the pandemic. This finding suggests that economic measures must be accompanied by the introduction and expansion of health and psychological interventions to support well-being and reduce mental health risks. Further research is needed to understand the intermediate and long-term ramifications of COVID-19 on individuals' SWB. We acknowledge that the results of this study should be applied to other contexts or age groups with caution due to the low COVID-19 fatality rate in Singapore and the older nature of our sample population. Evaluating the external validity of our findings would be a fruitful avenue for future research.
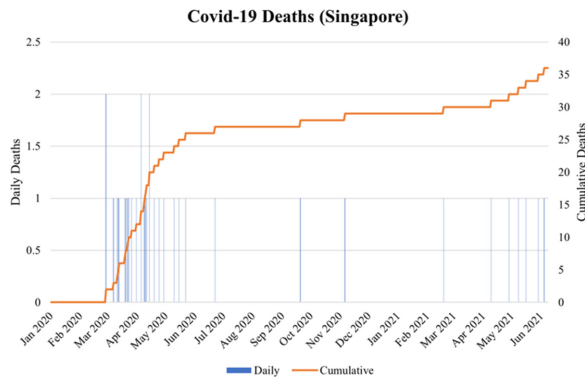
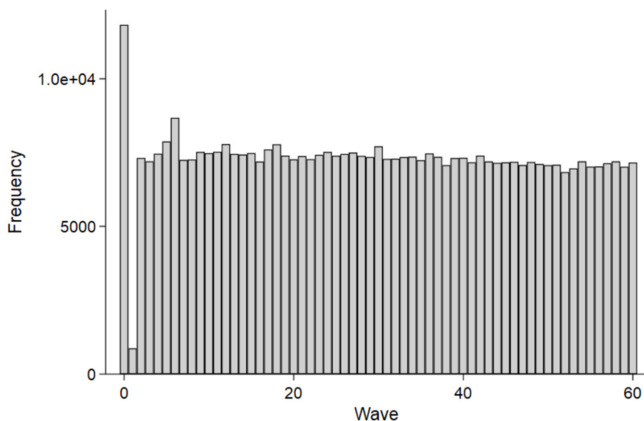## Acknowledgments

Appendix A
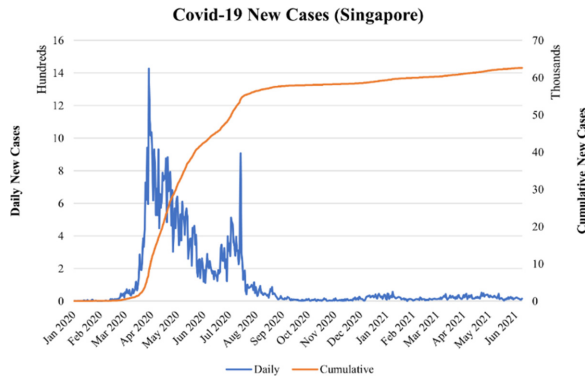
(a) Trend of COVID-19 Confirmed Cases


(b) Trend of COVID-19 Deaths

Source: Singapore Ministry of Health (2021).

Figure A.1. Trends of COVID-19 Infection and Deaths in Singapore

Notes: The figure shows the number of respondents for each monthly wave of the SLP. Wave 0 is the baseline survey that was in the field from May to July 2015. The baseline sample comprise of 11,827 respondents from 9101 households in the 50–70 years age category. Wave 1 is a pilot survey where only 1000 panel members were invited to participate; 873 respondents form the pilot sample.

Figure A.2. Frequency of Survey Respondents by Wave
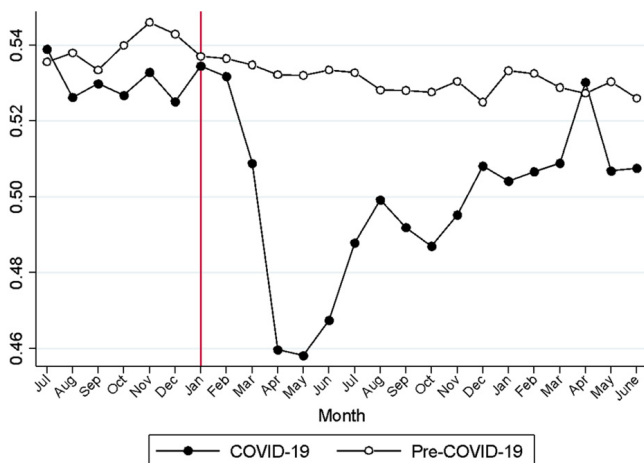
Notes: COVID-19 denotes the period from July 2019 to June 2021. Pre-COVID-19 denotes the period from July 2017 to June 2019. The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period.

Figure A.3. Trends of Overall Life Satisfaction Using the Probability of Satisfied or Very Satisfied with Overall Life
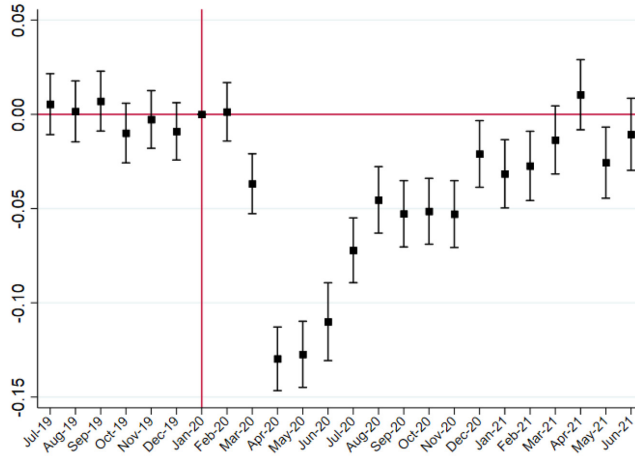
Notes: Black dots represent DiD estimates of the effects of COVID-19 on overall life satisfaction using the period of July 2019–June 2021 and the period of July 2017–June 2019 as the treatment and control groups, respectively. Caps indicate 95% confidence intervals.

Figure A.4. (Color online) DiD Estimates of Effects of COVID-19 on Life Satisfaction with Overall Life
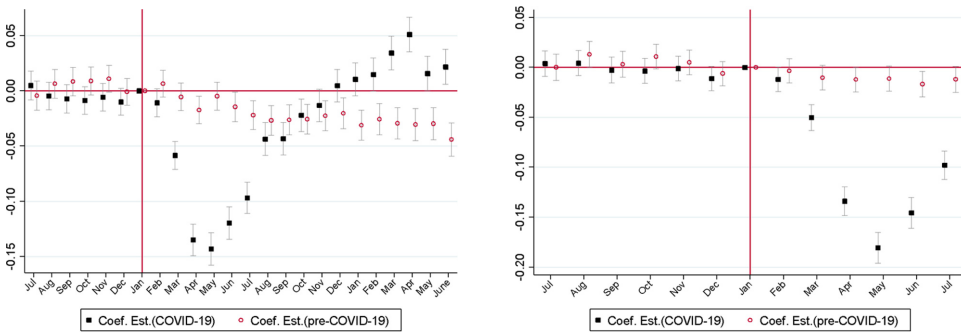
(a) Satisfaction with Overall Economic Situation   (b) Satisfaction with Daily Activities and Job (If Working)

Notes: Black dots (red circles) represent coefficient estimates of the change in the corresponding life satisfaction measure evaluated against January 2020 (January 2018) using Equation (1) for the periods of July 2019–June 2021 (July 2017–June 2019). The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period. Caps indicate 95% confidence intervals.

Figure A.5. (Color online) Effects of COVID-19 on Domain-Specific Life Satisfaction
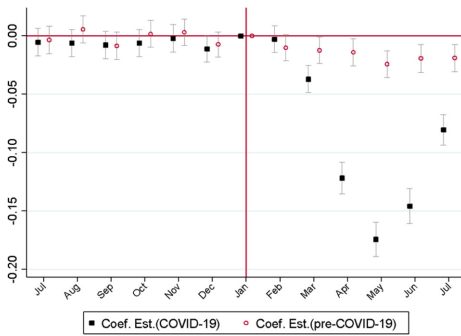
(c) Satisfaction with Social Contacts and Family Life
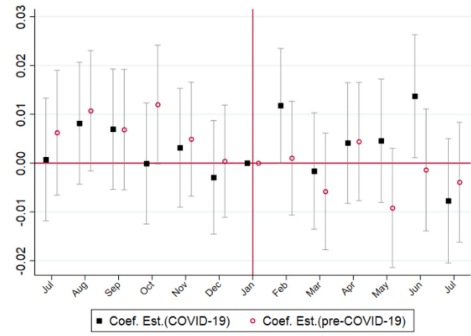
(d) Satisfaction with Health

(e) Satisfaction with Total Household Income

Figure A.5. (*Continued*)
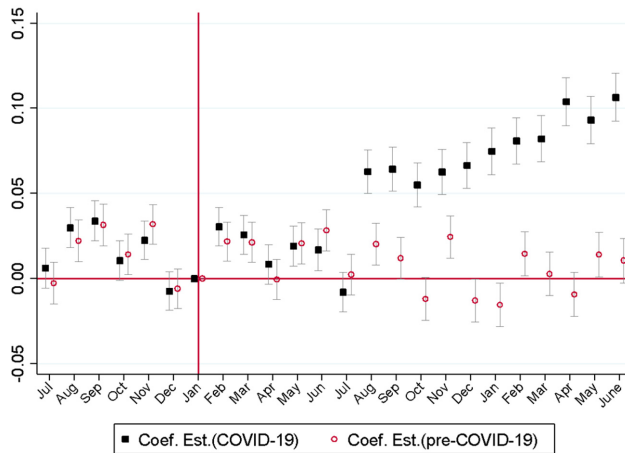
Notes: Squares represent coefficient estimates of the change in the overall health status score evaluated against January 2020 using Equation (1) for the period of July 2019–May 2021. The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period. Caps indicate 95% confidence intervals.

Figure A.6. Effects of COVID-19 on Self-Reported Health Status
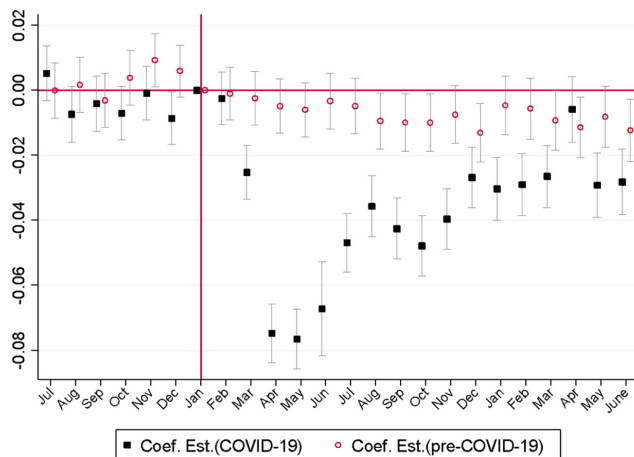
Notes: Squares represent coefficient estimates of the change in the probability of being satisfied or very satisfied with overall life evaluated against January 2020 using Equation (1) for the period of July 2019–May 2021. The vertical line indicates January 2020 for the post-COVID-19 period and January 2018 for the pre-COVID-19 period. Caps indicate 95% confidence intervals.

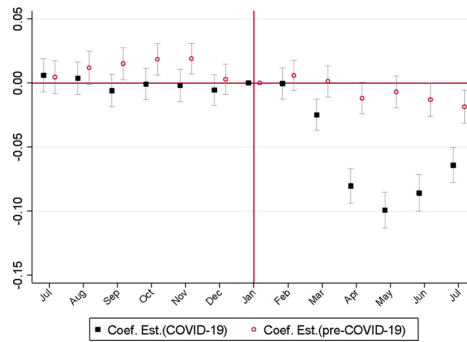Figure A.7. Effects of COVID-19 on Overall Life Satisfaction Using the Probability of Satisfied or Very Satisfied with Overall Life

Table A.1. Effects of COVID-19 on Life Satisfaction Measures Using Heteroskedastic Ordered Probit Model

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Vars.:	Overall Life Satisfaction	Overall Economic Satisfaction	Total Household Income Satisfaction	Daily Life and Job Satisfaction	Social Contacts and Family Life Satisfaction	Health Satisfaction
Jul-19	0.002	0.007	0.009	0.006	−0.006	−0.011
	(0.009)	(0.008)	(0.009)	(0.009)	(0.010)	(0.009)
Aug-19	−0.007	−0.005	0.006	0.005	−0.010	0.001
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Sep-19	−0.009	−0.008	−0.008	−0.004	−0.015	0.003
	(0.009)	(0.008)	(0.008)	(0.009)	(0.010)	(0.009)
Oct-19	−0.018**	−0.011	−0.003	−0.006	−0.013	−0.012
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Nov-19	0.000	−0.007	−0.003	−0.001	−0.007	−0.003
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Dec-19	−0.014*	−0.012	−0.006	−0.016*	−0.018**	−0.011
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)

Table A.1. (*Continued*)

Dep. Vars.:	(1) Overall Life Satisfaction	(2) Overall Economic Satisfaction	(3) Total Household Income Satisfaction	(4) Daily Life and Job Satisfaction	(5) Social Contacts and Family Life Satisfaction	(6) Health Satisfaction
Jan-20 (reference period)						
Feb-20	−0.009	−0.013	−0.001	−0.017*	−0.006	0.010
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Mar-20	−0.061***	−0.070***	−0.031***	−0.068***	−0.061***	−0.004
	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Apr-20	−0.178***	−0.156***	−0.093***	−0.178***	−0.173***	0.007
	(0.010)	(0.009)	(0.009)	(0.010)	(0.011)	(0.009)
May-20	−0.187***	−0.169***	−0.121***	−0.243***	−0.245***	−0.003
	(0.010)	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)
Jun-20	−0.157***	−0.137***	−0.099***	−0.192***	−0.199***	0.018*
	(0.016)	(0.009)	(0.009)	(0.011)	(0.012)	(0.009)
Jul-20	−0.109***	−0.114***	−0.079***	−0.136***	−0.120***	−0.008
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)
Aug-20	−0.083***	−0.053***				
	(0.010)	(0.010)				
Sep-20	−0.097***	−0.053***				
	(0.010)	(0.009)				
Oct-20	−0.098***	−0.026***				
	(0.010)	(0.009)				
Nov-20	−0.086***	−0.017*				
	(0.010)	(0.009)				
Dec-20	−0.052***	0.009				
	(0.010)	(0.010)				
Jan-21	−0.062***	0.011				
	(0.010)	(0.010)				
Feb-21	−0.050***	0.020**				
	(0.010)	(0.010)				
Mar-21	−0.047***	0.044***				
	(0.010)	(0.010)				
Apr-21	−0.012	0.068***				
	(0.011)	(0.010)				
May-21	−0.056***	0.025**				
	(0.011)	(0.010)				
Jun-21	−0.041***	0.032***				
	(0.011)	(0.010)				
Observations	177,704	181,465	99,624	99,641	99,674	99,678

Notes: Standard errors clustered at the individual level are reported in parentheses. Control variables include education attainments, age, age square, marital status and household size. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A.2. Heterogeneous Effects of COVID-19 on Overall Life Satisfaction by Individual Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Income Loss Status		By Chronic Health Conditions		By age		By Marital Status		By Education Attainment	
	Any Loss	No Loss	Yes	No	60 and Above	Below 60	Married	Not Married	Tertiary Educated	Below Tertiary
Jul-19	−0.009	0.008	0.005	0.001	0.011	−0.011	0.001	0.013	0.003	0.003
	(0.010)	(0.008)	(0.009)	(0.008)	(0.007)	(0.010)	(0.006)	(0.015)	(0.009)	(0.008)
Aug-19	−0.006	0.002	0.002	−0.003	0.008	−0.016	−0.006	0.023*	−0.007	0.003
	(0.010)	(0.008)	(0.009)	(0.008)	(0.007)	(0.010)	(0.007)	(0.014)	(0.010)	(0.008)
Sep-19	−0.011	0.002	0.003	−0.010	−0.003	−0.004	−0.012*	0.025*	−0.008	−0.001
	(0.010)	(0.008)	(0.009)	(0.008)	(0.007)	(0.010)	(0.007)	(0.014)	(0.009)	(0.008)
Oct-19	−0.018*	0.000	−0.008	−0.008	−0.003	−0.017*	−0.011*	0.004	−0.006	−0.009
	(0.010)	(0.007)	(0.009)	(0.007)	(0.007)	(0.010)	(0.006)	(0.014)	(0.009)	(0.008)
Nov-19	−0.005	0.014*	0.005	0.009	0.008	0.004	0.002	0.022	0.005	0.008
	(0.010)	(0.007)	(0.009)	(0.007)	(0.007)	(0.009)	(0.006)	(0.014)	(0.009)	(0.007)
Dec-19	−0.014	0.002	−0.005	−0.006	0.000	−0.016*	−0.013**	0.021	−0.010	−0.004
	(0.010)	(0.007)	(0.009)	(0.007)	(0.007)	(0.009)	(0.006)	(0.014)	(0.008)	(0.007)
Jan-20 (reference period)										
Feb-20	−0.009	−0.002	−0.004	−0.001	0.001	−0.008	−0.008	0.020	−0.011	0.002
	(0.009)	(0.007)	(0.009)	(0.007)	(0.007)	(0.009)	(0.006)	(0.014)	(0.009)	(0.007)
Mar-20	−0.054***	−0.032***	−0.045***	−0.042***	−0.039***	−0.052***	−0.051***	−0.015	−0.063***	−0.033***
	(0.010)	(0.008)	(0.009)	(0.008)	(0.007)	(0.010)	(0.006)	(0.014)	(0.010)	(0.007)
Apr-20	−0.174***	−0.109***	−0.142***	−0.130***	−0.127***	−0.150***	−0.141***	−0.116***	−0.158***	−0.124***
	(0.012)	(0.008)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.011)	(0.008)
May-20	−0.191***	−0.112***	−0.154***	−0.128***	−0.135***	−0.150***	−0.146***	−0.120***	−0.168***	−0.125***
	(0.013)	(0.009)	(0.010)	(0.009)	(0.009)	(0.012)	(0.008)	(0.016)	(0.011)	(0.009)

Table A.2. (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Income Loss Status		By Chronic Health Conditions		By age		By Marital Status		By Education Attainments	
	Any Loss	No Loss	Yes	No	60 and Above	Below 60	Married	Not Married	Tertiary Educated	Below Tertiary
Jun-20	−0.157***	−0.089***	−0.124***	−0.100***	−0.113***	−0.110***	−0.118***	−0.090***	−0.116***	−0.110***
	(0.015)	(0.011)	(0.013)	(0.011)	(0.011)	(0.014)	(0.009)	(0.020)	(0.014)	(0.011)
Jul-20	−0.121***	−0.056***	−0.081***	−0.080***	−0.078***	−0.083***	−0.086***	−0.054***	−0.096***	−0.071***
	(0.011)	(0.008)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.010)	(0.008)
Aug-20	−0.110***	−0.033***	−0.057***	−0.064***	−0.059***	−0.065***	−0.072***	−0.026*	−0.070***	−0.057***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.008)	(0.015)	(0.011)	(0.009)
Sep-20	−0.103***	−0.050***	−0.066***	−0.076***	−0.065***	−0.079***	−0.084***	−0.022	−0.073***	−0.070***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.011)	(0.009)
Oct-20	−0.100***	−0.054***	−0.065***	−0.074***	−0.066***	−0.077***	−0.084***	−0.018	−0.080***	−0.064***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.011)	(0.008)
Nov-20	−0.094***	−0.049***	−0.062***	−0.069***	−0.058***	−0.079***	−0.076***	−0.033**	−0.075***	−0.061***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.010)	(0.009)
Dec-20	−0.071***	−0.023***	−0.038***	−0.043***	−0.039***	−0.043***	−0.054***	0.004	−0.057***	−0.032***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.011)	(0.008)
Jan-21	−0.071***	−0.031***	−0.039***	−0.055***	−0.042***	−0.054***	−0.060***	0.001	−0.060***	−0.040***
	(0.012)	(0.009)	(0.011)	(0.009)	(0.009)	(0.011)	(0.008)	(0.015)	(0.011)	(0.009)
Feb-21	−0.062***	−0.031***	−0.036***	−0.043***	−0.036***	−0.049***	−0.054***	0.010	−0.049***	−0.036***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.009)	(0.011)	(0.008)	(0.016)	(0.011)	(0.009)
Mar-21	−0.080***	−0.011	−0.035***	−0.034***	−0.034***	−0.035***	−0.047***	0.011	−0.038***	−0.033***
	(0.012)	(0.009)	(0.010)	(0.009)	(0.008)	(0.011)	(0.007)	(0.015)	(0.011)	(0.009)
Apr-21	−0.042***	0.001	−0.009	−0.020**	−0.013	−0.016	−0.027***	0.035**	−0.026**	−0.008
	(0.012)	(0.009)	(0.011)	(0.009)	(0.009)	(0.011)	(0.008)	(0.015)	(0.011)	(0.009)

Table A.2. (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Income Loss Status		By Chronic Health Conditions		By age		By Marital Status		By Education Attainments	
	Any Loss	No Loss	Yes	No	60 and Above	Below 60	Married	Not Married	Tertiary Educated	Below Tertiary
May-21	-0.065***	-0.031***	-0.036***	-0.053***	-0.038***	-0.056***	-0.054***	-0.007	-0.055***	-0.039***
	(0.012)	(0.009)	(0.011)	(0.009)	(0.009)	(0.012)	(0.008)	(0.016)	(0.011)	(0.009)
Jun-21	-0.073***	-0.012	-0.026**	-0.046***	-0.034***	-0.042***	-0.048***	0.005	-0.044***	-0.033***
	(0.012)	(0.009)	(0.011)	(0.009)	(0.009)	(0.012)	(0.008)	(0.017)	(0.011)	(0.009)
Observations	58,059	97,645	82,415	94,448	111,176	66,528	139,117	38,587	63,345	114,359
R-squared	0.743	0.777	0.745	0.769	0.761	0.756	0.762	0.753	0.784	0.744

Notes: Standard errors clustered at the individual level are reported in parentheses. Control variables include education attainments, age, age square, marital status and household size. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A.3. Heterogeneous Effects of COVID-19 on Overall Life Satisfaction by Personality Traits

Personality Traits	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Extraversion		By Agreeableness		By Conscientiousness		By Neuroticism		By Openness	
	High	Low	High	Low	High	Low	High	Low	High	Low
Jul-19	0.002	0.001	0.014	−0.001	0.004	0.020	−0.034*	0.023*	0.016	0.006
	(0.017)	(0.016)	(0.014)	(0.014)	(0.013)	(0.014)	(0.020)	(0.013)	(0.016)	(0.017)
Aug-19	0.013	−0.001	0.010	−0.006	0.009	0.000	−0.051**	0.025*	0.010	0.002
	(0.016)	(0.015)	(0.014)	(0.014)	(0.014)	(0.014)	(0.020)	(0.013)	(0.016)	(0.016)
Sep-19	−0.000	0.012	−0.006	0.014	−0.007	0.031**	−0.018	0.023*	−0.007	0.010
	(0.016)	(0.016)	(0.014)	(0.014)	(0.013)	(0.013)	(0.020)	(0.013)	(0.016)	(0.017)
Oct-19	−0.001	−0.006	0.010	−0.017	−0.016	−0.004	−0.010	0.009	0.009	−0.001
	(0.016)	(0.015)	(0.014)	(0.014)	(0.013)	(0.013)	(0.020)	(0.013)	(0.015)	(0.017)
Nov-19	0.016	0.015	0.015	−0.000	0.019	0.005	−0.009	0.051***	0.022	0.016
	(0.016)	(0.016)	(0.014)	(0.013)	(0.013)	(0.013)	(0.020)	(0.013)	(0.016)	(0.016)
Dec-19	0.004	−0.003	0.004	−0.013	0.012	0.008	0.007	0.021	0.005	−0.006
	(0.015)	(0.016)	(0.013)	(0.012)	(0.013)	(0.013)	(0.017)	(0.013)	(0.015)	(0.016)
Jan-20 (reference period)										
Feb-20	−0.008	0.002	0.011	−0.004	−0.003	0.022*	−0.023	0.034***	−0.011	0.025
	(0.015)	(0.016)	(0.013)	(0.013)	(0.012)	(0.013)	(0.019)	(0.013)	(0.015)	(0.017)
Mar-20	−0.051***	−0.044***	−0.032**	−0.040***	−0.048***	−0.033**	−0.066***	−0.031**	−0.036**	−0.060***
	(0.016)	(0.017)	(0.014)	(0.013)	(0.014)	(0.013)	(0.020)	(0.014)	(0.016)	(0.016)
Apr-20	−0.174***	−0.152***	−0.126***	−0.100***	−0.142***	−0.090***	−0.193***	−0.118***	−0.145***	−0.162***
	(0.019)	(0.018)	(0.016)	(0.015)	(0.016)	(0.015)	(0.021)	(0.017)	(0.019)	(0.019)
May-20	−0.196***	−0.143***	−0.139***	−0.108***	−0.167***	−0.092***	−0.163***	−0.148***	−0.157***	−0.150***
	(0.020)	(0.019)	(0.017)	(0.016)	(0.017)	(0.015)	(0.023)	(0.017)	(0.020)	(0.020)

Table A.3. (*Continued*)

Personality Traits	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Extraversion		By Agreeableness		By Conscientiousness		By Neuroticism		By Openness	
	High	Low	High	Low	High	Low	High	Low	High	Low
Jun-20	-0.142***	-0.082***	-0.114***	-0.096***	-0.124***	-0.076***	-0.118***	-0.098***	-0.126***	-0.133***
	(0.025)	(0.024)	(0.021)	(0.019)	(0.021)	(0.018)	(0.029)	(0.021)	(0.024)	(0.025)
Jul-20	-0.100***	-0.065***	-0.072***	-0.058***	-0.074***	-0.047***	-0.093***	-0.064***	-0.087***	-0.104***
	(0.018)	(0.018)	(0.016)	(0.015)	(0.015)	(0.015)	(0.022)	(0.016)	(0.019)	(0.019)
Aug-20	-0.079***	-0.037*	-0.021	-0.057***	-0.067***	-0.032*	-0.066***	-0.048***	-0.089***	-0.041**
	(0.017)	(0.019)	(0.016)	(0.015)	(0.016)	(0.016)	(0.023)	(0.016)	(0.019)	(0.020)
Sep-20	-0.053***	-0.091***	-0.052***	-0.059***	-0.071***	-0.040**	-0.104***	-0.044***	-0.077***	-0.071***
	(0.018)	(0.019)	(0.016)	(0.016)	(0.016)	(0.016)	(0.023)	(0.016)	(0.018)	(0.019)
Oct-20	-0.073***	-0.064***	-0.072***	-0.065***	-0.061***	-0.043***	-0.116***	-0.050***	-0.079***	-0.072***
	(0.017)	(0.018)	(0.016)	(0.016)	(0.016)	(0.016)	(0.023)	(0.016)	(0.018)	(0.020)
Nov-20	-0.062***	-0.063***	-0.034**	-0.074***	-0.043***	-0.047***	-0.084***	-0.025	-0.074***	-0.064***
	(0.018)	(0.018)	(0.017)	(0.016)	(0.016)	(0.016)	(0.023)	(0.016)	(0.018)	(0.019)
Dec-20	-0.052***	-0.059***	-0.039**	-0.030*	-0.044***	-0.002	-0.085***	-0.019	-0.063***	-0.062***
	(0.017)	(0.019)	(0.016)	(0.016)	(0.015)	(0.016)	(0.022)	(0.016)	(0.018)	(0.020)
Jan-21	-0.075***	-0.038**	-0.042**	-0.030**	-0.044***	-0.019	-0.065***	-0.029*	-0.058***	-0.053***
	(0.018)	(0.019)	(0.017)	(0.015)	(0.016)	(0.016)	(0.022)	(0.017)	(0.019)	(0.019)
Feb-21	-0.038**	-0.040**	-0.031*	-0.046***	-0.046***	-0.023	-0.055**	-0.033*	-0.049***	-0.037*
	(0.018)	(0.018)	(0.017)	(0.016)	(0.016)	(0.015)	(0.023)	(0.017)	(0.019)	(0.019)
Mar-21	-0.034**	-0.042**	-0.032*	-0.029*	-0.036**	-0.016	-0.056**	-0.019	-0.055***	-0.050***
	(0.018)	(0.019)	(0.016)	(0.016)	(0.016)	(0.016)	(0.022)	(0.016)	(0.018)	(0.019)
Apr-21	-0.019	-0.002	0.002	0.002	-0.010	0.013	-0.043*	0.013	-0.015	-0.024
	(0.018)	(0.018)	(0.017)	(0.016)	(0.016)	(0.017)	(0.023)	(0.017)	(0.019)	(0.020)

Table A.3. (*Continued*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	By Extraversion		By Agreeableness		By Conscientiousness		By Neuroticism		By Openness	
Personality Traits	High	Low	High	Low	High	Low	High	Low	High	Low
May-21	−0.071***	−0.046**	−0.033**	−0.025	−0.056***	−0.004	−0.068***	−0.033*	−0.070***	−0.041**
	(0.019)	(0.020)	(0.017)	(0.017)	(0.016)	(0.017)	(0.024)	(0.017)	(0.020)	(0.020)
Jun-21	−0.039*	−0.048**	−0.039**	−0.028*	−0.052***	0.003	−0.065***	0.001	−0.059***	−0.035*
	(0.020)	(0.019)	(0.017)	(0.016)	(0.017)	(0.018)	(0.024)	(0.017)	(0.019)	(0.020)
Observations	24,496	24,396	26,401	34,797	31,200	33,453	19,934	25,484	22,147	23,433
R-squared	0.744	0.783	0.774	0.757	0.773	0.755	0.769	0.753	0.774	0.768

Notes: Standard errors clustered at the individual level are reported in parentheses. Control variables include education attainments, age, age square, marital status and household size. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

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