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Childbearing desires before and after the Covid-19 outbreak in Australia: Who changed their attitudes toward having a first or additional child?

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Abstract

Using a quasi-experimental cohort design, this study examines whether childbearing desires were affected by the Covid-19 pandemic, and investigates which pandemic-related factors have affected childbearing desires the most. To address these questions, a unique panel dataset is used, collected before and after the outbreak of Covid-19 in Australia. Results show that parents who already had one child were the most likely to experience a decline in childbearing desires as a result of the pandemic, while childbearing desires were most stable among those who were childless. Economic and employment related factors did not appear to be of great relevance in predicting changes in childbearing plans, however of strong importance were changes to the quality of couple relationships and of social support from family and friends.

Introduction

This paper investigates whether the Covid-19 pandemic had an effect on childbearing desires in Australia. People's childbearing plans and behaviours are known to respond to uncertain environments, such as recessions (Sobotka, Skirbekk, and Philipov 2011, Comolli et al. 2017) and unexpected events like climate disasters (Nobles et al. 2015), noting that these responses are not uniformly positive or negative. Hence, when the Covid-19 pandemic was declared, there was a consensus among demographers that this would disrupt people's fertility plans and behaviours.

Prior to the pandemic, fertility had already been declining in Australia. In this century, Australians are making life decisions, including decisions about becoming a parent or having more children, in increasingly uncertain contexts. In recent years, with more casualization and the arrival of the gig economy, people's confidence in job security has declined (Foster and Guttman 2018). However, the arrival of the pandemic exposed many to a level of uncertainty of the like not seen in their lifetimes. This new environment posed an unfamiliar risk with a high level of complexity and potentially wide-ranging economic and social impacts for individuals and society. It has been found that complex unfamiliar risks are much more alarming than familiar ones (Renn 2008), and therefore may produce larger declines in births than observed during times of regular cycles of economic recession.

While no person was untouched by the uncertainty brought on by the pandemic, early evidence suggests that the exact nature of the impact on people's fertility behaviour depended on their individual circumstances but also on the social policy context (Sobotka et al. 2021). Different countries experienced the pandemic in different ways, both in terms of the magnitude of cases and deaths as well in terms of the nature and severity of the lockdown measures which were implemented, and how much support governments gave to their citizens to mitigate the effects of job losses and economic disruption.

Australia was protected from the worst of the health consequences of the pandemic by shutting borders to all international travellers, and instigating strict lockdown measures for the domestic

population at an early stage of the pandemic. The government also implemented relatively generous social policy measures to support those who had experienced financial losses. As such the population did not experience the level of mortality observed in many other countries, but it was subjected to wide-scale social disruption and suspension of the usual ways of life.

In this paper we examine how childbearing desires were affected by the Covid-19 pandemic in a sample of the Australian population of reproductive age (31-37). The paper makes two contributions to the existing literature. Firstly, it examines whether there was a causal impact of Covid-19 on childbearing desires, using a quasi-experimental cohort design. Second, it investigates which pandemic-related factors have affected childbearing desires the most. To address these questions, we use a unique panel dataset, collected before and after the outbreak of Covid-19 in Australia.

Childbearing desires and uncertainty

Having a first child, or adding more children to an existing family, is one of the most important life decisions someone can make. Having children has been described as the 'ultimate vote of confidence in the future' (Martin 2003). When people feel the future is predictable and favourable, they are more likely to enact childbearing plans. In contrast, the more volatile and uncertain conditions are, the more difficult it can be to predict the consequences of having children, and people adopt a strategy to avert risk which involves avoiding or delaying childbearing (Fiori et al. 2013).

Australians have more experience with familiar risks, although those risks can have different effects depending on time, place, background, and the generation that experiences them. Increases in job insecurity and economic uncertainty in recent times are thought to be major factors behind the fall in fertility in high-income countries (McDonald 2006; Mills and Blossfeld 2013; Mitchell and Gray 2007; Winter and Teitelbaum 2013). In comparison, unfamiliar risks heighten responses to life decisions. Evidence from a wide range of previous unfamiliar shocks including recessions (Comolli

2017) or the fall of communist Russia (Rodin 2011), highlight that in response to observed or perceived uncertainty, people are averse to additional risks including childbearing and as a result fertility levels fall. Hence, in periods of uncertainty, people will tend to defer making major life choices which involve long-term commitments, such as starting a family or having more children (Vignoli et al. 2020). There are many specific historical examples of birth rates falling in times characterised by a high level of uncertainty such as global economic recessions (Sobotka, Skirbekk, and Philipov 2011; Matysiak, Sobotka, and Vignoli 2020).

When deciding to have a child people will often consider if they have the necessary resources available to them. These resources generally include economic means, social support from personal networks, adequate housing, and a stable relationship with their partner (Manning et al. 2022). The Covid-19 pandemic brought with it an unprecedented level of uncertainty and instability for people in many of these life domains. However, the pandemic-induced uncertainty was unlike uncertainty seen during other times such as economic recessions because it involved multiple life domains. Besides being concerned about the economic implications of the pandemic, people were also anxious about the long-term health effects of the virus, and may have experienced mental health effects from the prolonged social distancing measures and lack of a clear timeline of when life would return to normal (Manning et al. 2022).

Uncertainty does not have the same effect across all sections of society. Micro-level studies of economic and employment instability find that the effect of uncertainty on childbearing intentions and fertility varies by background characteristics. For example, faced with unemployment or employment uncertainty, highly educated women may adopt a risk aversion strategy of postponing childbearing whereas lower educated women may increase or retain their rate of entry into motherhood (Sobotka, Skirbekk, and Philipov 2011).

While most of the discussion about the impact of the pandemic has focussed on the economic impact of job loss, lockdowns and stay-at-home orders will also have had unexpected effects on childbearing plans. For some cohabiting couples the frequent lockdowns have created new

opportunities to engage in shared activities, which promote relationship satisfaction and stability (Claxton and Perri-Jenkins 2008; Girme, Overall, and Faingataa 2014; Amato et al. 2007). Moreover, by creating a chance for couples to face a shared stressor together, the pandemic yielded additional benefits. For instance, results from a large national study in the United States indicate that, on average, individuals became more forgiving and less blaming of their partners' negative behaviours by attributing them more to the pandemic as a stressor rather than to their partner's internal characteristics (Williamson 2020). The pandemic may have also contributed to more secure attachment dynamics, as shown in the case of other moderate-intensity disasters (Mancini, Westphal, and Griffin 2021). For other couples, however, quarantine may exacerbate partnership conflict due to being able to spend less time apart (Mazza et al. 2020). The effects of lockdowns on childbearing plans should also be considered.

The level of uncertainty felt, and therefore the potential impact on fertility behaviour, would be moderated by an individual's circumstances as well as by the social policy setting. There is considerable variation cross-nationally in the experiences of people. For example, while some lost their jobs, others were able to continue via working from home. These experiences vary by the policy context. For those that lost their jobs or experienced a significant reduction in their working hours, how a government responded in terms of providing income support would impact on how much economic insecurity they experienced.

Investigating a shock like the Covid-19 pandemic is complex. In times of crises, data can be hard to source, or inappropriate for investigating the impact of the event. In the research that has been conducted on the effects of Covid-19 on childbearing plans, two main types of data have been used. The first type of data are surveys conducted during the pandemic that include a retrospective section asking people directly if they had changed their fertility plans as a result of Covid-19. This strategy has been used in studies in Australia (Qu 2021), Canada (Fostik and Galbraith 2021), Italy (Micelli, et al. 2020; Guetto, Bazzani, and Vignoli 2022), Poland (Malicka, Mynarska, and Świderska 2021; Sienicka et al. 2021), the United States (Lindberg et al. 2020), United Kingdom (Raybould,

Mynarska, and Sear 2021) as well as a cross-national study comparing Italy, Germany, France, Spain and the United Kingdom (Luppi, Arpino, and Rosina 2020). The types of questions which are asked varies, but usually the surveys include a question asking people if the timing of their plans has changed (e.g. whether they still want children but have delayed plans) and sometimes if the quantum of plans has changed (e.g. if they now want fewer children than they did before). Asking people if the pandemic changed their childbearing plans is subject to recall error as it relies on people's own assessment of what their childbearing plans used to be, and how they have changed over time. Hence, in these studies the potential of identifying a true causal relationship between the pandemic and changes in childbearing plans is limited.

The second group of studies make use of longitudinal data to track changes in individuals' childbearing plans over time, including before and after the onset of the pandemic. To date, these type of data have only been used in a few studies including in Moldova (Emery and Koops 2022) and Kenya (Zimmerman et al. 2022). However, because these analyses have not used counterfactual groups, their ability to quantify the causal effect of Covid-19 on childbearing plans is also limited. This is because there is no way to know whether the changes that are observed would have occurred in the absence of the pandemic. Previous research has shown that childbearing desires are progressively revised over the course of the reproductive life, with the adjustment strongly affected by age (Gray, Evans and Reimondos 2013). Hence, a change observed over the period of the onset of the pandemic may not be attributed to the pandemic with any degree of confidence.

By contrast, longitudinal data analysed using quasi-experimental methods such as difference-in-difference techniques using both pre-event and matched comparison group designs, which is the methodology employed in this study, allows for a causal association to be determined with more certainty. Moreover, the causal effect is more precisely quantified as quasi-experimental methods allow to isolate changes due to a specific event, like the outbreak of Covid-19, from changes due to factors other than the pandemic, like age effects.

The literature generally finds that most people did not change their fertility plans, with a small percentage indicating that they had completely abandoned intentions to have children, and a larger percentage indicating that they would delay their childbearing plans. The studies outlined above differ in the socio-demographic and pandemic related variables included in the analysis, as well as whether they measure changes in the quantum and/or tempo of fertility intentions. Most studies focus only on those who were planning to have children before the pandemic and examine the extent to which they either did not experience any change in intentions, whether they abandoned their intentions, or whether they decided to postpone childbearing. However, one study that included people who did not initially intend to have a child before the pandemic, found that a small proportion of couples changed their minds about parenthood as a result of the pandemic, saying that they now want a child (Micelli et al. 2020). While most of the focus has been on the negative effects in terms of increased economic insecurity, loss of social support networks and other increased stressors, this finding points to the importance of also taking into account the possible positive effects of the pandemic on fertility plans and understanding the heterogeneity of peoples' experiences.

The Covid-19 pandemic in Australia

Covid-19 was first detected in early December 2019 in Wuhan, China. By March 2020, it was officially declared a pandemic by the World Health Organisation (WHO), after spreading in 113 countries. The first confirmed case of Covid-19 in Australia occurred in late-January 2020. Throughout the year, the number of cases and deaths remained at relatively low levels, with two distinct waves characterized by above average cases and deaths. The first wave, from mid-March to mid-April, affected all States and Territories, while in the second wave, from June to September, the majority of cases were notified in the state of Victoria (Australian Institute of Health and Welfare (AIHW) 2021).

During 2020, approximately 28,500 new cases were recorded in the country, leading to a total of 909 deaths (AIHW 2021). Compared to international standards, the number of recorded cases and

deaths have been low (Ritchie et al. 2022). As a consequence, there was a minimal decline in life expectancy due to Covid-19 in 2020, while declines in mortality (and corresponding increases in life expectancy) were observed for other causes of deaths, likely due to the strict social distancing measures implemented to prevent the spread of the disease (Canudas-Romo, Houle, and Adar 2022). In this respect, Australia's experience of Covid-19 has been markedly different to that of most other high-income countries (Aburto et al. 2022).

A wide range of strict containment measures were implemented by the Australian Government to fight the spread of the virus. Initial border security measures, such as restrictions on non-citizens entering the country from China, were implemented in January. By 21 March, these restrictions were extended to all non-citizens and non-residents, while Australian citizens were urged to return home as soon as possible and a warning was introduced against those leaving the country for non-essential reasons. Moreover, in order to contain local transmissions of Covid-19, stringent social distancing measures were taken, which profoundly affected the daily lives of Australians and negatively impacted the local economy. These included school and workplace closures, promoting working from home arrangements, cancellation of mass gatherings and stay-at-home orders. The decision to take strict containment measures at an early stage, when the number of cases per capita was relatively low, has been identified as a primary reason for the country's relative success in slowing the spread of the disease (O'Sullivan, Rahamathulla, and Pawar 2020).

With the aim of producing a summary indicator reflecting the stringency of government responses to the pandemic, the Oxford's Blavatnik School of Government developed a 'stringency index' comparing countries' social-distancing policies (Hale et al. 2021). On average, Australia's stringency-index was 51 between March and September 2020, with a peak of 82 from mid-March to mid-April, corresponding to the first Covid-19 wave. While this index reflects the national level of stringency in social-distancing policies, some cities and regions were affected more than others. For example, the city of Melbourne, in Victoria, has endured the nation's most severe lockdown and one

of the hardest lockdowns in the world, with strict stay-at-home orders for a continuous period of almost four months (between the 9th of July and the 27th of October 2020).

In the second half of March, in response to the rapid deterioration of economic activity due to physical distancing and social isolation measures, the Australian Government implemented one of the largest labour market interventions in Australia's economic history. Initially announced as lasting for six-months, until September 2020, the JobKeeper and JobSeeker payments have been central components of the government social policy response to the pandemic (Ramia and Perrone 2021). The JobKeeper Payment was a wage subsidy paid to just over one quarter of the Australian labour force (3.5 million people) (Borland and Hunt 2021) with the aim of supporting business and job survival, providing income support and maintaining the link between employees and their employers (The Treasury 2020). On the other hand, the JobSeeker Payment was an income support measure directed to those that were left unemployed or underemployed by the crisis, designed to work in tandem with the JobKeeper Payment to enhance income support (The Treasury 2020).

Even though Australia's social policy response to the Covid-19 pandemic has been relatively generous (Wilson 2020), the scale of socio-economic disruptions experienced by its population in the months following the onset of the pandemic were unprecedented in recent history (O'Sullivan, Rahamathulla, and Pawar 2020). The disruption, uncertainty and policy changes generated by the pandemic are also likely to have had profound consequences in many other areas of life, such as decisions related to childbearing.

Data and Methods

Difference-in-difference design

Longitudinal social surveys, conducted before and after the pandemic provide one of the best sources of information for analysing the impact of Covid-19 on childbearing desires, as they enable a comparison to pre-Covid-19 and post-Covid-19 responses. For instance, a decline in the desire to have a child after Covid-19, as compared to a pre-Covid-19 period, may suggest that the pandemic

had a negative effect on childbearing plans. However, because childbearing desires tend to decline with age (Gray, Evans, and Reimondos 2013), regardless of the presence of a pandemic, a decline *per se* would not be enough to determine a causal effect of the pandemic, as we may have observed a decline even in the absence of the pandemic. Hence, in order to be able to control for this ageing effect, it is crucial to add a second term of comparison, which is represented by a control group, with similar characteristics to that of the treatment group, but that did not experience the consequences of Covid-19.

Since the pandemic has likely profoundly affected the lives of all members of the population, a control group that is highly comparable to the treatment group in key determinants of fertility desires, but that has remained unaffected by the pandemic can only be found in previous cohorts. For this reason, instead of comparing groups of respondents across space, an approach often taken in difference-in-differences designs, we compare groups of individuals belonging to different birth cohorts, and moving through the same ages in different calendar years.

Specifically, we analyse the change in childbearing desires between two-years before and a five to six months after the outbreak of the Covid-19 pandemic of respondents aged 31-37 in 2020 (born in 1989-1995), and compare it with the change in childbearing desires of respondents with similar characteristics who reached the same age of 31-37 in 2012 (born in 1981-87) before the pandemic started. The treatment group is given by respondents aged 28-35 in 2018 and followed-up in 2020. The control group is given by men and women aged 28-35 in 2010 and followed-up in 2012. Figure 1 provides a schematic representation of the cohorts and periods analysed.

[Figure 1 here]

An estimate of the effect of Covid-19 on childbearing desires is then given by:

$$\hat{\delta}_{DD} = \left(\overline{Y_T^1} - \overline{Y_T^0}\right) - \left(\overline{Y_C^1} - \overline{Y_C^0}\right)$$

Where the bar indicates the average value over the individual units, the subscript on Y denotes the treatment (T) or control (C) group, and the superscript on Y denotes age 28-35 (0) or 31-37 (1). We followed a data-driven approach for selecting these cohorts. From a preliminary investigation

conducted across all respondents of reproductive age it emerged that the DD coefficient was always negative, although it was only statistically significant for the group of respondents aged 29 to 35. This is explained by the fact that at younger ages, situational constraints are less likely to influence childbearing desires because individuals are not yet planning to have children. As people move through their childbearing ages, childbearing desires are more likely to translate into intentions (Miller, Severy, and Pasta 1993). As a consequence, temporary shocks, like the outbreak of Covid-19, may influence childbearing plans more substantially because individuals are expecting to act upon these desires relatively soon. On the other side, at more advanced reproductive ages, men and women are more definite about their desires to have a child and potentially less influenced by external shocks (Wagner, Huinink, and Liefbroer 2019). Moreover, at older ages, a revision of childbearing desires downwards has stronger implications, because it implies giving up having an additional child or remaining childless.

Materials

The data come from the Household Income and Labour Dynamics in Australia (HILDA) survey, which is a panel study with twenty waves of data collected every year since 2001 (Watson 2021). Because of the social distancing requirements brought about by the pandemic, in 2020 face-to-face interviews were predominantly replaced by telephone interviews. This change in the mode of delivery did not importantly impact the quality of data collected. Indeed, compared to previous waves, there was a small reduction (1.5%) in the response rates of previous wave respondents, with similar non-response rates and similar rates of missingness on specific items (Watson, et al 2021).

In its last wave, fieldwork commenced in August 2020 until February 2021, with almost 90% of interviews conducted between the months of August and September (Summerfield et al. 2021). Since respondents interviewed in the last wave of HILDA had already experienced the two Covid-19 waves, the survey was able to capture much of the disruption brought about by the pandemic. As such, it provides a unique source of information for investigating how the policy responses

implemented by the Government to manage the spread of the virus have affected the childbearing plans of Australians. Figure 2 provides a timeline mapping the experience of Covid-19 pandemic in Australia and the HILDA fieldwork in 2020.

In our analysis, we mostly used waves collected in 2010, 2012, 2018 and 2020 to construct two distinct cohorts of respondents followed over time between the ages of 28-35 and 31-37, born in 1981-87 or in 1989-95, respectively (as displayed in Figure 1). Our dependent variable is represented by a person's desire for children (either a first or additional child), which in the survey was measured by the following question: 'Would you like to have a child/more children in the future?' Respondents were asked to pick a number ranging from 0, 'definitely would not like to have', to 10, 'definitely like'. In addition, we included a number of time-invariant covariates measured in the pre-treatment phase. These comprised: sex, relationship status (single, married, cohabiting), number of children (0, 1, 2, 3 or above), education (lower secondary or less, upper secondary, higher education), type of job contract (permanent, casual), immigration status (born in Australia or overseas), and number of siblings (0, 1 or above).

[Figure 2 here]

Model specification

The full model used to identify the effect of Covid-19 on childbearing desires estimated using ordinary least squares (OLS) is illustrated in Eq. (1):

$$Y_{i,c,t} = \alpha + \beta_1 Age_{i,t} + \beta_2 Treatment_c + \delta_{DD}\left(Age_{i,t} * Treatment_c\right) + X_i + \varepsilon_{i,t} \quad (1)$$

Where $Y_{i,c,t}$ is a measure of the intensity of childbearing desires of respondent i, in cohort c, at time t. Age is a dummy for being aged 31-37 in year 2012 for the control group or 2020 for the treatment group. $Treatment$ is a dummy equal to 1 for being born in 1989-95. The coefficient of the interactive term $Age_{i,t} * Treatment_c$ captures the causal effect of the Covid-19 pandemic on the intensity of childbearing desires of cohorts born in 1989-95. X_i is a vector of individual time-invariant covariates measured in the pre-treatment phase. The effect on childbearing desires due to the increase in age is captured by the mean change in the control group, while the mean change in the treatment group

captures both the aging effect and the treatment effect. By subtracting the difference over time among untreated cohorts from the difference over time among treated cohorts, we obtain an estimate of the treatment effect. Since we suspect that the effect of Covid-19 are heterogeneous across groups of individuals with different number of children, we run separate analyses for each birth parity, up to the third birth.

We assume that men and women are randomly assigned to the treatment group or control group, i.e., exposure to the treatment is statistically independent of any observable or unobservable factor that may also influence the outcome. We expect this assumption to hold because the assignment to a specific cohort is random, which means that the selection into treatment is also random. As a result, when comparing individuals in the treatment and control cohorts at the time of their first observation at age of 28-35 on variables associated with childbearing desires, they are expected to be similar, on average. To assess the equivalence of treatment and control cohorts we perform standard statistical tests of the difference between the means across key determinants of fertility desires. The results of these analyses, presented in Table 1, show that only the average person's desire for children is significantly different between the two groups, with respondents aged 31-37 during Covid-19 more likely to have a lower desire for children compared to their peers born 8 years before (4.46 vs 5.07).

[Table 1 here]

Identification strategy

Even though respondents might have differed in their initial level of childbearing desires depending upon the year of their birth, i.e., "cohort effect", the key identifying assumption is that the trend in these outcomes across the two years of investigation would have been the same in the absence of the Covid-19 pandemic. In other words, childbearing desires by age should have trended parallel. We investigate the plausibility of this assumption by implementing a placebo test. We select a group of placebo individuals born in 1973-79, who, just like the individuals in the control group, are aged 31-37 in a period not affected by Covid-19 (as shown in Figure 2). We then repeat the same analyses

shown above for the placebo and control group. If the model specification is correct, no statistically significant effect for the interactive term capturing the effect of Covid-19 should be observed.

As a form of auxiliary analysis to ensure the validity of our DD strategy, we conduct a visual inspection of the dynamics in childbearing desires in two pre-treatment waves. Results of this analysis are presented in Figure 3. As expected, childbearing desires declined over time within each group (aging effect). The trend seems reasonably parallel between the control and the placebo group and between the treatment and the control group until before the outbreak of Covid-19, after which childbearing desires of the treatment group visibly change trajectory, while the trends of the placebo and control groups continue to trend parallel. Age effects are controlled in the analysis to the extent that they operate in both treatment and control groups to the same extent.

[Figure 3 here]

Multinomial regression analysis

The DD analyses provide valuable information to determine whether Covid-19 influenced childbearing desires. However, it does not allow to explicitly analyse why the respondents changed their fertility preferences. The usefulness of the DD results could be enhanced by conducting an investigation of which pandemic-related factors have affected childbearing desires the most. For this reason, we perform a multinomial regression analysis for which we identify a three-category dependent variable indicating whether childbearing desires have increased, declined or remained stable between the ages of 29-35 and 31-37. We restrict the analysis to respondents who provided a score for desire for children of 6 or higher as we are specifically interested in which factors are associated with the revision of fertility preferences among those wishing to have children. We consider two groups of pandemic-related factors that may have influenced such revision, capturing either economic or social disruption.

Economic factors included:

- Employment uncertainty, which reflects whether respondents experienced one or more of the following situations: a pay cut, a reduction of working hours, a forced paid leave, and job loss;
- Wealth reduction, which reflects whether respondents experienced one or more of the following situations: experienced debt, sold assets, used savings and took money from superannuation because of Covid-19.

Social factors comprised:

- Practising social distancing behaviour;
- Quality of intimate relationship with partner, which reflect changes in the relationship of the respondents and the partner as a consequence of Covid-19;
- Closeness with relatives and friends, captured by the level of contact with friends and family living outside of the household since Covid-19 started.

These variables are sourced from a new module on Covid-19 that was included in the last wave of HILDA to collect information on how the policy responses implemented by the Government to contain the spread of the virus have affected the lives of Australians on a wide number of life domains (Wooden 2020). In the full model, we also control for the same socio-demographic variables used in the diff-in-diff analysis and for a variable indicating whether the respondents had a child during the study period.

Results

The effect of Covid-19 on childbearing desires

The findings from the DD analysis are illustrated in Table 2. Column (1) reports the results of the baseline model, while Column (2) shows the effect of the pandemic mediated by controlling for sex, relationship status, children ever born, education, type of job contract, immigration status, and number of siblings. The control variables are categorical, and the reference categories are being: male,

married, childless, low educated (lower secondary education or less), born in Australia and without siblings.

[Table 2 here]

Covid-19 had an estimated causal negative impact on childbearing desires of 0.365, corresponding to a decline of 6.2% (-0.365/5.913*100). This estimate is robust across models, when controlling for a number of time-invariant covariates measured in the pre-treatment period (Column (2)). Relationship status was a strong mediator of the effect of Covid-19 on childbearing desires, as single individuals were associated with a 15.5% decline in childbearing desires (-1.122/7.244*100), as compared to those who were married. Declines in the wish to have a child were also more pronounced among those that were already parents. Indeed, there was a strong negative relationship between the number of children already had and childbearing desires. Higher levels of education were associated with an increase in the desire to have a child of 10.7% (0.778/7.224*100). Compared to having a permanent job, being employed in a casual job was associated with an increase in the desire to have a child by 3.9% (0.285/7.244*100).

Table 3 shows the results for the comparison between the control and placebo cohorts. The placebo treatment did not have significant effects on the difference in childbearing desires between the control and placebo cohorts, supporting the validity of the assumption that childbearing desires across the two years of investigation would have trended parallel in the absence of the Covid-19 pandemic. After adding controls, the effect of the placebo treatment on childbearing desires remained statistically insignificant and of negligible magnitude (less than 1%).

[Table 3 here]

Figure 4 shows the estimated percentage change in the reported desire to have a child obtained from fitting regression equation (1) for the full sample and for specific parity subgroups (Tables A1 and A2 in Appendix report the original coefficients). Our analyses revealed that Covid-19 had a negative effect on all the subgroups considered, despite being statistically significant only among childless respondents and among respondents with only one child (p-value < 0.05). This was

especially the case for the latter group, with an estimated percentage decline in desire due to Covid-19 of 16.5%, which was much higher than the estimated percentage decline for childless respondents of 5.8%.

[Figure 4 here]

Results from the multinomial analysis

The previous results identified a clear causal effect of the pandemic on revising childbearing plans downwards. In this next part we look in more detail at what caused desires to change, among those who initially wanted a child.

Table 4 shows the mean change in childbearing desires by selected socio-economic and pandemic-related factors. Older respondents aged 33-35 were more likely to indicate a larger decline in their childbearing desires, as were women, those who were married, and those who already had children. Lower education was also associated with a larger decline in desires, as was not working or working on a casual contract. Those born in other English-speaking countries and with no siblings were associated with a smaller decline in desires. In terms of the pandemic-related factors, the descriptive statistics indicate that employment uncertainty and wealth reduction were positively associated with a decline in desires, which is unexpected. Experiencing a decline in the quality of relationship with one's partner was also associated with a decline in fertility intentions.

[Table 4 here]

The change in desires was then classified into three categories: stable, decline and increase and modelled using multinomial logistic regression with 'stable desires' as the reference group. In the models which only include the pandemic-related factors (model 1 and model 3) we find that economic changes had no major effect. The variables relating to quality of relationship with one's partner and closeness with friends and family were a significant predictor of declining childbearing desires, but had no effect on increasing desires. Specifically, compared to those not in a relationship, those whose relationship with their partner worsened were more likely to indicate a decline in

childbearing desires, compared to keeping childbearing desires stable (OR: 2.31). Interestingly, an increase in closeness with relatives and friends was associated with a lower likelihood of experiencing a decline in childbearing desires (OR: 0.68).

Turning to the socio-economic characteristics (model 2 and model 4), those in the 33-35 age group were more likely to experience a change in childbearing desires either upwards (OR: 1.86) or downwards (OR: 1.68) compared to the reference group age 29-32. Those who did have a child over the period were more likely to experience a decline in childbearing desires (OR: 2.46), and less likely to experience an increase (OR: 0.41). Parents were also significantly more likely to experience a decline. Interestingly, those with two children already were also associated with a higher probability to experience an increase in desires. For higher education we observe that those with upper secondary level education were more likely to experience a decline in desires (OR: 1.87) compare to those with lower secondary or less education. Being employed in a casual occupation was associated with a higher probability of revising childbearing plans downwards (OR: 1.61).

[Table 5 here]

Discussion

Our study used a quasi-experimental cohort design to examine whether exposure to Covid-19 had an effect on childbearing desires in Australia. The HILDA data provides a unique opportunity to examine the evolution of childbearing desires in cohorts exposed to Covid-19, and compare this to closely matched comparison cohorts. Despite Australia not experiencing the same level of mortality and high case numbers observed in many other countries, we found a clear negative effect of Covid-19 on the childbearing desires of cohorts of men and women aged 31-37 in the following two years. While a downward revision of childbearing desires with age can be expected (Gray, Evans and Reimondos 2013), the drop observed since the pre-pandemic period would not have been as deep in the absence of Covid-19.

Demographic theory has already linked Covid-19 with lowered desired fertility (Aassve et al. 2020). However, so far, no empirical study has examined this possibility using pre-event and matched comparison group designs. Previous quantitative evidence is limited to cross-sectional or longitudinal studies with no counterfactual (Lindberg et al. 2020; Luppi, Arpino and Rosina 2020; Fostik and Galbraith 2021; Malicka, Mynarska and Świderska 2021). As such, they cannot establish a causal effect nor quantify the amount of change that is due to the pandemic *per se*.

While we observed that the cohorts exposed to the Covid-19 pandemic reported a significant decrease in the desire to have children relative to the earlier comparison cohorts who had not experienced the pandemic, there were some important differences by number of children ever born. Our results indicate that it was parents who already had one child that were the most likely to experience a decline in childbearing desires as a result of the pandemic. Among those individuals who initially wanted to have another child, we further found that childbearing desires were most stable among those who were childless. A possible interpretation for this trend is that isolation from social networks and the lower availability of informal childcare may have made parents more reluctant to the idea of having an additional child, and fertility intentions of childless individuals tend to be more persistent because they have not yet met their goal of becoming a parent.

Economic and employment-related factors did not appear to be of great relevance in predicting changes in childbearing plans. This may be because the social policy interventions in Australia lessened the potentially large impact of losing a job. What showed to be important in terms of childbearing plans was changes in the quality of couple relationships and of social support from family and friends. Those in couples whose relationship had improved or stayed the same were less likely to experience a decline in childbearing desires, compared to single people. This impact can be interpreted as a result of the effects of stay-at-home orders and other social restrictions. While these findings may be due to the uniqueness of the Australian context in dealing with the pandemic, they also highlight the importance of wide-scale social disruption and suspension of normal life on childbearing plans. This aspect is likely to hold also for other settings where governments did not

implement generous social policy measures to support those who had experienced financial losses like in Australia, but it may mean that comparatively, the effect of the pandemic on childbearing plans is attenuated because the potential economic impacts were lessened.

Our findings also point to the importance of considering both the negative and positive influences of the pandemic on childbearing desires. Different people would have experienced different positive and negative effects, and these may have counterbalanced each other leading to stable childbearing intentions or the negative effects may have outweighed the positive effects leading to a decline in childbearing intentions. As shown in the multinomial results, a small group experienced an increase in their fertility desires, indicating that in their experience of the pandemic, the positive changes created by the pandemic outweighed the negative. However, there were no clear pandemic-related factors that predicted an increase in desires compared to a stability in desires.

Our measure of fertility desires is different to the fertility intentions used in the other surveys which retrospectively ask people if they have changed their childbearing plans due to Covid-19. In those surveys, respondents are asked explicitly about how plans have changed including the plans regarding the number of children and the timing of children. Our own measure is a more general one capturing the overall desire for children, and is therefore more aligned to questions asking about the quantum of children. Given that the question has no time frame attached to it, a decline in childbearing desires is indicative of a decline in the wish to have a(nother) child.

The understanding of how fertility desires changed during the pandemic is key for explaining subsequent fertility patterns and for understanding fertility behaviour in general. While the decline in desires may only be temporary for some people, it does carry the risk that childbearing plans may indeed remain unfulfilled due to age-related effects of delaying childbearing to later ages (Beaujouan et al. 2019). Our finding suggests that fertility levels will likely continue to decline and to follow the downward trajectory that preceded the pandemic.

Figure 1. Lexis surface showing a representation of the selected cohorts and age groups**.**

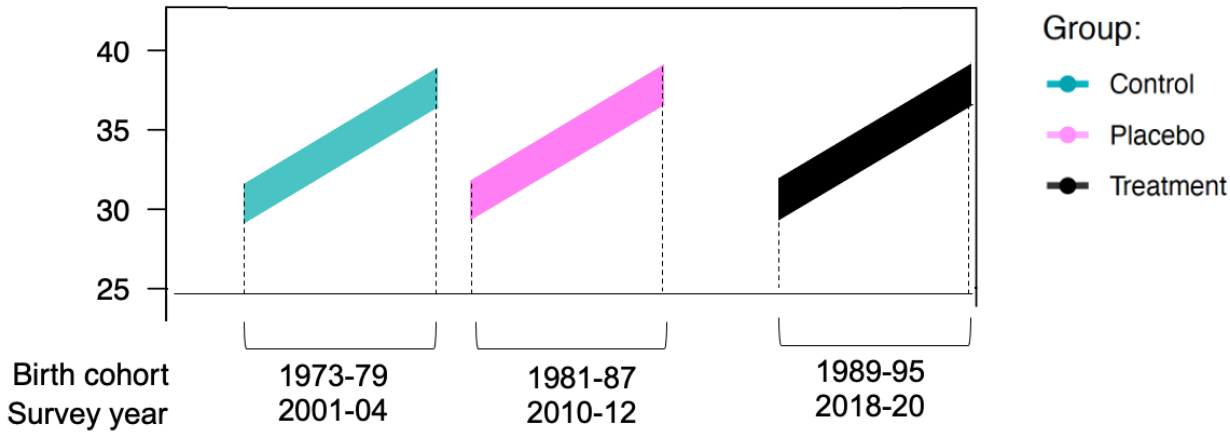


Figure 2. Timeline mapping the experience of Covid-19 pandemic in Australia and the HILDA fieldwork in 2020

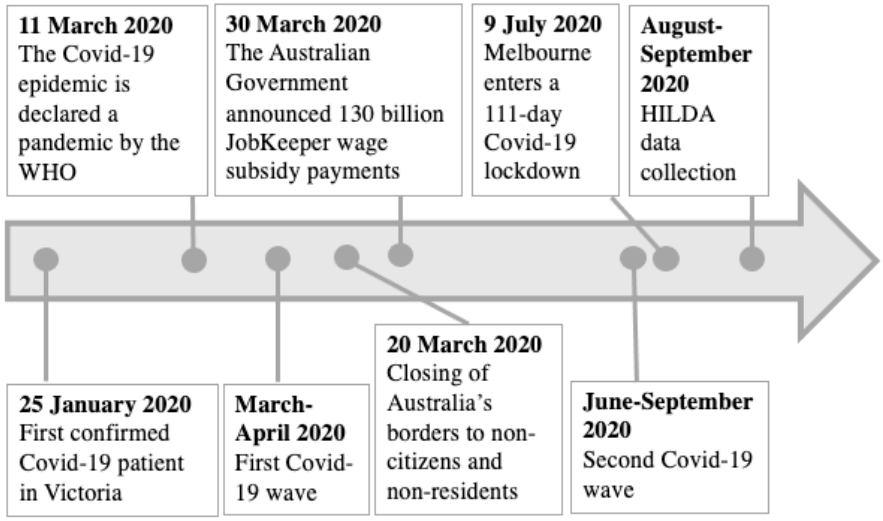
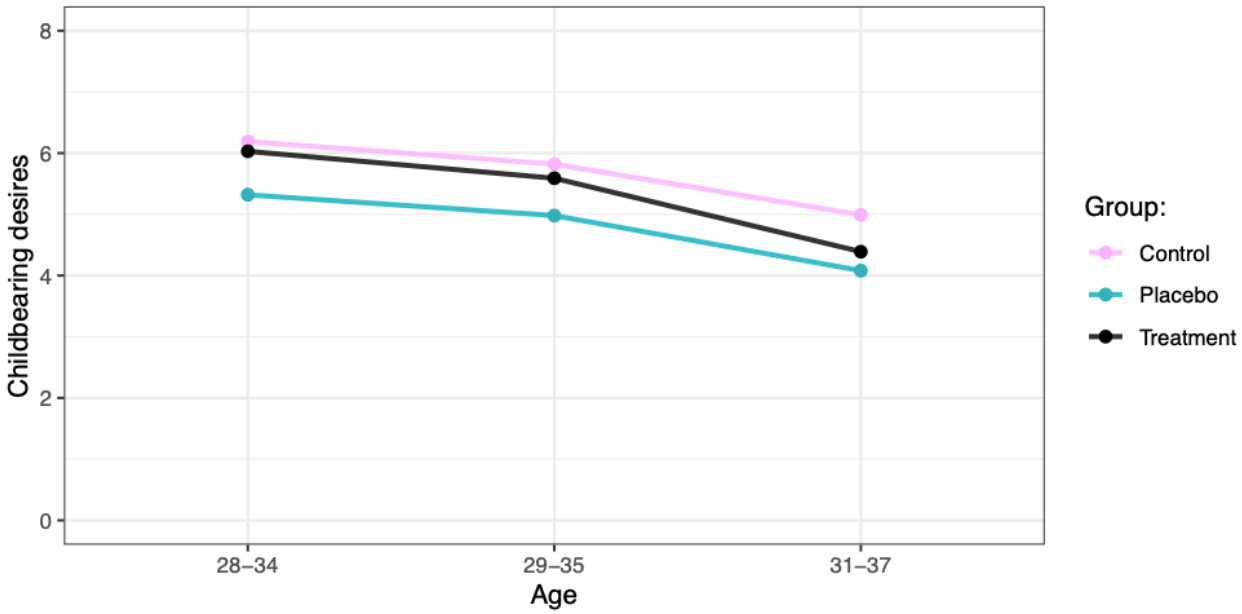


Figure 3. Childbearing desires of men and women born in 1973-79, 1981-87, and 1989-95, by age. *Source:* HILDA survey, release 20.



SOURCE*:* HILDA survey, release 20.

Table 1. Percentage distribution of respondents aged 31-37 by selected characteristics, before and during Covid-19.

	Pre-Covid-19	**Post-Covid-19**
Childbearing desires	**5.07**	**4.46**
Sex		
Female	53.22	53.69
Relationship status		
Married	54.32	51.30
Cohabiting	24.14	25.27
Single	21.54	23.43
Parity		
Number of children ever born	1.18	1.18
Education		
Lower secondary or less	13.13	11.15
Upper secondary	50.79	52.49
Higher education	36.08	36.36
Job contract		
Permanent	59.91	61.23
Casual	12.74	11.73
Not working	27.36	27.04
Immigration status		
Born overseas	17.22	17.48
Born in Australia	82.78	82.52
Number of siblings		
One or more	96.70	95.07
N	1,272	2,071

NOTE: Bold numbers indicate statistically significant ($p < 0.001$) differences between treatment and control groups. Two-sample t-test used for childbearing desires and parity, and chi-square test used for all other variables.
SOURCE*:* HILDA survey, release 20.

Table 2. Difference-in-difference estimates of the effect of Covid-19 on the childbearing desires of men and women aged 31-37, treatment versus control group

Treatment versus Control		
	Childbearing desires	
	(1)	(2)
Age 31-37	-0.839***	-0.839***
	(0.159)	(0.134)
Treatment cohort	-0.248*	0.216*
	(0.143)	(0.120)
Age 31-37 X Treatment cohort	-0.365*	-0.365**
	(0.202)	(0.170)
Sex		
Male (Ref.)		
Female		-0.082
		(0.085)
Relationship status		
Married (Ref.)		
Cohabiting		0.039
		(0.105)
Single		-1.122***
		(0.113)
Number of children		
Childless (Ref.)		
One		-1.376***
		(0.115)
Two		-4.196***
		(0.117)
Three or more		-5.470***
		(0.139)
Education		
Lower secondary or less (Ref.)		
Upper secondary		0.289**
		(0.135)
Higher education		0.778***
		(0.148)
Job contract		
Permanent (Ref.)		
Casual		0.285**
		(0.132)
Not working		-0.033
		(0.101)
Immigration status		
Born in Australia (Ref.)		
Born overseas		0.001
		(0.111)
Number of siblings		
Zero (Ref.)		
One or more		0.578**
		(0.205)
Constant	5.913***	7.244***
Observations	6,684	6,684
R^2	0.020	0.310

*p <0.1, **p<0.05, ***p<0.01

NOTE: Standard errors are shown in parentheses, below the OLS coefficients. Estimation is performed using STATA 14.2. SOURCE: HILDA survey, release 20.

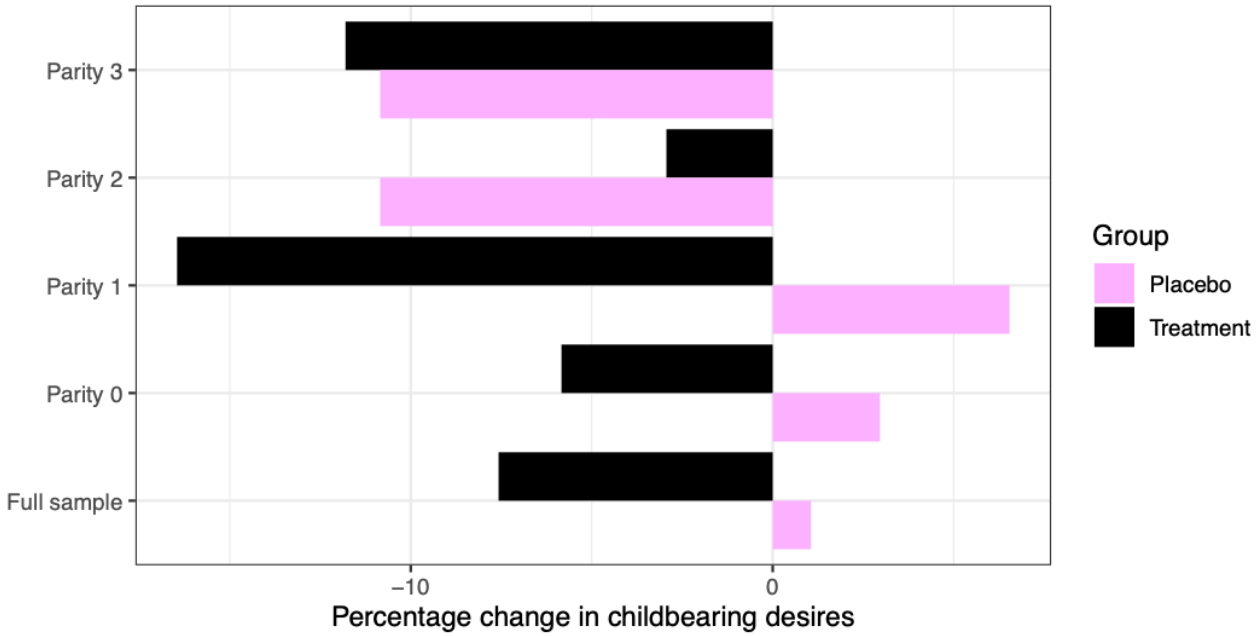
Table 3. Difference-in-difference estimates of the effect of Covid-19 on the childbearing desires of men and women aged 31-37, control versus placebo group

Control versus Placebo		
	Childbearing desires	
	(1)	(2)
Age 31-37	-0.892***	-0.892***
	(0.150)	(0.127)
Treatment cohort	0.889***	0.500***
	(0.155)	(0.132)
Age 31-37 X Treatment cohort	0.053	0.053
	(0.219)	(0.185)
Sex		
Male (Ref.)		
Female		-0.021
		(0.096)
Relationship status		
Married (Ref.)		
Cohabiting		-0.025
		(0.125)
Single		-0.985***
		(0.124)
Number of children		
Childless (Ref.)		
One		-1.260***
		(0.133)
Two		-4.234***
		(0.130)
Three or more		-5.221***
		(0.154)
Education		
Lower secondary or less (Ref.)		
Upper secondary		0.585***
		(0.125)
Higher education		1.013***
		(0.144)
Job contract		
Permanent (Ref.)		
Casual		0.438**
		(0.143)
Not working		0.182*
		(0.112)
Immigration status		
Born in Australia (Ref.)		
Born overseas		-0.099
		(0.275)
Number of siblings		
Zero (Ref.)		
One or more		0.033
		(0.275)
Constant	5.023***	6.876***
Observations	5,432	5,432
R^2	0.024	0.305

*p <0.1, **p<0.05, ***p<0.01

NOTE: Standard errors are shown in parentheses, below the OLS coefficients. Estimation is performed using STATA 14.2. SOURCE: HILDA survey, release 20.

Figure 4. Percentage change in the desire to have a child due to Covid-19 by parity, treatment, control and placebo groups.



NOTE: The figure shows the estimated percentage change in the reported desire to have a child, calculated by dividing the DD estimate by the estimated level of childbearing desire in the treatment group if Covid-19 did not happen (i.e., $\hat{\delta}_{DD}$ / $(Y_T^0 + Y_C^1 - Y_C^0)$). The effect estimates are calculated predictions from fitting regression equation (1) for the full sample and for specific parity subgroups. Only the DD estimates for the treatment groups obtained for the full sample, parity 0 and parity 1 are statistically significant ($p < 0.05$). Estimation is performed using STATA 14.2. SOURCE: HILDA survey, release 20.

Table 4. Mean change in scores for desire for children by selected socio-economic characteristics and pandemic-related factors, N= 1,147.

	Desire for children	N (%)		Desire for children	N (%)
Socio-economic characteristics	Mean decline		**Pandemic-related factors**	Mean decline	
Age group			**Employment uncertainty**		
29-32	1.99	64.58	Yes	2.05	28.86
33-35	3.02	35.42	No	2.48	71.14
Sex			**Wealth reduction**		
Male	2.18	47.57	Yes	2.20	21.97
Female	2.51	52.43	No	2.40	78.03
Relationship status			**Practising social distancing**		
Single	1.33	21.18	Not true or rarely true	2.71	7.50
Married	3.10	50.35	Sometimes true	2.75	15.79
Cohabiting	1.80	28.47	Often or almost always true	2.24	76.70
Number of children			**Quality of relationship with partner**		
Childless	0.87	55.03	Improved	1.87	25.00
One	4.07	27.43	Stayed the same	2.67	66.70
Two	4.21	13.11	Worsened	3.62	8.30
Three or more	4.74	4.43			
			Closeness with relatives and friends		
Education			Did not increase	2.53	76.20
Lower secondary or less	2.80	7.03	Increased	1.80	23.80
Upper secondary	2.62	47.57			
Higher education	2.01	45.40	**Total sample**	2.36	
Job contract					
Permanent	2.16	67.62			
Casual	2.47	11.55			
Not working	2.93	20.83			
Immigration status					
Born in Australia	2.44	81.95			
Born overseas	1.95	18.05			
Number of siblings					
Zero	2.26	4.97			
One or more	2.36	95.03			

NOTE: Respondents providing a score for childbearing desires lower than 6 in the pre-covid wave are dropped.

Table 5. Increase and decrease in childbearing desires among respondents wishing to have a child in the pre-covid period (Reference: Stable)

	Decline (N= 605)		Increase (N= 192)	
	(1)	(2)	(3)	(4)
Pandemic-related factors				
Employment uncertainty				
No (Ref.)				
Yes	0.84 (0.13)	0.98 (0.16)	1.23 (0.24)	1.14 (9.23)
Wealth reduction				
No (Ref.)				
Yes	0.87 (0.14)	0.70 (0.13)	0.68 (0.16)	0.64* (0.15)
Practising social distancing				
Not true or rarely true (Ref.)				
Sometimes true	1.04 (0.31)	0.96 (0.31)	0.76 (0.32)	0.71 (0.30)
Often or almost always true	0.91 (0.24)	0.83 (0.23)	1.06 (0.37)	1.02 (0.36)
Quality of relationship with partner				
Not in a relationship (Ref.)				
Improved	0.91 (0.20)	0.49*** (0.12)	0.96 (0.26)	1.12 (0.32)
Stayed the same	1.14 (0.20)	0.50*** (0.11)	0.89 (0.21)	1.05 (0.27)
Worsened	2.31** (0.76)	1.13 (0.41)	1.03 (0.48)	1.37 (0.67)
Closeness with relatives and friends				
Did not increase (Ref.)				
Increased	0.68** (0.11)	0.71** (0.12)	0.83 (0.17)	0.88 (0.19)
Socio-economic characteristics				
Age group				
29-32 (Ref.)				
33-35		1.86*** (0.30)		1.68*** (0.34)
Sex				
Male (Ref.)				
Female		0.99 (0.15)		1.01 (0.19)
Had a child				
No (Ref.)				
Yes		2.46*** (0.42)		0.41*** (0.10)
Number of children				
Childless (Ref.)				
One		3.33*** (0.61)		1.06 (0.27)
Two		5.32*** (1.47)		2.33** (0.79)
Three or more		6.22*** (2.92)		1.49 (0.95)
Education				
Lower secondary or less (Ref.)				
Upper secondary		1.87** (0.56)		1.69 (0.66)
Higher education		1.06 (0.33)		1.40 (0.56)
Job contract				
Permanent (Ref.)				
Casual		1.61* (0.40)		1.44 (0.43)
Not working		1.21 (0.24)		0.95 (0.24)
Immigration status				
Born in Australia (Ref.)				
Born overseas		0.88 (0.17)		0.94 (0.22)
Number of siblings				
Zero				
One or more		0.62 (0.22)		0.64 (0.27)

*p <0.1, **p<0.05, ***p<0.01

NOTE: Standard errors are shown in parentheses, below the odds ratios. Estimation is performed using STATA 14.2. SOURCE: HILDA survey, release 20.

Table A1. Difference-in-difference estimates of the effect of Covid-19 on the childbearing desires of childless men and women aged 31-37, treatment versus control group

	Treatment versus Control	
	(1)	**(2)**
Age 31-37	-0.125 (0.198)	-0.125 (0.191)
Treatment cohort	-0.203 (0.178)	-0.099 (0.172)
Age 31-37 X Treatment cohort	-0.421* (0.252)	-0.421* (0.243)
Sex (Reference: Male)		
Female		-0.237 (0.122)
Relationship status (Reference: Married)		
Cohabiting		-0.335* (0.149)
Single		-1.536*** (0.146)
Education (Reference: Lower secondary or less)		
Upper secondary		0.303 (0.243)
Higher education		0.873*** (0.248)
Job contract (Reference: Permanent)		
Casual		-0.015 (0.185)
Not working		-0.772*** (0.165)
Immigration status (Reference: Born in Australia)		
Born overseas		-0.063 (0.151)
Number of siblings (Reference: Zero)		
One or more		0.715** (0.260)
Constant	7.538***	7.165***
Observations	2,700	2,700
R^2	0.008	0.083

*p <0.05, **p<0.01, ***p<0.001
NOTES: Standard errors are shown in parentheses, below the OLS coefficients. Estimation is performed using STATA 14.2. SOURCES: HILDA, release 20.

Table A2. Difference-in-difference estimates of the effect of Covid-19 on the childbearing desires of men and women with one child aged 31-37, treatment versus control group

	Treatment versus Control	
	(1)	**(2)**
Age 31-37	-1.817*** (0.316)	-1.823*** (0.317)
Treatment cohort	-0.239 (0.282)	-0.263 (0.283)
Age 31-37 X Treatment cohort	-0.882* (0.399)	-0.866* (0.224)
Sex (Reference: Male)		
Female		-0.092 (0.199)
Relationship status (Reference: Married)		
Cohabiting		-0.208 (0.236)
Single		-1.321*** (0.293)
Education (Reference: Lower secondary or less)		
Upper secondary		1.125*** (0.310)
Higher education		1.565*** (0.343)
Job contract (Reference: Permanent)		
Casual		0.338 (0.313)
Not working		0.363 (0.229)
Immigration status (Reference: Born in Australia)		
Born overseas		-0.366 (0.263)
Number of siblings (Reference: Zero)		
One or more		0.214 (0.463)
Constant	7.350***	6.249***
Observations	1,462	1,462
R^2	0.103	0.134

*p <0.05, **p<0.01, ***p<0.001
NOTES: Standard errors are shown in parentheses, below the OLS coefficients. Estimation is performed using STATA 14.2. SOURCES: HILDA, release 20.

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