THREE ESSAYS ON HEALTH ECONOMICS: APPLICATIONS TO HUMAN AND CIVIC CAPITAL

JOAQUÍN PASEYRO MAYOL

UNIVERSITÀ DEGLI STUDI FIRENZE

UNIVERSITÀ DI SIENA

UNIVERSITÀ DI PISA

Thesis submitted for the degree of Doctor of Philosophy in Economics

Department of Economics and Statistics, University of Siena
University of Florence | University of Siena | University of Pisa

March 2024

Joaquín Paseyro Mayol: *Three Essays on Health Economics: Applications to Human and Civic Capital* , Thesis submitted for the degree of Doctor of Philosophy in Economics, © March 2024

SUPERVISOR:
Tiziano Razzolini

To Elvira and Sergio, for guiding me with your example.

PUBLICATIONS

The author acknowledges permission to use previously published material in this dissertation. The provenance of the chapters is as follows:

Chapter 1. Unpublished material.

Chapter 2. Unpublished material. Jointly written with Juan Pereira, PhD Candidate in Economics at Brown University.

Chapter 3. Unpublished material.

Chapter 4. In part from Joaquín Paseyro Mayol and Tiziano Razzolini (2022). "Covid-19 vaccine uptake: the role of civic capital to overcome the free rider problem." In: *Applied Economics Letters* 0.0, pp. 1–7. DOI: 10.1080/13504851.2022.2146647. In part, from a previous, extended version of this article, and in part, new.

ACKNOWLEDGMENTS

This thesis would not have been possible without the guidance and help of several people who, in one way or another, have contributed to its completion. It is my pleasure to thank each of them wholeheartedly for making it possible.

I have been fortunate to work on two of the three chapters of this thesis with two amazing co-authors who have not only made my task much easier, but have also enriched me with their perspective during the process. This thesis would not have been possible without them.

I am greatly indebted to my supervisor, Tiziano Razzolini, whose academic rigor motivated me to reach my full potential. Even more remarkable and unique is his genuine and selfless interest in developing me as a professional. I will be forever grateful for all that he has done for me during this time.

I extend heartfelt thanks to Juan Pereira, not just a co-author but a dear friend. Despite the time zone differences between Italy and U.S., our countless online discussions challenged and reshaped my viewpoints, enriching the thesis. I'm also grateful for his constant support and guidance during moments of personal and professional uncertainty.

I would also like to thank the professors who hosted me during my three research visits. First of all to Olivier Marie, for all the dedication and attention he gave me during my stay at Erasmus University Rotterdam. To all the faculty and doctoral students, I am very grateful for the interest shown in my research and for receiving me so warmly.

Secondly, to Judit Vall and all the researchers at the Barcelona Institute of Economics - University of Barcelona (UB) for welcoming me to what was my alma mater at my MSc. In particular, I would like to thank the PhD students of the UB for welcoming me as one more in the program and making me feel even more at home in a city where I already felt at home.

Thirdly, to Alejandro Cid, Giorgio Chiovelli, Juan Dubra, Ana Balsa, and all the faculty of the University of Montevideo for welcoming me and giving me the space to share my research with them. Undoubtedly their vision helped to enrich my research on so many different levels.

I would also like to thank all the members of the PhD program, professors, administrative workers, and particularly my colleagues. Also, I want to thank Mónica Gorgoroso and Rafael Aguirre from the Uruguayan Ministry of Health for dedicating their time and attention to all the questions we had for them. Chapters 2 and 3 would not have been possible without their help.

I do not want to end this section without remembering with particular affection my friends in Italy for giving me a place to call home during this time. My years in Siena and Florence would not have been the same without all the aperitifs, pizzas and pastas we shared

together. Without all the moments we laughed, danced, and cried together. Without all the life we lived together. Simply, *grazie per tutto*!

I want to finish by thanking my family and friends in Uruguay. Thank you for being that home to which I try to return every time I can. Thank you for supporting me and for always being there even at a distance. Thank you for having made me who I am today, and for being that guide that drives me to be better tomorrow.

To all of you, thank you.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

LARC Long Acting Contraceptive Method

MOH Ministry of Health

QQ Quantity-Quality

IUD Intra Uterine Device

TFR Total Fertility Rate

APGAR Appearance, Pulse, Grimace response, Activity and Respiration

SIP Perinatal Information System

ASQ-3 Ages and Stages Questionnaires - Third Edition

CBCL 1.5-5 Child Behaviour Checklist for ages 1.5-5

1 INTRODUCTION

This thesis is the culmination of nearly three years of work on various topics, synthesized into a single piece. Consequently, I feel the need to explicitly convey to the reader how the chapters are connected and why they can unequivocally be labeled as essays on Health Economics.

There are two reasons for this. In a first, linear and straightforward interpretation, it falls within the realms of this literature as it uses the "Economic Approach" to explore research questions related to health topics: namely, vaccines and contraceptive methods. To simplify reality and improve our understanding on individuals' behaviour, I make use of models and assume individuals maximize some type of welfare under a set of restrictions to their actions (e.g. time, resources, memory, etc.) (Becker, 1993).

In a second, potentially more holistic and profound interpretation of this work, the term "Economics" takes a different significance as we consider the relevance of the variables of interest in this study to phenomena that have intrigued economists from the very inception of the field, such as growth and development—more specifically, human and civic capital.

Since the pioneering work of Becker, 1962 and Ben-Porath, 1967, human capital has been a core concept used by economists to explain key economic factors such as productivity and growth changes (Mincer, 1984). As defined by Goldin, 2016, human capital is "*the stock of skills that the labor force possesses. The flow of these skills is forthcoming when the return to investment exceeds the cost.*". Relevant for the interpretation of this thesis, early childhood is a crucial phase in the formation of human capital (Heckman, Pinto, and Savelyev, 2013). Any shock at this stage is likely to have a substantial and persistent impact on future life outcomes, including health, education, labour market outcomes and social behaviors (Campbell et al., 2014; Currie and Almond, 2011; Heckman, 2007, 2008; Heckman, Stixrud, and Urzua, 2006).

Conversely, social, or civic capital, as more precisely defined by Guiso, Sapienza, and Zingales, 2011a, refers to: "*those persistent and shared beliefs and values that help a group overcome the free rider problem in the pursuit of socially valuable activities*". Broader conceptualizations have been used by economists to explain variations in growth (Knack and Keefer, 1997), financial development (Guiso, Sapienza, and Zingales, 2004), and the organization of firms (Bloom, Sadun, and Van Reenen, 2012), among many others.

This work is divided into two parts. The first explores how improved access to contraceptive methods can influence the conditions of individuals at birth and their early childhood development, which has a significant impact on their future human capital. The second part delves into the importance of civic capital in overcoming the free-rider problem associated with public goods provision, particularly focusing on the Covid-19 vaccine uptake.

In chapters one and two, which comprise the first part, I examine the profound implications of a nationwide policy implemented in Uruguay that improved women's access to contraceptive methods. This initiative introduced subdermal implants, a long-acting contraceptive method (LARC) that was previously unavailable in the country. The exceptional effectiveness of this method compared to more commonly used methods, such as the pill and condoms, empowered participating women to have greater control over their fertility, helping them to align their intentions with their behavior.

Unintended pregnancies, which are more frequent in disadvantaged households, exacerbate existing problems, perpetuating intergenerational disparities. However, policies that address socioeconomic inequalities often overlook the consequences of the decision to have a child. In chapter one, in collaboration with Juan Pereira, a PhD Candidate from Brown University, we use geolocated birth data to estimate the effect of policy on the number and characteristics of births, focusing on unintended pregnancies, parental investment, and newborn health outcomes. The results reveal a significant 14% reduction in births in the five years following the implementation of the policy, increasing to 30% by the end of the study. The decline is observed especially among younger, less educated women with more than two children. Unintended pregnancies decrease by 23% on average, with a notable increase of 4-6% in parental investment measures during gestation. Suggestive evidence of improvements in neonatal health outcomes is also found.

These findings underscore the role of long-acting contraceptive methods in reducing unplanned pregnancies, even in contexts where abortion is legal, and financial barriers to access other methods are minimal. Moreover, they emphasize the immediate impact of policies guaranteeing women's reproductive rights on newborn health outcomes and parental investment, ultimately contributing to enhanced socioeconomic development.

In the second chapter, I extend the analysis to investigate the impact of having fewer siblings on early childhood development as a result of the same policy. Using survey and administrative data, and combining regression and matching techniques, I study what is the impact of having fewer siblings on a child's early childhood development. The quantity and quality of children in a family are strongly related. The fewer children there are, the more resources there are to distribute among the existing children. My main results suggest that children who had fewer siblings as a consequence of this program are less likely to have development delays, especially related to problem resolution and gross and fine motor skills. In line with an increase in allocated resources, the results point to an earlier referral of the child to a care and education center as a possible mechanism.

The main contribution of this study is to provide new evidence for the existence of a QQ trade-off that is already identifiable at very early stages of life. While previous studies have mainly analysed the impact of changes in the number of siblings on the quality of individuals in the medium and long term, this study focuses on early childhood developmental outcomes. Empowering women through reproductive rights not only benefits them but also positively influences the development of already born children, who receive increased time, attention, and resources.

Taken together, these two chapters inform about the far-reaching impacts of providing access to high-quality family planning services on human capital formation. While we know that early childhood is a crucial phase in a human being's life, these results highlight the importance of pre-conception policies for that matter.

Finally, in the third chapter of my thesis, in collaboration with Prof. Tiziano Razzolini, we study the role that civic capital may play to overcome the free rider problem in the creation of public goods. Vaccination rates are likely to reflect the expected benefits and drawbacks for individuals. As a larger share of the population gets vaccinated, individuals have more incentives to free ride and benefit from the positive externalities of a high vaccination rate, while not being affected by the potential harms of receiving vaccination. Using Covid-19 vaccination data at the municipality level in the Italian region of Lombardy, we show that communities with a higher level of civic capital were able to overcome this collective action problem. An indirect measure of the willingness to contribute to a public good (i.e. the share of residents paying the TV licence) proves to be particularly useful to predict the success of vaccination campaigns.

The findings of this chapter confirm that civic capital may represent a key element in overcoming the free rider problem in the provision of a public good, in this case high vaccination coverage. In particular, the empirical results indicate that information on local communities regarding pro-social behaviours (such as altruism) and willingness to contribute for the provision of a public good can be used to identify areas that should be specifically targeted by vaccination campaigns.

To conclude, the initial aim of this chapter was to present the topics studied in this thesis and to provide the reader with a possible answer to a question that may arise during the reading of the thesis, and which I am often asked when presenting my work: "How is this Economics?". In all honesty, I am aware that these arguments will be insufficient for some, as the areas that Economics should be concerned with differ from one individual to another. I hope, nevertheless, that this brief introduction has provided some clues on why the findings of this work are relevant to the socioeconomic development of individuals and societies. The purpose of the following chapters is to convince the reader of this.

2 PLANNING BETTER

UNPLANNED PREGNANCIES, PARENTAL INVESTMENT, AND NEWBORN OUTCOMES

2.1 INTRODUCTION

Despite a steady increase in contraceptive access in recent decades, the number of unintended pregnancies remains surprisingly high. 42% of pregnancies were unintended in the United States and Uruguay, the country of analysis, in 2012 (Finer and Zolna, 2016). Although staggering on its own, this statistic also hides a dramatic heterogeneity. While the rate of unintended pregnancies in Uruguay was 18% among mothers with college degrees, the incidence jumps to 60% among mothers with only primary education.

Two types of economic arguments support the idea that lowering the high number of unplanned pregnancies should be a top priority of public policy. The first one is that development starts at conception. Children born of unwanted pregnancies are on average more likely to be in poorer health at birth (Kost and Lindberg, 2015), and contribute to reinforcing the cycle of poverty (Bailey, 2013; Miller, Wherry, and Foster, 2023). Unplanned births, concentrated among low-income and low-educated parents, place a further burden on households that already face adverse living circumstances, setting the newborn on a lifetime of disparities that are ultimately linked to later delayed cognitive development and poor school performance (Currie and Almond, 2011; Larson, 2007; Sawhill, Karpilow, and Venator, 2014). Indeed, Seshadri and Zhou, 2022 carries out a counterfactual exercise and finds that providing better contraceptives to poorer households would increase inter-generational mobility in the United States by 0.3 standard deviations across states.

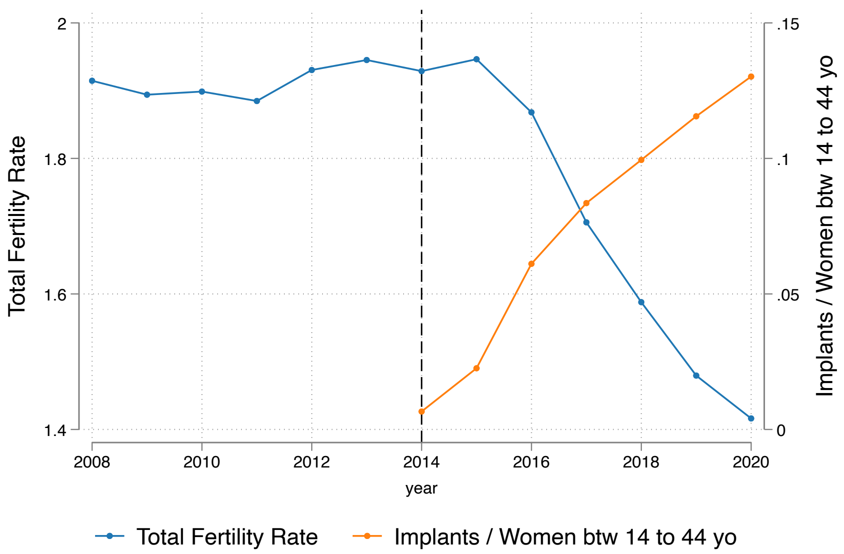
The second argument focuses on the cost that an unintended pregnancy places on women themselves (Gallen et al., 2023). Policies aimed at reducing unintended pregnancies have the potential to improve women's well-being, for instance, by increasing their educational attainment and employment outcomes (Bailey, 2006; Bailey, Hershbein, and Miller, 2012; Barham et al., 2021; Goldin, 2006; Goldin and Katz, 2002; Hock, 2007; Miller, 2010)

This study seeks to answer: How does access to a better and more effective contraceptive method affect fertility? Does it decrease the incidence of unintended pregnancies? Does this lead to better newborn health outcomes and parental investment during pregnancy?

To answer these questions, we take advantage of a policy carried out by the Uruguayan Ministry of Health (MOH). Starting in 2014, the Ministry improved sexual and reproduction counseling by introducing in the country a new and more efficient contraceptive method:

subdermal implants. The outstanding efficacy of the implant (99.9% for up to 5 years) is explained by its critical advantage over other methods: it does not require any action on the part of the user to ensure its correct functioning. The demand for the implant was so impressive that in just 4 years it reached 10% of all women of reproductive age and has been associated with the largest decline in the TFR in the country's history, which fell from 1.9 to 1.4 in a 5-year span (Figure 1).

Figure 1: Implants and TFR



Note: This figure shows from 2008 to 2020 the TFR for Uruguay and the number of supplied contraceptives per women in gestational age (from 14 to 44 years old). The left-hand-side y-axis shows the TFR and the right-hand-side y-axis shows the number of implants supplied per women in gestational age.
Source: Live Birth Certificates (CNV) and State Health Services Administration (ASSE)

Relying on the staggered rollout of the policy, we exploit the temporal and geographic variation in adoption to estimate the effect of access to subdermal implants on fertility, pregnancy intention, parental investment during gestation, and children's outcomes at birth.

Our first finding documents a sharp decrease in fertility that averages a 14% effect and reaches almost 40% at the end of our period of analysis (6 years). This decline is mostly driven by two types of populations: on one hand, young and low-educated women, and on the other hand, women from all socioeconomic backgrounds and ages who are already mothers and are preventing an additional child. This pattern suggests that, unlike what previous studies have found (Ananat and Hungerman, 2012; Goldin, 2006; Miller, 2010), family planning policies can not only delay pregnancies but also have the capacity to significantly reduce the total number of pregnancies and, consequently, the TFR.

Our second finding shows that unplanned pregnancies fall 60% more than the average fertility decline. In line with the increase over time of the supply of the contraceptive, we find a large increase of pregnancy intention of roughly 8% towards the end of the analyzed period. Measures of contraceptive failure decreased, suggesting that the policy addressed a contraceptive usage problem rather than an accessibility one. In addition, parental investment throughout the gestation period improves in a similar way to pregnancy intention results. The number of prenatal care visits attended, the participation of the mother in a breastfeeding course, and the presence of the partner at delivery increased significantly towards the end of the period, in a range of 4%-6%. We also find evidence of a reduction in smoking habits during pregnancy. These results not only back up the pregnancy intention outcomes, but they are also relevant on their own as they are indicative of better children's short and long-run development.

Our third result documents suggestive evidence of better children's health outcomes at birth. We observe a positive trend break (which, depending on the estimator, becomes significant in later periods) for the binary variable indicating if the newborn weight is correct for her gestational age. We also find an increase in the Appearance, Pulse, Grimace response, Activity and Respiration (APGAR) score at minute 5.[1]

Considering the negative relationship between unplanned pregnancies and children's birth and parental investment outcomes, the results seem, at first glance, obvious. However, far from being evident, our short-term findings are essentially led by the characteristics of program participants relative to the rest of the female population. Indeed, similar studies have found opposite results (Ananat and Hungerman, 2012), emphasizing the novelty of our findings.

In the long run, there are two potential mediating mechanisms explaining the effects. A direct mechanism, related to women who were able to delay their pregnancies, invest in their own development, and have (planned) children later in life when they are better prepared to do so. And, a second mechanism, associated with women who stopped their childbearing and therefore, by selection, shaped the distribution of births' characteristics. We discuss more about these mechanisms in the conceptual framework and discussion section.

This paper relates to three bodies of work in economics. First, it contributes to a modest amount of research indicating that contraception has an effect on newborns. Most closely related, Rau, Sarzosa, and Urzúa, 2021 shows that collusive activities between pharmaceutical firms in Chile led to a stark increase in contraceptive prices, which caused a rise in unplanned pregnancies and an increase in the number of underweight births. Opposite to our results, Ananat and Hungerman, 2012, finds that in the short-term, pill access in the U.S. increased both the share of children with low weight at birth and the share born to poor households. Finally, Bailey, Malkova, and McLaren, 2019 finds that children born in U.S. counties that were ex-

1 The APGAR score measures five things to check a baby's health. Each is scored on a scale of 0 to 2, with 2 being the best score: 1. Appearance (skin color) 2. Pulse (heart rate) 3. Grimace response (reflexes), 4. Activity (muscle tone), 5. Respiration (breathing rate and effort).

posed to a family planning program (Title X) in the 60's and 70's have better long-term economic outcomes. We show how a country-wide policy can empower women to better plan their fertility decisions, and as a consequence improve parental investment during gestation and children's birth outcomes.

Second, this paper relates to the effect of contraception on fertility. Previous studies have shown the puzzling result of a negligible change in the TFR due to family programs. While these studies (Ananat and Hungerman, 2012; Bailey, 2006; Goldin and Katz, 2002; Miller, 2010) show that access to contraception delays pregnancies, our findings indicate on top of the postponing results, a change in fertility as a result of the substantial proportion of mothers with two or more children responding to the policy.

In the third place, we contribute to a strand of literature that studies the effect of Long Acting Contraceptive Method (LARC)s on fertility. Prior research has identified that providing LARCs for free or at a reduced fee to low-income women increases their take-up (Bailey et al., 2023; Mestad et al., 2011) and has a sizable impact on the number of teen pregnancies (Kelly, Lindo, and Packham, 2020; Lindo and Packham, 2017). We provide evidence of the role that LARCs can play in reducing unplanned births, even in contexts where abortion is legal and there are virtually no financial barriers to accessing other contraceptive methods.

These findings are also of relevance to policymakers. Financial, moral and information barriers, as well as behavioral biases in the use of contraceptives are associated with unintended childbearing (Marie and Zwiers, 2022; Seshadri and Zhou, 2022; Stevens and Berlan, 2014). According to a recent study by the United Nations Population Fund (Baker, Keogh, Luchsinger, et al., 2022), 121 million pregnancies in the world were unplanned in 2022. It also documents that 60% of unintended pregnancies end in abortion and an estimated 45 percent of all abortions are unsafe, causing 5 – 13 percent of all maternal deaths. This study shows the effectiveness of the subdermal implant in preventing unplanned pregnancies and fostering women's agency by guaranteeing their right to have more control over their fertility.

The rest of the paper is organized as follows. Section 2.2 describes the Uruguayan health system, the policy under study, and the fertility context in which it was implemented. Section 2.3 provides a conceptual framework of how the policy is likely to affect unintended pregnancies, parental investment, and newborn outcomes. Section 2.4 describes our data, while Section 2.5 and Section 2.6 introduce our empirical strategy and the econometrics behind it. Section 2.7 presents our results and Section 2.8 discusses them. Finally, Section 2.9 concludes.

2.2 POLICY AND CONTEXT

2.2.1 *The Uruguayan health system*

The Uruguayan health system is deeply rooted in the belief that health is a fundamental human right, a public good, and a responsibility of the state. This approach has resulted in total health expenditure in Uruguay reaching 10.5% of the Gross Domestic Product (GDP) in 2019. The Ministry of Public Health is responsible for overseeing a comprehensive healthcare system that includes both public and private providers, ensuring universal coverage across the country.[2]

With a population of around 3.5 million, approximately 2.5 million people in Uruguay are enrolled in the healthcare system through social security. This includes formal employees and retirees who contribute social security taxes for themselves and their dependents. The remaining population, including informal workers and the unemployed, can choose to either enroll in public health insurance (which is mostly free[3]) or pay for private insurance entirely. Interestingly, around 500,000 people who contribute to the health system through social security opt to use public health services to avoid high copayments.

The MOH reported that 39% of women between the ages of 15 and 44 used public health services in 2014. A distinctive feature of the Uruguayan health system is that, while most women from lower socioeconomic status use the public health system, there are non-negligible numbers of them who use the private sub-sector.[4]

The public healthcare system is organized into three tiers. The highest tier includes all of the nation's public hospitals, while the medium tier is made up of "health centers" (Centros de Salud), which provide a variety of services, such as imaging and laboratory work, and act as a link between hospitals and primary care. The first tier provides territorial-based care, offering access to general practitioners, gynecologists, and pediatric services. Throughout the paper, we will refer to all these different types of health facilities as "health clinics" or "health centers".

2.2.2 *Fertility context in Uruguay and the region*

Uruguay's total fertility rate (TFR) has been consistently below the replacement level of 2.1 children per woman for the past two decades. Compared to its neighbors in the Southern Cone region of South America, Uruguay's TFR has historically been among the lowest.

The country's fertility pattern in the early years of the twentieth century masked, nevertheless, two distinct realities: more educated women had been increasingly delaying childbearing, while younger

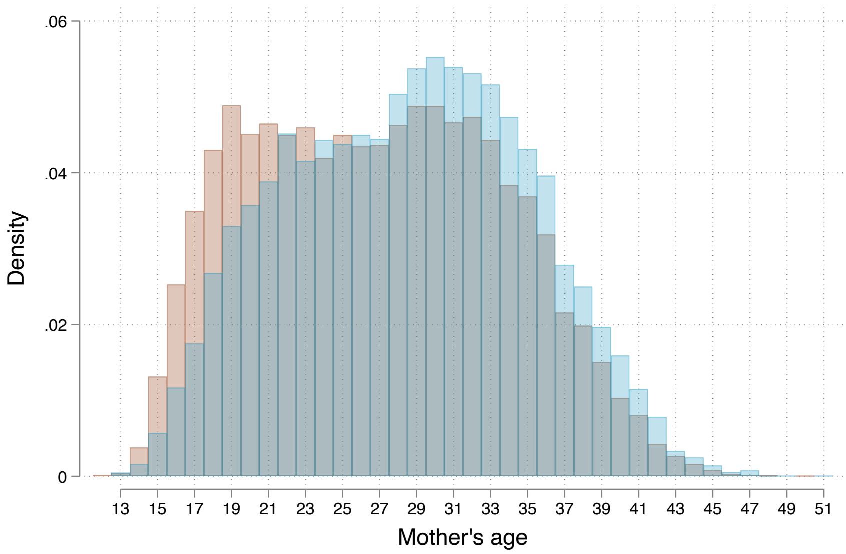
2 Functioning of the health system in Uruguay - PAHO 2021.
3 Some procedures and tickets have low copayments in the public health subsystem.
4 According to statistics from the Continuous Household Survey for the year 2018, 41% of childbearing-age users of the private health system were from the two lowest income quintiles, compared to 88% for public health.

cohorts of women from poorer and less formally educated backgrounds saw no delay in their age at first birth. As a consequence, until 2015, Uruguay had a clear bimodal fertility profile with peaks around ages 20 and 30 (Cabella, Nathan, and Pardo, 2019b). Moreover, the births concentrated around the first peak of the distribution were mostly unplanned (Brunet et al., 2020). In other words, the country had relatively high fertility rates among teens and low TFR among young and adult women. Against this backdrop, it is not surprising that once the country managed to better help teenagers to control their fertility the TFR plummeted.

Since 2015, the country has been experiencing a salient demographic transition, characterized by a sharp decrease in the TFR in a short time span. After being stagnant during the first decade of the twentieth century, births began to decline in 2015 in such a sharp way that in only 5 years, the TFR went from roughly 2.0 to 1.4 children per woman. This dramatic change in the fertility rate is contemporaneous with a set of educational and contraceptive policies that the MOH has carried out since 2012.

The first one, which will be further discussed in the next subsection, is the introduction in 2014 of a new option to the basket of contraceptive methods offered to women: subdermal implants. Figure 1 shows the evolution of the TFR in the left-hand side y-axis and the number of subdermal implants supplied at different public health clinics over the number of women at gestational age in the right-hand side axis. There is a clear increase in the availability of the method concurrently with the fertility decline. Additionally, Figure 2 shows how the decline in fertility washed out the bimodal fertility distribution that characterized the pre-2015 period.

Figure 2: Mothers' age distribution



Note: This figure shows in red the distribution of the age of women who gave birth in 2013. In blue the distribution of the age of women that gave birth in 2019.

A second important change that took place in 2012 was the legalization of the voluntary termination of pregnancy before 12 weeks of gestation (Law Nº 28.987).[5] Although we want to emphasize that perhaps both policies (among other possible explanations) are behind the decrease in the TFR, we are confident that our results are capturing the effect of the policy and not those of abortion legalization. First, as we describe in Section 2.5, we rely on the staggered adoption of the policy in time and space which is uncorrelated to the nationwide abortion legalization. Indeed, abortion accessibility happened in all health clinics at the same time. Second, unlike the decrease in the TFR, the evolution of the number of abortions per year has remained flat since 2014. Third, we show in Figure A1 in the Appendix the evolution of the TFR over time for Argentina. The neighboring country implemented a very similar policy during the same years but, unlike Uruguay, abortion was legalized in 2020 (Law 27.610). Fourth, self-induced abortions using misoprostol have been a common practice in the country since the early 2000s (Cabella and Velázquez, 2022). Abortion numbers are shown in Table A3 in the Appendix.

2.2.3 *The Policy*

With the aim of expanding and improving the supply of contraceptive methods, in 2014 the MOH, with technical and financial aid from the United Nations Population Fund (UNFPA), decided to incorporate subdermal implants into the basket of contraceptives[6] and offer them free of charge through the public health system. This long-acting contraceptive method (LARC) has a failure rate of less than 1% since it entirely eliminates potential user errors (as opposed to birth control pills, injectables, patches, rings, and condoms, which have failure rates of 6-18%)[7]. Given its outstanding efficacy and safety, it was considered by authorities to be a good complement to the available contraceptive options at the time. According to the 2015 National Reproductive Survey carried out by the National Statistics Institute, 43% of women reported using oral contraceptive pills, 31% (male) condoms, 10% Intra Uterine Device (IUD), and 14% did not use any contraceptive method.

LARCs are good candidates to help reduce unintended pregnancies. As they do not require any action from the user, they are more ef-

5 These two actions are framed within the approval of the Law on the Defense of the Right to Sexual and Reproductive Health (Nº 18,426) in 2010, which aimed to guarantee the right of individuals to decide whether or not to have children and, if so, at what point life to do so. In this regard, besides the two policies previously described, since 2013, the MOH provides financial support programs for assisted fertilisation (Cabella, Nathan, and Pardo, 2019a; López Gómez et al., 2016).

6 This basket included male and female condoms, contraceptive pills, and intrauterine devices. Users of the private health system could access the subdermal implants by paying a small fee.

7 In particular, the pill and male condom have 9% and 18% *typical use* failure rates over one year, respectively. Source: "Contraceptive Use in the United States", Guttmacher Institute, October 2015 https://www.guttmacher.org/fact-sheet/contraceptive-use-united-states

fective than traditional short-acting methods. Moreover, LARCs reduce the non-financial costs associated with contraception (Bailey, Malkova, and McLaren, 2019), such as the behavioral costs related to the risk of forgetting to regularly take the pill as well as the need to return to the doctor to ask for a prescription to have access to the method. Similarly, these methods can also help mitigate behavioral biases that are very frequent in the use of contraceptives (Baicker, Mullainathan, and Schwartzstein, 2015; Stevens and Berlan, 2014). Overall, LARCs have the potential to reduce the alleged main cause of unintended pregnancies: the inconsistent use of contraceptive methods (Ong et al., 2012).

The subdermal implant employed in this program consists of a pair of flexible cylinders that constantly release levonorgestrel after being placed into the inner region of the non-dominant upper arm. Even though there is no need for a skin incision, these implants must be inserted by trained professionals.

In June 2014, the MOH launched a pilot in 14 health centers in the country to assess the acceptability of the method among the women's population. The acceptability and demand for the method was so impressive that, towards the end of 2014, health centers in the rest of the country were gradually incorporated into the program. Indeed, by 2020, 97,800 implants had been distributed, representing about 13% of the total number of women at gestational age in the country. Table A1 included in the Appendix provides more information on the deployment of the program. Although no information is available on the characteristics of the women who received the implant, the Ministry of Health reports that, of those who participated in the pilot (3,000 women), 51% were under 25 years of age, and 88% already had children. As for their previous contraceptive method, 34% used male condoms, 29% the contraceptive pill, 8% the IUD, and 15% did not use any method. The contraceptive use of these women is similar to the national average, 43% of women reported using oral contraceptive pills, 31% (male) condoms, 10% IUD, and 14% did not use any contraceptive method.

Selection into the program by health clinics did not follow a well-defined criteria. The only requirement for centers to receive the policy was to be able to offer all other contraceptive methods. The MOH then, decided which clinic received the policy and at what time.

Three key components of the program altered how women experienced sex and reproductive health consultations. The first is having access to subdermal implants. This method was not available in the country before it was introduced by this policy. The second component is that, unlike a intra-uterine device (IUD), which can only be inserted by a gynecologist, an implant can be inserted by a general practitioner, an obstetrician, or a gynecologist. The third component is that in order to acquire the implant, health facilities had to update all other forms of contraception first so that women's choice of contraception would not be constrained by the availability of other methods.

The access and usability of contraceptives are critical in determining family planning policies' effectiveness and preventing unintended pregnancies. The problem of access pertains to the availability, affordability, and geographical proximity of contraceptive methods to individuals and communities. In many regions, particularly in low-income areas, limited access to contraception remains a significant barrier (Dehlendorf et al., 2010; Shartzer et al., 2016). Insufficient access can restrict individuals' options, leaving them with limited control over their reproductive health.

Usability, on the other hand, refers to the practicality of the contraceptive methods. A contraceptive method may be available, but if it is not user-friendly, culturally acceptable, or appropriate for an individual's needs, its effectiveness diminishes. Issues of usability encompass factors like ease of use, potential side effects, cultural sensitivities, and personal preferences. Indeed 29% of all births in Uruguay in 2013, happened even if some contraception was used (95% of them were using condoms -45%- or pills -49%-).

The introduction of subdermal implants to the basket of contraception in the country was intended to provide a better method to cope with a usability problem, especially related to the use of Short Active Reversible Contraceptives[8]. Implants are free of human error, and therefore, are a more reliable method to prevent unwanted pregnancies.

2.3 CONCEPTUAL FRAMEWORK

Unintended pregnancies, which include both mistimed and unwanted pregnancies, are not evenly distributed among the population of women.[9] Mothers of unintended pregnancies are more likely to present riskier behaviors, such as tobacco smoking or alcohol and drug use during pregnancy, and to attend a lower number of prenatal visits (Altfeld et al., 1998; Pagnini and Reichman, 2000; Than et al., 2005; Weller, Eberstein, and Bailey, 1987). In addition, some studies have also found an increased risk of low birth weight and premature delivery (Eggleston, Tsui, and Kotelchuck, 2001; Sable and Wilkinson, 2000).

Indeed, using data from Uruguay's births in 2013, we observe similar patterns. Table 1 shows the mean difference for mothers, pregnancies, and newborn characteristics between planned and unplanned pregnancies. Except for the proportion of preterm births, all characteristics are significantly different. Mothers who planned their pregnancies are older, more educated, and have fewer children. Also, while only 27% of the mothers who reported having planned their pregnancy attended public health centers, 53% of the unplanned pregnancies received care in public clinics. In addition, planned pregnancies are associated with more prenatal care visits, higher attendance in delivery preparation courses, almost half the incidence of tobacco smoking habits, less reported intimate partner violence, and lower

8 As Finer and Zolna, 2016 observes, inconsistent use of SARCs was associated with 43% of unintended pregnancies in the U.S. in 2011.

9 See Table 2 for a precise definition of the question capturing unintendedness.

alcohol and drug use. Newborn characteristics also show salient, although not that sizeable, differences. Children born from unplanned pregnancies weigh on average 18 grams less, are 1.6% less likely to have an accurate weight for gestational age at birth, and have significant, although small, differences in APGAR scores.

At first glance, based on the information shown on Table 1, one could think that the policy will lead to obvious positive results on parental investment and children's health outcomes. This would be the case if the policy were distributed equally among women who do not wish to have a child. Nevertheless, family planning programs often reinforce disparities by favoring the more affluent population.[10] The characteristics of program participants relative to the rest of the population are therefore key to understanding the short-term impact of the policy. If, for instance, the policy has a higher take-up among more educated women who are better equipped to navigate the intricacies of unintended pregnancy, then the average parental investment and newborn outcome in the treatment area will mechanically decrease in the short term, and we will find a negative effect of the policy on those outcomes.

In this study, we examine the immediate, short-term effect of the policy. Given that the implants last for five years (unless they are removed), and that our data only cover 6 years after the introduction of the policy (2014-2020), there is a very short time span to fully observe the medium- and long-run effects of the policy. Nonetheless, the ultimate influence of the policy hinges on two possible mechanisms (Bailey, Malkova, and McLaren, 2019). The first one, explained by those women who took up the implant and later decided not to have children; and a second mechanism, described by those who, aided by the implant, postponed their pregnancy for the future. The latter mechanism (i.e. *direct effect*), describes a situation in which, by allowing women to have more control over their fertility, the policy helps them to be better equipped for a potential future pregnancy. By delaying the pregnancies, women could increase their labor force participation, and schooling, and find a more suitable partner, among other potential investments. The first mechanism, on the other hand, describes a pure selection effect.

10 Ananat and Hungerman, 2012 finds that the introduction of the pill in the U.S. had a "negative selection effect", as the program participants were above the average on the resource distribution.

Table 1: Planned and unplanned pregnancy differences

	Planned (1)	Unplanned (2)	Difference (3)	P-Value (4)
Panel A: Mother's characteristics				
Age	28.484	24.787	3.696	0.000
Years of education	11.301	8.834	2.466	0.000
Previous pregnancies	1.041	1.492	-0.450	0.000
Public Health Care	0.271	0.529	-0.258	0.000
Panel B: Pregnancy characteristics				
# Prenatal visits	10.072	8.464	1.608	0.000
Attend labor preparation	0.584	0.347	0.236	0.000
Tobacco smoker	0.160	0.276	-0.116	0.000
IPV	0.002	0.006	-0.004	0.000
Mother drug user	0.003	0.010	-0.007	0.000
Mother alcohol user	0.002	0.004	-0.002	0.005
Panel C: Newborn characteristics				
Weight	3,286.020	3,268.090	17.808	0.016
Correct Weight for g.a.	0.871	0.856	0.016	0.001
Preterm	0.082	0.088	-0.006	0.107
APGAR 1	8.545	8.519	0.027	0.061
APGAR 5	9.662	9.624	0.038	0.001

Notes: This table shows the mean difference between the characteristics of planned and unplanned pregnancies. The results are for Uruguay in 2013 based. Column(1) shows the average for planned pregnancies, column (2) the average for unplanned characteristics. Column (3) shows the difference between (1) and (2), and column (4) shows the p-value of a hypothesis testing of (1)=(2). Panel A describes mothers' characteristics, Panel B shows characteristics of the pregnancy, and Panel C shows newborn characteristics. Source: SIP.

2.4 DATA

The main source of data comes from the Perinatal Information System (SIP) ("Sistema Informático Perinatal"), a resource developed by the Latin American Center for Perinatology of the Pan American Health Organization for studying and improving maternal and child health outcomes. The SIP is a comprehensive tool created to assist clinical decision-making across the whole perinatal period, including prenatal, labor, postpartum, neonatal care, and post-abortion care. Beginning with the mother's initial appointment, the SIP has thorough clinical records and supplementary surveys for the majority of births in the nation.

In this study, we make use of SIP data from 2011 to 2020. Table 2 contains the definitions of the main variables that we use in our analysis. To approximate the effect on parental investment, we look at the number of prenatal care visits attended as a measure of commitment to the current pregnancy and as a robustness for the intention results. We also look at the mother's tobacco smoking habits and alcohol and drug consumption. Furthermore, we look at the mother's participation in a breastfeeding course. and the presence of the partner at delivery to shed light on the parent's commitment to the newborn. To understand the effect on newborn health outcomes, we look at: weight at birth, APGAR scores at minutes 1 and 5, and preterm delivery status.

Although it is a requirement for all public and private health facilities to record and report perinatal data to the Ministry, this is not always the case. We compared the number of births reported in the SIP database with the number of births recorded at the National Registry of Live Birth Certificates (CNV for its Spanish initials), which has full coverage in Uruguay, in order to evaluate the accuracy of the data in the SIP database. We identified some differences in reporting for eight out of nineteen regions ("departamentos") across both datasets. In particular, as described in Table A21 and Figure A3 and Figure A4 in the Appendix, the coverage of the SIP dataset shows extraordinary variation for these eight regions.[11] As a result, we decided to exclude them from our analysis.

We have the precise address from the SIP, which is a crucial component of our identification strategy. Using this information, we attempted to geolocated each birth in the dataset using GoogleMaps and the Unique Geographic Address System API.[12] 78% of the observations could be geolocated with accuracy. The remaining 22% of births for which geolocation was not possible did not exhibit differences in observable factors.

In addition to the SIP database, the study also uses data from the 2011 Uruguayan Census, the National Institute of Statistics "localidades" and "barrios" shapefiles, household surveys from 2011 to 2019 (ECH), and the geolocation of all public health clinics from the Geographic Information System of the Ministry of Social Development (SIG-MIDES). Furthermore, the MOH and the State Health Services Administration (ASSE) provided records that enabled us to identify which health centers were part of the program and the year in which they were incorporated.

11 SIP-coverage varied more than an arbitrarily defined threshold (10%) for some years relative to the mean coverage for the region (i.e. $coverage_{it} - mean\_coverage_i)/mean\_coverage_i$).

12 See https://www.gub.uy/infraestructura-datos-espaciales/tramites-y-servicios/servicios/sistema-unico-direcciones-geograficas for further details of this API.

Table 2: Definition of variables

Age:	Age of the mother.
Education:	Years of education of the mother.
Planned Pregnancy:	Refers to a wanted and timed pregnancy. Binary variable indicating with 1 if the mother answers "Yes" to the following question during the first prenatal visit: When you found out about this pregnancy, did you want to be pregnant? (and "No" to the following questions: Did you want to wait longer? Or did you not want to have (more) children?). 0 otherwise.
Contraceptive failure:	Binary variable indicating with 1 if the mother reports to have been using a contraceptive method when she got pregnant.
N Prenatal:	Number of prenatal visits attended.
Weight:	Weight (in grams) of the newborn.
Correct Weight:	Binary variable indicating with 1 if the medical assessment considers the newborn's weight is appropriate for gestational age. 0 otherwise.
Partner:	Binary variable indicating with 1 if the partner was present at delivery. 0 otherwise.
Breastfeeding:	Binary variable indicating with 1 if the mother assisted to a breastfeeding counseling visit. 0 otherwise.
Tobacco:	Binary variable indicating with 1 if the mother reports to smoke tobacco at any point of the pregnancy. 0 otherwise
Preparation:	Binary variable indicating with 1 if the mother assisted preparation course for labor and delivery. 0 otherwise.
Preterm:	Binary variable indicating with 1 if the baby was born before the 37^{th} week of pregnancy.
APGAR 1:	Standardized assessment performed on a baby 1 minute after birth. The provider examines breathing effort, heart rate, muscle tone, reflexes and skin color. The score goes from 0 (low values) to 10 (high values).
APGAR 5:	Assessment identical to APGAR 1 but performed 5 minutes after birth.
Days Hospital:	Number of days that the newborn had to be hospitalized after birth.

Notes: The definitions of these variables come from the SIP codebook.

2.5 EMPIRICAL STRATEGY AND DESCRIPTIVE STATISTICS

The research design is based on the staggered adoption of the program. As described earlier, once the MOH decided to scale up the policy, different health centers located in different places at different times started to receive it. We observe the health center that received the policy, where it is located, and in which year they started to provide the new contraceptive method. However, since we do not know the population that regularly assists the health centers, we base our analysis on the smallest geographical units containing the health centers.

These smallest geographical units consist of urban areas distributed throughout the country.[13] From the Uruguayan geographic data available, we consider "localidades" for the countryside and "neighborhoods" for Montevideo, the country's capital. For uniformity, we call these units "geographic units" throughout the paper. Based on these geographical units, we assign treatment as follows: if the unit has a

13 95% of the population in Uruguay lived in urban areas in 2012 according to World Bank data.

treated health center, we then classify the unit as treated in the year in which the first health center inside that unit received treatment; therefore, we have units treated in 2014, 2015, 2016, and 2017. The units that have health centers that never received treatment are categorized as never treated. Finally, there are some units that do not have health centers; in this case, we approximate treatment based on the distance from the unit to the nearest health center; thus, if the nearest health center received treatment, the unit is categorized as treated, and never treated otherwise. Table 3 Panel A, shows the number of units that were incorporated into the program in different years.

Table 3: Descriptive statistics

	T-2014	T-2015	T-2016	T-2017	Never-T
	(1)	(2)	(3)	(4)	(5)
Panel A: Quantities					
N Geographical units	24	55	87	38	136
N Births Pre-2014	14,474	26,463	16,468	11,258	2,847
Panel B: Mother's characteristics from SIP database (2011-2013)					
Mother's Age	25.466	27.957	26.217	27.234	27.913
	(6.618)	(6.739)	(6.632)	(6.717)	(6.737)
Mother Years of Education	8.701	11.203	9.506	10.439	10.861
	(2.968)	(4.035)	(3.240)	(3.778)	(3.804)
Planned	0.491	0.632	0.555	0.596	0.658
	(0.500)	(0.482)	(0.497)	(0.491)	(0.475)
Previous Pregnancies	1.369	0.950	1.141	1.040	1.009
	(1.596)	(1.290)	(1.407)	(1.341)	(1.308)
Panel C: Woman of childbearing age - Census (2011)					
Nº of women	5,971	6,809	4,995	4,863	1,631
	(2,044)	(4,301)	(3,048)	(2,433)	(1,284)
Age	28.578	29.026	28.959	29.285	29.364
	(8.644)	(8.283)	(.665)	(8.648)	(8.769)
Nº Children	1.436	0.907	1.324	1.119	1.182
	(1.603)	(1.189)	(1.483)	(1.354)	(1.351)
Years of Education	8.967	11.570	9.504	10.619	10.449
	(3.003)	(3.187)	(3.183)	(3.258)	(3.509)
Labor Force Participation (%)	0.559	0.661	0.592	0.631	0.594
	(0.495)	(0.466)	(0.487)	(0.475)	(0.470)

Notes: This table shows quantities and summary statistics of the most relevant variables for each treatment and never treated group. Each treated group is based on the year in which the geographical unit started treatment. Panel A shows the number of observations (geographical units and births). Panel B shows averages and standard deviations in parenthesis using only observations of the pre-treatment period (2011-2013). Panel C shows averages and standard deviations in parenthesis of the women at gestational age. For a detailed description of the variables see Table 2. Sources: SIP and 2011 National Census.

Assigning treatment in this way creates three important caveats that bias our results downward. First, even though health centers are categorized into three main categories[14], we consider their treatment incidence in the same way. Second, even though the limits of the geographical units are drawn so that the population inside them

14 Hospitals, 2nd order health centers (Centros de Salud), and 1st order health clinics (Policlinicas).

conforms to a local community, the health centers situated there can nevertheless treat patients who live outside the boundaries of the geographical unit. Third, the policy has an information training component to understand how to place the implant, and trained doctors can work in clinics that are located in comparison units. All of these concerns imply that never-treated or late-treated units might have spillovers from nearby treated units. If this holds true, comparison units will have some percentage of their population receiving treatment.

Table 3 shows the main characteristics of the geographical units according to the time in which they started (or never started) the policy. Panel A shows the number of geographical units treated at different points in time, the total number of births in each cohort treatment group, and the number of births prior to 2014. 2016, followed by 2015, were the years when most of the units received the policy. Nonetheless, births are not distributed uniformly across units, as the last two rows of panel A show, units that entered treatment in 2015 had the largest number of births, and the other treatment groups actually had a similar quantity. Interestingly, the never-treated group, although it has a large number of units, has the lowest number of births. Panel B describes the average birth characteristics observed from the SIP pre-2014. The mothers in the cohort group that started treatment in 2014 and 2016 are on average younger, less educated, have bigger families, and have a higher incidence of unplanned pregnancies. The other treated cohorts and the never-treated have similar characteristics. Note that while there may be differences in levels across treatment cohorts, the main identifying assumption of our model only requires the deployment of the policy to be independent of these variables' *trends*. This point is further discussed in Section 2.6 and supporting evidence is shown in Section 2.7. Panel C, which compiles means and standard deviations from the 2011 Census, reflects similar facts to Panel B.

Table 4 describes the characteristics of the main dependent variables of the study. Some interesting features from the table are that, on average, contraceptive failure is reported in roughly 3 out of 10 pregnancies, 86% of babies are born with the correct weight for their gestational age, 81% of mothers attend breastfeeding courses, and 7 out of 10 partners are present at delivery. It is important to notice from this table that the number of observations changes across the variables due to missing observations in the database. To account for this issue, we show in the Appendix that for all variables, missing values are random. In addition, when we estimate the regressions, we impute missing values with the mean of the observed values and add a missing values fixed effect.[15]

15 This dummy takes the value 1 when the variable was imputed and 0 otherwise.

Table 4: Dependent variables characteristics

Variable	Mean	Std. Dev.	Min.	Max.	N
Planned	0.581	0.493	0	1	68,899
Contraceptive Failure	0.272	0.445	0	1	67,656
Partner at Birth	0.731	0.444	0	1	64,838
Tobacco	0.214	0.410	0	1	69,431
Attended labor preparation	0.488	0.500	0	1	66,477
Breastfeeding	0.813	0.390	0	1	66,562
N Prenatal	9.195	3.098	0	23	71,070
Correct weight	0.858	0.349	0	1	71,510
Weight	3,259.751	569.068	280	5,790	71,396
APGAR 1	8.506	1.116	0	10	71,100
APGAR 5	9.626	0.829	0	10	71,105
Days Hospital	1.799	4.724	0	90	31,959
Preterm	0.089	0.285	0	1	71,086

Notes: This table presents birth-level summary statistics for the pre-policy period of analysis (2011-2013). For a detailed description of the variables see Table 2. Source: SIP.

2.6 ECONOMETRICS FRAMEWORK

To obtain estimates that can be credibly interpreted as causal, we leverage the staggered rollout of the policy across geographical units in the years 2014 through 2020. Under a set of assumptions described below, the quasi-experimental variation generated by the staggered policy rollout allows us to estimate the causal impact of the policy on the number of births at each geographic unit using an event study difference-in-differences design as described in the equation below:

$$Births_{hgt} = \alpha_g + \lambda_t + \sum_{l=-5}^{-2} \beta_l 1[t - Tyr_g = l] + \sum_{s=0}^{6} \beta_s 1[t - Tyr_g = s] + \epsilon_{hgt} \quad (1)$$

To assess the impact of the policy on the number of births, we collapse the data at the geographic unit level. Thus, h stands for the geographic unit from treatment-cohort g in year t. $1[.]$ is an indicator function that takes the value of one for a treated observation at $t - Tyr$ time period, where Tyr is the year at which that observation received the policy. Therefore, β_l will shed light on the parallel trend assumption, while β_s will assess the dynamic effect of the policy. In addition, α_g are treatment cohort fixed effects, signaling 1 when a given unit in a specific unit is treated, and λ_t are year fixed effects. We estimate equation (1) using Poisson QMLE regression and clustering standard errors at the geographic unit level.[16] These results hold

16 When we estimate the effect on births using CS or BJS estimators we transform our dependent variable to ln(births+0.5)

when we estimate equation (1) with geographic-unit fixed effects instead of treated cohort group fixed effects.

To understand the policy's heterogeneous effect, we estimate equation (1) by narrowing down our data set to focus on specific characteristics of interest. For example, when determining whether teenagers reacted more to the policy, we restrict our data set to estimate equation 1 to women 19 years old or younger. In addition, when we show aggregate results regarding the average effects of the policy we compute these values by averaging event study estimates from Callaway and Sant'Anna, 2021.

The second part of our analysis studies the intention to have a child, the parental investment during the pregnancy, and the newborn health outcomes of the births that happened after the policy. To do so we estimate equation (2) which is very similar to equation (1), with the particularity that we estimate the results with a database at the birth level, thus i stands for birth. Therefore, the outcome is Y_{ihgt} where, again, i is a birth in geographic unit h from treatment-cohort g in year t. We estimate equation (2) using ordinary least squares and clustering standard errors at the geographic unit level.

$$Y_{ihgt} = \alpha_g + \lambda_t + \sum_{l=-5}^{-2} \mu_l 1[t - Tyr_g = l] + \sum_{s=0}^{6} \mu_s 1[t - Tyr_g = s] + \upsilon_{ihgt} \tag{2}$$

Since the supply of contraceptives increases over time, the dose of the policy is maximized at the end of the period analyzed. Due to this fact, we rely on event study estimates and not on the canonical average treatment on the treated from two-way fixed effects without the full dynamic dummies, as we believe this better captures the nature of the policy implementation and rollout.

Regarding equation (1) the first important assumption we make is that, absent the policy, the trend of births would have been the same in treated and comparison units. In other words, we assume that the trend of the comparison groups mimics the trend that the treated unit would have had if not treated. The second important assumption is that there are no anticipation effects, and we show that with the event study. The third identifying assumption relates to the fact that the parameter of interest in the TWFE regression is a weighted average of the different 2x2 group comparisons. This is problematic as the comparison between late and earlier, already treated units, could bias the results when there are heterogeneous effects (Borusyak, Jaravel, and Spiess, 2022; Callaway and Sant'Anna, 2021; Chaisemartin and D'Haultfœuille, 2020; Goodman-Bacon, 2021; Roth, 2022; Sun and Abraham, 2021). To prevent this issue, we show that our results are robust when using proposed econometric estimators that account for this issue. In particular, we use the Callaway and Sant'Anna, 2021 (CS hereinafter) and Borusyak, Jaravel, and Spiess, 2022 (BJS hereinafter) estimators as they allow us to use the not-yet-treated units as comparison observations besides of the never-treated ones. Notice that the

BJS estimator provides more efficient estimations but requires stricter assumptions than the CS (Roth et al., 2023). Given this trade-off, it is not surprising that some results are not significant for the CS estimator while they are found to be significant using the BJS one. A conservative approach leads us to consider the CS results.

We would like to emphasize that, given the characteristics of our identification strategy and all the caveats described above, especially those concerning the downward bias in our estimations, the direction of the trend changes, not the precise magnitudes of the coefficients, should be considered when interpreting the results.

2.7 RESULTS

2.7.1 *The Effect of the Policy on Fertility*

We begin by examining the effect of access to subdermal implants on fertility. Figure 3 shows the results of the estimates of equation (1) using QMLE Poisson, CS, and BJS estimators on the number of births per year at each geographical unit.[17] Estimates to the left of the vertical dashed axes represent geographical units in pre-program years and estimates to the right capture the dynamic effect of the policy.

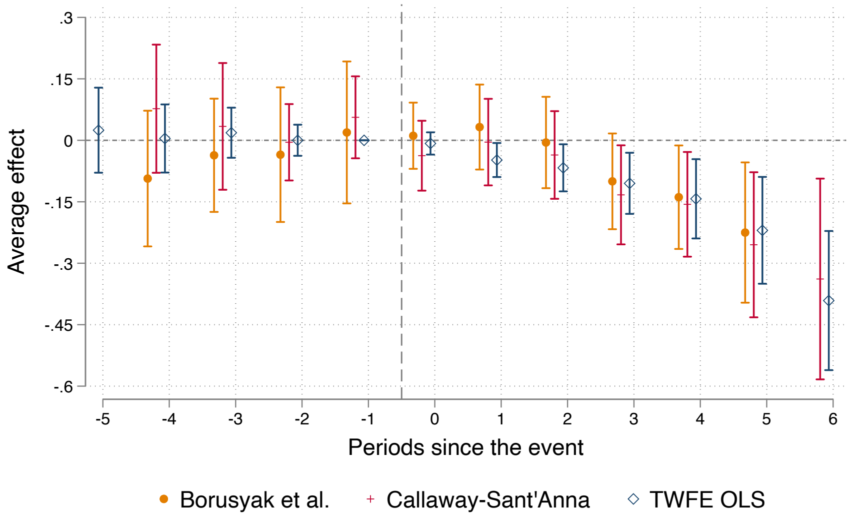
Consistent with the increase in the number of contraceptives supplied every year, Figure 3 shows the steady decline in the number of births per year that followed after the implementation of the policy. After the expected (considering the 9-month gestation period) null result at period 0, there is a reduction in fertility ranging from 5% in early periods to more than 20% during the last two periods of analysis. The estimate of the average effect of all periods, computed with the CS estimation, yields a 14% decrease.

In general, all estimators (TWFE, CS and BJS) show very similar results. However, as standard errors are bigger for the CS and BJS the coefficients -especially in the first periods- are not always significant. Moreover, TWFE coefficients always are contained within the 95% confidence intervals of CS and BJS.

To fully comprehend the policy's consequences, it is critical to identify the women most impacted by it. In the following paragraphs, we look at the heterogeneous effect of the policy on fertility for different demographic segments. We first show in Figure 4 the fertility results sliced by different characteristics, and we then in Figure 5, complement these results by looking at a more detailed description of the fertility decline. The idea is that by understanding the characteristics of the women who self-selected into the policy, we can, first, provide some hints regarding the underlying mechanisms, both direct and selection effects. This understanding hinges on discerning whether the fertility impact primarily stems from the stopping or postponing of childbirth. Second, we can better rationalize the short-term impact

17 Table A4 to Table A8 in the Appendix display the results in table format.

Figure 3: Effects of the Policy on Fertility



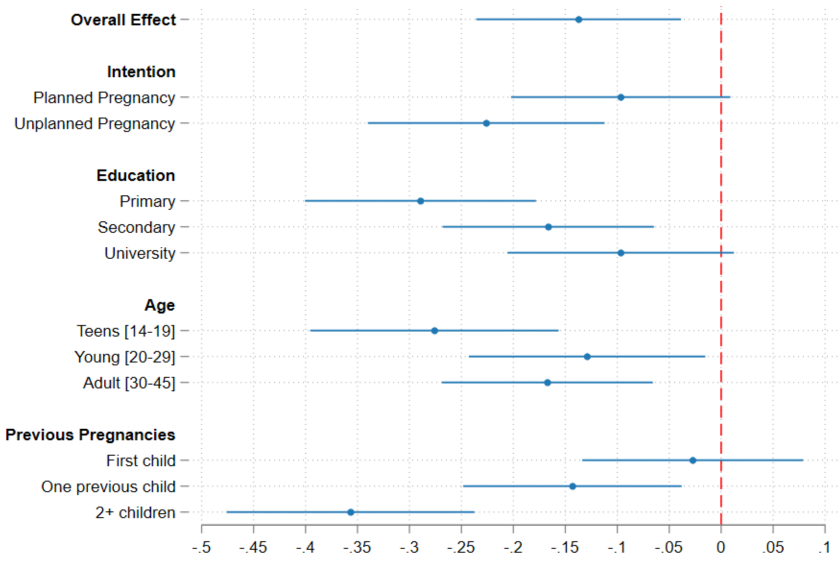
Note: This figure overlays the event-study plots constructed using three different estimators: a dynamic version of the TWFE model, equation (1), estimated using QMLE Poisson (in blue with circle markers); Callaway and Sant'Anna, 2021 (in red with hyphen markers); and Borusyak, Jaravel, and Spiess, 2022 (in orange with solid circle markers). The outcome variable is the number of births for TWFE, and the logarithm of births for the other two estimators. The data is at geographic unit-year. Standard errors are clustered at the geographic unit level for TWFE and BJS and are bootstrapped for CS.

of the policy on parental investment during pregnancy and newborn health outcomes.

Figure 4 shows the average effect of the policy among women with different ages, education, and number of previous pregnancies. The results exhibited in the figure are the average of the post-policy period coefficients estimated with the CS estimator for each of the demographic characteristics represented. In other words, the result for teenagers corresponds to computing equation (1) only among the population of teenage mothers with the CS estimator and averaging the post-policy coefficients. Table A5 in the Appendix shows the event study from equation (1) together with the results that combine all the periods.

The policy led to a decline of childbirth at all education levels. However, the results are larger among women with only primary education, followed by those with secondary education, and are less important among women with college degrees. Event study coefficients in Table A5 better describe the striking impact of the policy for each education segment. From an initially imprecise 5% impact, the number of births among women with primary education plummeted, reaching a 60% decline in the last two periods. Among women with secondary education, the pattern is very similar to the general decline, that is, half the effect of the decline among those with primary education. For women with college degrees the results, although large in magnitude, are imprecise.

Figure 4: Impact of Policy on Fertility by Mother's Characteristics



Note: This figure shows the coefficients and confidence intervals of estimating the CS estimator and computing the ATT pooled results (with bootstrapped standard errors). The data is at the geographic unit-year level and is conditioned on each variable. For instance, for the result on teens we compute CS on a database that has as dependent variable the number of teen pregnancies for each geographic unit from 2011-2020.

In addition, while women from all age segments are affected by the policy, the largest effect is among teens and adult women. Table A5 describes the dynamic decline, for teen women, starting from an imprecise 10%, the impacts of the policy accumulate reaching 50% in the last two periods. For adult women the impact of the policy, although sizable in the first periods, actually decreases sharply during the last two periods reaching a 30% decline. Among young women, the effect is imprecise and smaller in size, it is similar in magnitudes and dynamic to the overall effect.

Finally, we find a large drop among women who already have 2 or more children and no effect among women who are having their first child. As we will further discuss in the following paragraphs this null results among mothers giving birth to their first child masks a large heterogeneity among women with different education level. Table A5 supports the results depicted in Figure 4 regarding the effect of the policy among women who already had two or more children. Already in the first period the effect reaches a 12.6% decline, which keeps subsequently declining with estimated coefficients as large as 60% and 70% in the last two periods.

To better understand and contextualize the patterns presented in Figure 4 we slice the data further, interacting the age, education, and previous pregnancy categories. We do this in two ways. First, in Figure 5 we present nine charts showing the age distribution between 2019 (red) and 2013 (light blue). The three columns of Figure 5 present the different education segments (primary, secondary, and university), and the rows, the number of previous pregnancies.

To complement and back up the descriptive results presented in Figure 5 we estimate equation (1) slicing the data by each combination between the number of previous pregnancies and the education and age categories. Table A6, Table A7 and Table A8 in the Appendix show the eighteen columns from these combinations. Note that neither the descriptive exercise nor the regression analysis that we show in the Appendix can be considered as a definitive answer of the causal impact of the policy [18]. However, the fact that both exercises arrive to the same conclusions provides confidence in the interpretation of the results.

To keep a close track between Figure 5 and Table A6, Table A7, and Table A8, since each row on the figure parallels each of the tables, we present the Figure 5 results row by row. The first row unlocks the puzzling results of a null effect among first-time mothers. There are two oppositely signed movements that drive the null effect presented before. On the one hand, the biggest drop in the number of births happens among less educated teen women. On the other hand, adult, college-educated women exhibit a small increase. These results are backed up in Table A6.

The second row of Figure 5 shows a similar pattern as the first row, but the fertility decline in this second row is remarkably more distinct. It expands the decline to a broader age range, making the percentage effect more pronounced, as depicted in Table A7. Moreover, as in the first row, the decline is more evident among teen and less-educated women, and among these populations, the results are far more conspicuous than those for first-time mothers.

The third row shows the change in the number of births among women who already had two or more children. It portrays a sharp and generalized decline in the number of births among all ages and education levels. Furthermore, as Table A8 illustrates, the magnitudes of the effects are consistently larger than the other tables, and are again, especially large among low-educated teen women.

Two takeaways from the previous paragraphs help to characterize the fertility decline. First, an acute decrease in the number of births among women who have at least one child. Second, a consistent decrease among younger and less-educated women that becomes gradually more noticeable as the number of previous pregnancies increases. These results, in the first place, bolster the case for a direct effect of the policy on the country TFR, and in the second place, set the stage for a positive impact of the policy on planned pregnancies, parental investment during pregnancy, and newborn outcomes.

The notorious effects among women who already have children create the conditions for a permanent decrease in the TFR of Uruguay. Considering that these women are most likely stopping their childbearing rather than postponing future pregnancies, these results sug-

18 On the one hand, the regressions must be taken with caution. Naturally, as we condition the number of births on additional variables, we decrease the number of geographical units in the analysis and the credibility of the identifying assumptions is weakened. On the other hand, the descriptive exercise simply compares two points in time.

gest that the rebound in fertility will not go back to pre-policy values, and hence, the policy will have an ultimate impact on the total number of births. This is a novel contribution of this study to the literature studying the effect of family planning policies, as previous research (Goldin, 2006; Miller, 2010) has shown that family planning programs postpone rather than halt the number of births.

Pregnancies among young and less-educated women are associated with unplanned motherhood, less parental investment during the gestation period, and worse newborn outcomes. Hence, the characterization of the fertility decline paves the way for the results we present in the following sections. The described take-up of the policy among the women population prevented a negative selection, as found in Ananat and Hungerman, 2012.

2.7.2 *The Effect of the Policy on Planned Pregnancies and Contraceptive Failure*

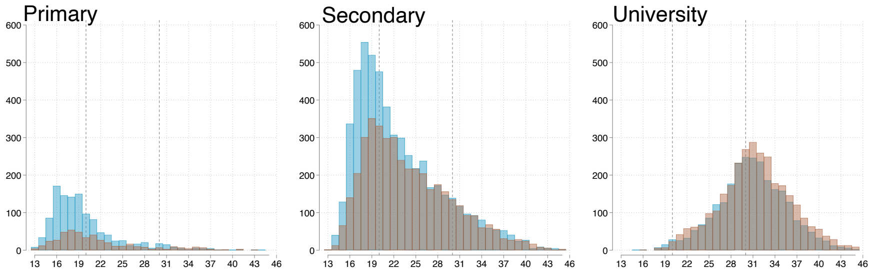
The top part of Figure 4 shows the results of the policy among planned and unplanned pregnancies. The number of unplanned pregnancies declined by 23% on average, 65% more than the average effect of the policy on fertility. Table A5 also shows event study coefficients that are considerably larger than those of the overall result, reaching values above 30% in the last periods of analysis. Although imprecise, planned pregnancies also decrease by a smaller magnitude of 10%, in fact, event study coefficients are not consistently significant in the post-policy period.

The left-hand-side of Figure 6 [19] shows the result of estimating equation (2) when the dependent variable is planned pregnancy. Each coefficient in the post-period represents the difference at each point in time between the share of planned pregnancies in the treatment and the comparison units. Starting from period two, the share of planned pregnancies significantly changes its trajectory. In accordance with the increasing supply of contraception over the years, the effect on planned pregnancies accumulates over time, reaching an impact of more than 5% in the last periods of analysis.

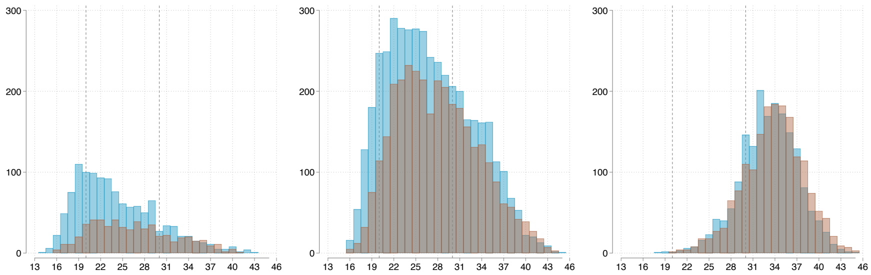
In the right-hand side of Figure 6 we present the results when the dependent variable indicates if the pregnancy happened due to a failure in the use of contraception. Negative coefficients in the post-period suggest that the policy is addressing a problem of contraception usage. The figure documents an imprecise decrease in contraceptive failure that increases and becomes significant towards the end of the period. Although it seems to be a change in trends, the results are small in magnitude.

19 In the Appendix Table A9, Table A10 and Table A11 show the results presented in Figure 6

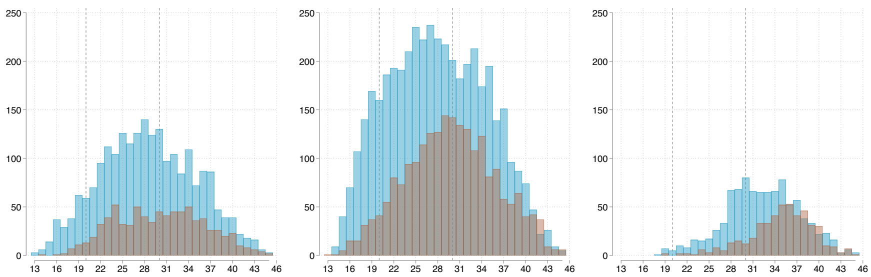
Figure 5: Age Frequency Distributions by Education (columns) and Number of Previous Births (rows)



(a) First Child



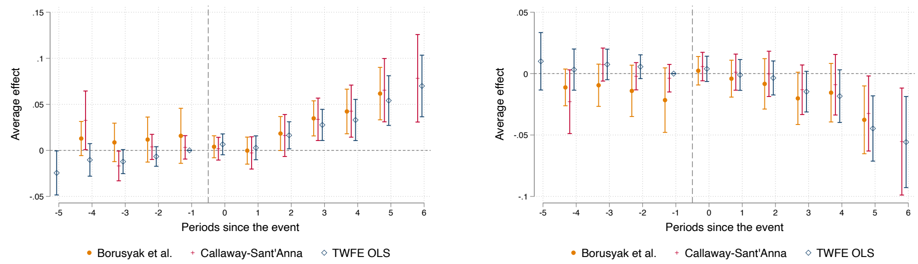
(b) One Previous Child



(c) Two or More Children

Note: This figure shows in red the distribution of the age of women who gave birth in 2013. In blue the distribution of the age of women that gave birth in 2019. The top three figures are the distributions of first-time mothers with primary, secondary, and university education, respectively. The three figures in the middle are analogous but for women who already had one child; and the last three for women who already had at least two children.

Figure 6: Intention Results



(a) Planned Pregnancy (b) Contraceptive Failure

Note: This figure overlays the event-study plots constructed using three different estimators: a dynamic version of the TWFE model, equation (2), estimated using OLS (in blue with circle markers); Callaway and Sant'Anna, 2021 (in red with hyphen markers); and Borusyak, Jaravel, and Spiess, 2022 (in orange with solid circle markers). The outcome variable is Planned pregnancy on the left-hand side and Contraceptive Failure on the right-hand side. The data is at birth-year. BJS and CS estimators do not produce estimates for period -5. Standard errors are clustered at the geographic unit level for TWFE and BJS and are bootstrapped for CS.

2.7.3 *The Effect of the Policy on Parental Investment during Pregnancy*

In this subsection, we take a look at a set of outcomes that relate to the investment and commitment that parents (especially mothers) place during the nine-month gestation period. These results, on top of providing interesting insights on their own, also provide behavioral evidence that bolster the self-reported results on planned pregnancy presented in the last subsection.

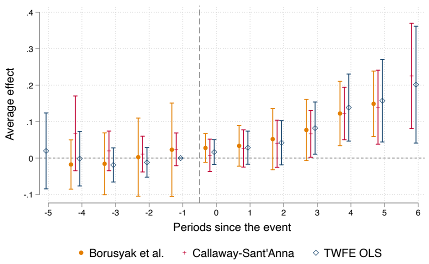
Figure 7 [20] shows the results of estimating equation (2) on the set of parental investment outcomes: the presence of the partner at delivery, the smoking habits of the mother, the attendance of a delivery preparation lecture, the decision of the mother to attend a breastfeeding course, and the number of prenatal visit attended. Almost all variables, with the exception of delivery preparation, show the same pattern: a subtle boost starting in period two that consolidates and significantly breaks the trend from period 3 onward.

Prenatal care visits increased significantly in the last four periods of analysis. When looking at the percentage change, the results are similar to those of intention, reinforcing the findings that births happening in the treated areas are on average from families that could better match their fertility intention with their behavior. All coefficients, from the three different estimators, are very similar in magnitude and precision. Also, we find a somewhat imprecise but sustained decline in the smoking habits of pregnant mothers, which is again consistent with the planned pregnancy results.

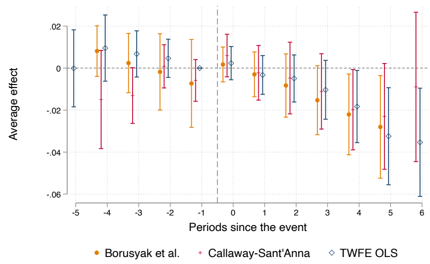
Also, Figure 7 documents an increase in the presence of the partner at delivery, which again gains momentum towards the end of

20 Table A12, Table A13 and Table A14 in the Appendix present the estimated results documented in Figure 7

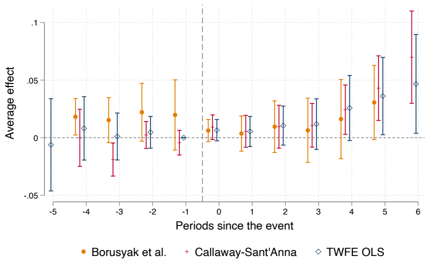
Figure 7: Parental Investment



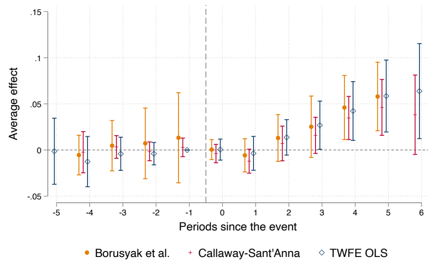
(a) ln(Nº Prenatal visits)



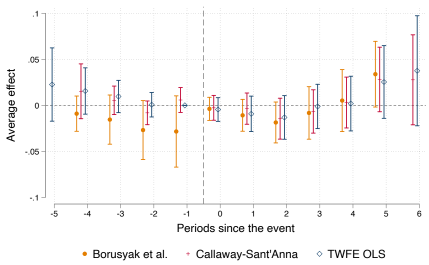
(b) Tobacco



(c) Partner at Delivery



(d) Breastfeeding



(e) Delivery Preparation

Note: This figure overlays the same three estimators for equation (2). The data is at birth-year. BJS and CS estimator do not produce estimates for period -5. Standard errors are clustered at the geographic unit level for TWFE and BJS and are bootstrapped for CS.

the period, reaching a roughly 5 % increase. In this case, the results are mostly determined by the last three periods. On top of that, pre-period trends show different coefficients across the estimator, which in some cases, show significant pre-trend results. In addition, the participation of mothers in breastfeeding courses increased significantly after the implementation of the policy. The effect builds up over time, reaching approximately a 5% increase. Except for the last period coefficient, all other results are very similar across the different estimators. Finally, we do not find significant effects on attendance at the one-day workshop on labor preparation. We also found a null effect (not shown) on the mother's alcohol and drug use.

2.7.4 *The Effect of the Policy on Newborn Health Outcomes*

In this section, we present the results on newborn health outcomes. The positive effect of the policy on planned pregnancies and the positive association between planned pregnancies and newborn health outcomes presented in Table 1 establishes the framework for the evidence on children's outcomes at birth. It should be observed that even though the differences between children's outcomes among planned and unplanned pregnancies presented in Table 1 are statistically different, they are not sizeable. Then, it is not surprising that the results on newborns are smaller in magnitude.

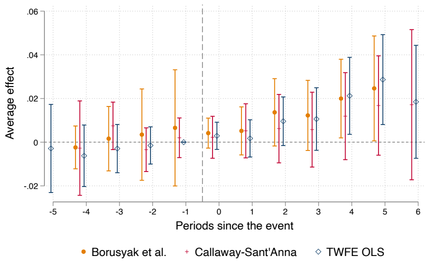
Figure 8 [21] shows the results of estimating equation (2) when the dependent variables are outcomes of the health of the newborn. The proportion of births with the correct weight presents a consistent increase that begins at time 2. Indeed, when we estimate the effect using unit fixed effects instead of treatment group fixed effects, we find more precise and stronger results, bolstering the trend break as the coefficients in the last period become significant. There is no change in the weight measured in grams. This result was somewhat expected as baseline outcomes reported in Table 1 document only a 17-gram difference between intended and unintended birth.

Regarding the one and five-minute measures of APGAR scores, we find similar but more compelling results for APGAR scores at 5 minutes. The measurement at minute 5 shows positive and significant results starting at period 2 whereas APGAR score at minute 1 has suggestive evidence of a pattern change that did not materialize in the results. For both measures, we do find inconsistent results in the pretend coefficients across the different estimators. Finally, we do not find effects on the number of pregnancies that were pre-term.

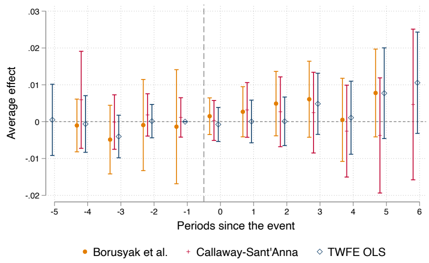
These results suggest an improvement in the health of the newborn due to the policy. These findings, document changes in the trajectories of the outcomes even when the baseline differences are not large, as documented in Table 1. In addition, it is important to bear in mind that these results are more of a lower bound due to the downward bias of the research design, rather than a precise estimation of the true parameters.

21 Table A15, Table A16 and Table A17 in the appendix present the event study estimated coefficients

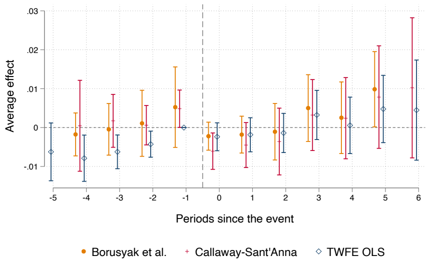
Figure 8: Newborn Outcomes



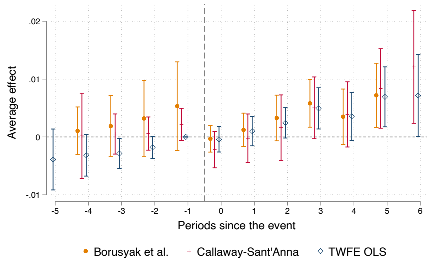
(a) Correct G. Weight



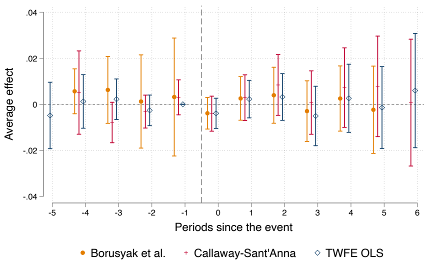
(b) ln(Weight)



(c) ln(APGAR 1)



(d) ln(APGAR 5)



(e) Preterm Delivery

Note: This figure overlays the same three estimators for equation (2). The data is at birth-year. BJS and CS estimators do not produce estimates for period -5. Standard errors are clustered at the geographic unit level for TWFE and BJS and are bootstrapped for CS.

2.8 DISCUSSION

Two aspects of the findings are worth discussing. First, building on the discussion of Section 2.3, we show in this section how the change in the distribution of the demographic variables of the women who gave birth in 2019 vs 2013 relates to the shift in the distribution of parental investment and newborn outcomes. Secondly, with the intention to better nail down the potential mechanism, we discuss in this section how the fertility effects on section Section 2.7 shed light on both potential mechanisms.

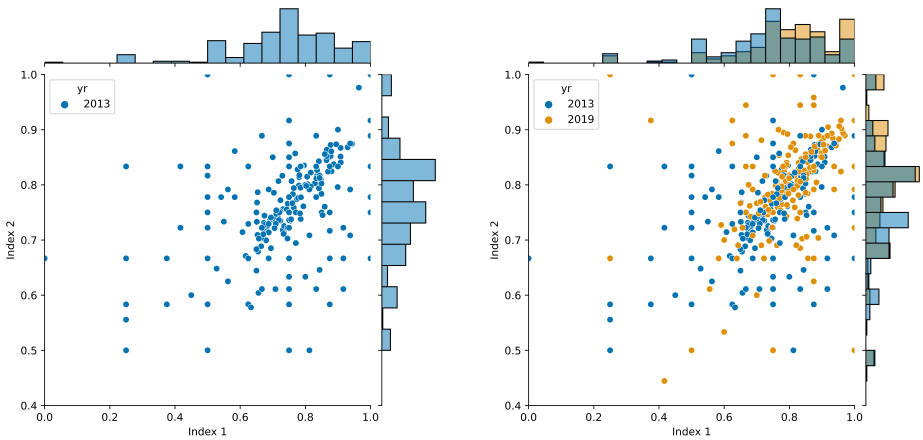
To further illustrate the success of the policy on empowering women in their fertility decision, we show in this section two indices and plot their joint distribution in Figure 9. Index 1 is a summary measure of pre-birth characteristics that weights each of the following binary variables equally: not being a teenage mother, having more than primary education, pregnancy being planned, and not having the pregnancy due to a contraceptive failure. We picked these characteristics not only because they could not be controlled after the pregnancy, but also because they are (among the data we have) the characteristics associated with better pregnancy outcomes.[22]

Following the discussion introduced in Section 2.3, this exercise intends to show the effectiveness of the policy take-up. As previously discussed, the short-term effect of the policy on parental investment and newborn outcomes depends, to a great extent, on the characteristics of the women who take up the policy. If women better equipped to navigate an unintended pregnancy were the most affected group, then, the results could have had the opposite sign to the ones we find. Index 1 summarizes the shift in the distribution of women's characteristics. The upper part of Figure 9 shows the histogram of Index 1, colored in blue for the 2013 values and in gold for the 2019 values. The right-hand side of the figure shows how the distribution of the index shifts to the right, pointing out that mothers in 2019 have a better score among the characteristics that are related to better pregnancy outcomes. We collapse these measurements at the geographic unit level, hence the bin scattered in Figure 9 are the average value of the geographical unit.

Index 2 is a summary measure of parental investment decisions and newborn outcomes. We create this index by weighting equally the following binary variables: whether the mother attended a breastfeeding course, whether the partner was present at delivery, the tobacco smoking habits of the mother, if the number of prenatal visits attended is above the average, if the newborn weight is correct for the gestational age, and if the APGAR score at minute 5 is above the average. Values of Index 2 closer to 1 reflect higher levels of parental investment and better newborn outcomes. The left-hand side of Figure 9 shows the distribution of both indexes in 2013, while the right-hand side shows the distribution for 2019.

22 Different definitions of this index drive to the same conclusion.

Figure 9: Change in distributions



(a) Distribution in 2013 (b) Distribution in 2019

Note: This figure shows index 1 and index 2 distributions in 2013 (left-hand-side) and 2019 (right-hand-side). Index 1 is the average of 4 binary variables (not teenager, not only primary education, planned pregnancy, Not contraceptive failure). Index 2 is the average of 6 binary variables (prenatal above average, not tobacco smoker, breastfeeding course participation, partner at delivery, APGAR score at minute 5 above average, and Correct weight for gestational age). Each index is created individually for each birth and then averaged at the geographical unit. Then each point in the join distribution scatter plot indicates the average value of a geographic unit.

The right-hand-side of Figure 9 shows how Index 2 shifts upwards, toward better values of parental investment and newborn outcomes. Also, the binned scattered plot shows how the joint distribution converged in 2019 to the right-hand-side angle, pointing out that the truncation in the distribution of mother's characteristics is associated with better pregnancy and parental investment outcomes. In short, it underlines the tremendous success of the policy's implementation in reaching the most deprived women.

To understand what is the prevailing mechanism in our results and ultimately of the policy in general, we would need to observe the share of women who ended up having a future pregnancy to understand the direct effect of the policy on newborn outcomes. As we discussed in Section 2.3, there are two prevailing mechanisms: a selection effect, of women who do not have children and pushed upwards the average outcome per child, and a direct effect of women who delay the pregnancy to the future with the help of the implant. Even though we can not distinguish between both mechanisms, it would be reasonable to assume that, given the short span of time that we are analyzing the effect almost entirely corresponds to a selection effect. Based on the fertility subsection of Section 2.7, especially considering the non-negligible effect on first births among teens, the longer-term effects of this policy will include both effects.

2.9 CONCLUSION

This paper studies the effect of a nationwide policy implemented in Uruguay that improved women's access to contraception by adding subdermal implants (a LARC) to the contraceptive options previously available in the country. We rely on the staggered adoption of this policy to identify its causal effect. In particular, we find that living in a geographic unit that was exposed to the program reduced the number of births by 14%. This reduction changed the distribution of births such that pregnancy intention increased by 6%, resulting in improved parental investment and newborn outcomes.

Our results indicate that the implant helped individuals overcome a contraceptive use problem. This suggests that giving women adequate tools to better plan their fertility has immediate effects on newborn health indicators that will later translate into improved socioeconomic outcomes.

This study contributes to the existing literature by emphasizing the potential of LARCs to mitigate unplanned pregnancies and their wide-ranging repercussions. It underscores that beyond addressing contraceptive usage issues, policies that empower women to make well-informed fertility decisions can lead to lasting fertility changes and immediate improvements in newborn health outcomes. This research highlights the multifaceted nature of reproductive health interventions and their potential to initiate positive socioeconomic transformations.

Moreover, considering the unprecedented birth decline caused by this policy, future work should try to assess the effects of this policy in different spheres of women's lives, such as education and labor outcomes, and even intimate partner violent crimes.

2.10 APPENDIX

Complementary Tables and Figures

Table A1: Rollout of the policy

Month-Year	Nº Treated Health Centers	Subdermal Implants Stock	Nº Women (Age between 15-44)
Dec-14	62	4,900	740,423
Dec-15	102	16,800	743,555
Dec-16	189	45,600	746,111
Dec-17	277	62,500	748,311
Dec-18	296	74,600	750,117
Dec-19	301	86,800	751,188
Dec-20	301	97,800	751,130

Notes: There is a total of 852 public health centers considering primary, secondary and tertiary care. Source implants stock: Ministry of Public Health. Source number of women in the country: National Statistics Institute. Source number of treated health centers: ASSE (State Health Services Administration).

Table A2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Age	27.479	6.726	10	55	220,144
Education	10.587	3.792	0	21	213,700
Planned	0.613	0.487	0	1	213,219
Previous Pregnancies	0.983	1.275	0	20	208,797
Contr Failure	0.247	0.431	0	1	211,737
N Prenatal	9.512	2.960	0	25	219,609
Weight	3,268.755	567.949	280	5,790	220,080
Correct weight	0.862	0.345	0	1	220,295
Breastfeeding	0.802	0.398	0	1	206,132
Tobacco	0.186	0.389	0	1	210,504
Partner	0.787	0.410	0	1	206,198
Preparation	0.459	0.498	0	1	205,872
Preterm	0.089	0.285	0	1	219,265
APGAR 1	8.560	1.055	0	10	219,309
APGAR 5	9.670	0.791	0	10	219,313
Days Hospital	1.590	4.402	0	99	92,673

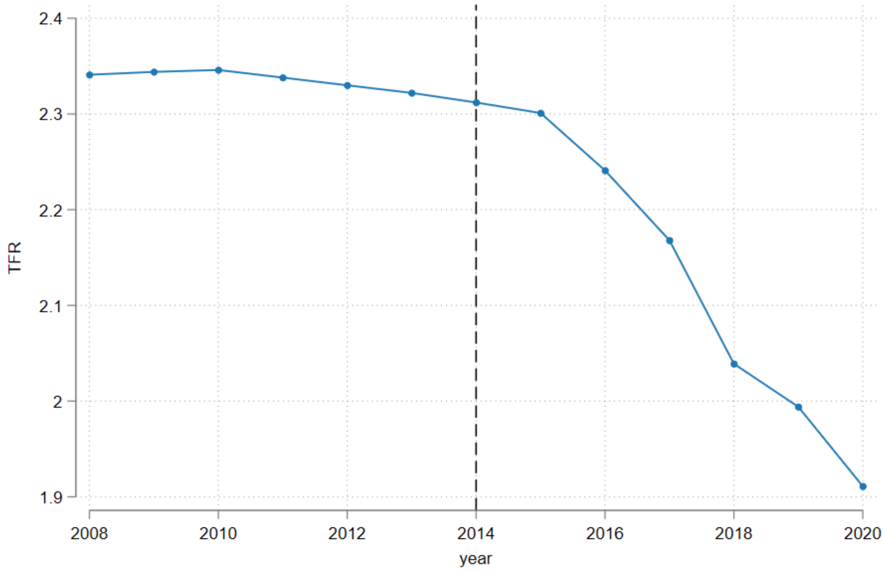
Notes: This table presents birth-level summary statistics for the entire period of analysis (2011-2020). For a detailed description of the variables see Table 2. Source: SIP.

Table A3: Number of abortions, implants stock and women

	Abortions	Subdermal Implants Stock	Women at reproductive age
2013	7,171	.	736,423
2014	8,537	4,900	740,423
2015	9,362	16,800	743,555
2016	9,719	45,600	746,111
2017	9,830	62,500	748,311
2018	10,373	74,600	750,117
2019	10,210	86,800	751,188
2020	9,915	97,800	751,130

Source implants stock and number of abortions: Ministry of Public Health.
Source number of women in the country: National Statistics Institute.

Figure A1: TFR Argentina



Note: This figure shows the Total Fertility Rate for Argentina (2008-2020). The vertical dashed line marks the beginning of a policy in Argentina similar to the one implemented in Uruguay. Source: World Bank.

Fertility results in tables

Table A4: Fertility Results

Time Periods	(1) TWFE	(2) BJS	(3) CS
-5	0.025	0.000	0.000
	(0.053)	(.)	(.)
-4	0.004	-0.093	0.077
	(0.042)	(0.084)	(0.082)
-3	0.019	-0.037	0.034
	(0.031)	(0.071)	(0.079)
-2	0.000	-0.035	-0.005
	(0.019)	(0.084)	(0.050)
-1	0.000	0.019	0.056
	(.)	(0.088)	(0.049)
0	-0.008	0.011	-0.038
	(0.014)	(0.041)	(0.044)
+1	-0.048**	0.032	-0.004
	(0.021)	(0.053)	(0.055)
+2	-0.067**	-0.005	-0.036
	(0.029)	(0.057)	(0.059)
+3	-0.105***	-0.100*	-0.133**
	(0.038)	(0.060)	(0.059)
+4	-0.143***	-0.139**	-0.156**
	(0.049)	(0.064)	(0.066)
+5	-0.220***	-0.225***	-0.255***
	(0.066)	(0.087)	(0.090)
+6	-0.391***	0.000	-0.338***
	(0.087)	(.)	(0.126)
N	3,362	3,338	3,362

Notes: This table shows the event study results of estimating equation (1) with QMLE Poisson, CS estimator and BJS estimator. The data as the geographic unit-year level. Standard errors are clustered at the geographic unit level for TWFE and BJS and bootstrapped for CS. Time -1 is omitted for TWFE. CS and BJS do not provide estimates for period -5. In addition BJS does not provide estimates for period +6 as the number of treated units for that time period is too low to provide a reliable estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Fertility Heterogeneity - CS

	Overall Effect	Intention		Education			Age			Previous Pregnancies		
		Planned	Unplanned	Primary	Secondary	University	Teen	Young	Adult	First Child	One Child	2+ Children
-4	0.077	0.042	0.145*	0.182**	0.073	-0.053	0.138	0.094	-0.013	0.055	0.015	0.160*
	(0.082)	(0.081)	(0.082)	(0.084)	(0.080)	(0.078)	(0.084)	(0.084)	(0.080)	(0.080)	(0.076)	(0.082)
-3	0.034	-0.002	0.073	-0.060	0.031	0.072	0.026	-0.015	0.117	0.110	0.009	-0.035
	(0.079)	(0.074)	(0.077)	(0.080)	(0.076)	(0.070)	(0.073)	(0.077)	(0.079)	(0.073)	(0.073)	(0.077)
-2	-0.005	-0.004	-0.029	0.045	-0.000	-0.055	-0.061	0.001	0.005	-0.095*	0.004	0.093
	(0.050)	(0.053)	(0.053)	(0.061)	(0.053)	(0.047)	(0.057)	(0.059)	(0.056)	(0.057)	(0.053)	(0.060)
-1	0.056	0.102**	-0.015	-0.004	-0.016	0.152***	-0.011	0.111**	-0.003	0.112**	0.111**	-0.060
	(0.049)	(0.050)	(0.058)	(0.056)	(0.051)	(0.053)	(0.059)	(0.055)	(0.056)	(0.056)	(0.053)	(0.058)
0	-0.038	-0.031	-0.040	-0.045	-0.009	-0.092	-0.033	-0.038	-0.050	-0.033	-0.047	-0.068
	(0.044)	(0.044)	(0.055)	(0.057)	(0.048)	(0.057)	(0.055)	(0.052)	(0.052)	(0.051)	(0.051)	(0.054)
+1	-0.004	-0.017	-0.023	-0.055	-0.018	-0.048	-0.098	-0.017	-0.020	0.000	-0.061	-0.126**
	(0.055)	(0.059)	(0.058)	(0.061)	(0.058)	(0.064)	(0.064)	(0.058)	(0.060)	(0.053)	(0.062)	(0.063)
+2	-0.036	-0.025	-0.048	-0.129*	-0.052	-0.028	-0.130**	-0.061	-0.028	0.036	-0.064	-0.231***
	(0.056)	(0.056)	(0.064)	(0.068)	(0.060)	(0.066)	(0.064)	(0.061)	(0.060)	(0.060)	(0.056)	(0.068)
+3	-0.133**	-0.107*	-0.174***	-0.208***	-0.180***	-0.083	-0.219***	-0.189***	-0.088	-0.041	-0.103	-0.352***
	(0.059)	(0.056)	(0.067)	(0.069)	(0.065)	(0.073)	(0.069)	(0.066)	(0.062)	(0.058)	(0.065)	(0.073)
+4	-0.156**	-0.090	-0.270***	-0.317***	-0.229***	-0.092	-0.424***	-0.161**	-0.156**	-0.065	-0.187***	-0.389***
	(0.066)	(0.062)	(0.076)	(0.079)	(0.070)	(0.076)	(0.075)	(0.074)	(0.069)	(0.066)	(0.068)	(0.083)
+5	-0.255***	-0.180**	-0.337***	-0.654***	-0.338***	-0.178**	-0.521***	-0.206**	-0.405***	-0.064	-0.170**	-0.715***
	(0.090)	(0.087)	(0.096)	(0.106)	(0.091)	(0.087)	(0.112)	(0.098)	(0.087)	(0.095)	(0.080)	(0.096)
+6	-0.338***	-0.226	-0.691***	-0.617***	-0.339**	-0.154	-0.507***	-0.232	-0.423***	-0.026	-0.370**	-0.617***
	(0.126)	(0.177)	(0.147)	(0.143)	(0.134)	(0.116)	(0.188)	(0.158)	(0.143)	(0.161)	(0.162)	(0.158)
Pooled Result	-0.137***	-0.097*	-0.226***	-0.289***	-0.166***	-0.097*	-0.276***	-0.129**	-0.167***	-0.027	-0.143***	-0.357***
	(0.050)	(0.054)	(0.058)	(0.057)	(0.052)	(0.056)	(0.061)	(0.058)	(0.052)	(0.054)	(0.054)	(0.061)
N	3,362	3,292	3,163	2,906	3,262	2,586	2,875	3,193	3,043	3,172	3,084	3,044

Notes: This table shows the event study results of estimating equation (1) with the CS estimator. The data as the birth-year level. Standard errors are calculated using bootstrapping. CS does not provide estimates for period -5. The pooled result (ATT) is the simple average of the dynamic effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Fertility Results - First Child Effect

	First Child Effect	Education			Age		
		Primary	Secondary	University	Teen	Young	Adult
-4	0.055	-0.000	0.080	0.085	0.135	0.017	0.001
	(0.080)	(0.087)	(0.083)	(0.080)	(0.089)	(0.085)	(0.079)
-3	0.110	-0.013	0.131*	0.072	0.024	0.063	0.197***
	(0.073)	(0.085)	(0.077)	(0.069)	(0.076)	(0.074)	(0.071)
-2	-0.095*	-0.004	-0.074	-0.060	-0.084	-0.021	-0.104*
	(0.057)	(0.072)	(0.061)	(0.054)	(0.065)	(0.059)	(0.058)
-1	0.112**	0.013	0.008	0.168***	0.009	0.059	0.130**
	(0.056)	(0.072)	(0.055)	(0.057)	(0.062)	(0.056)	(0.054)
0	-0.033	-0.116*	0.042	-0.130**	-0.009	0.081	-0.103*
	(0.051)	(0.070)	(0.053)	(0.066)	(0.058)	(0.059)	(0.058)
+1	0.000	0.025	0.012	-0.153**	-0.054	0.079	-0.104*
	(0.053)	(0.071)	(0.055)	(0.065)	(0.064)	(0.059)	(0.062)
+2	0.036	-0.050	0.051	-0.057	0.018	0.045	-0.020
	(0.060)	(0.080)	(0.058)	(0.070)	(0.064)	(0.062)	(0.065)
+3	-0.041	-0.140*	-0.084	-0.080	-0.102	-0.049	-0.099
	(0.058)	(0.082)	(0.060)	(0.075)	(0.065)	(0.068)	(0.072)
+4	-0.065	-0.281***	-0.092	-0.048	-0.262***	0.014	-0.118
	(0.066)	(0.093)	(0.067)	(0.082)	(0.074)	(0.072)	(0.082)
+5	-0.064	-0.488***	-0.088	-0.174	-0.273**	-0.009	-0.259***
	(0.095)	(0.125)	(0.086)	(0.097)	(0.111)	(0.095)	(0.092)
+6	-0.026	-0.397**	0.080	-0.054	-0.195	0.064	-0.191
	(0.161)	(0.188)	(0.179)	(0.135)	(0.181)	(0.159)	(0.158)
Pooled Result	-0.027	-0.207**	-0.011	-0.099	-0.125**	0.032	-0.128**
	(0.054)	(0.073)	(0.054)	(0.061)	(0.059)	(0.057)	(0.060)
N	3,172	2,289	3,012	2,277	2,707	2,853	2,356

Notes: This table shows the event study results of estimating equation (1) with the CS estimator and conditioning the births the first time mothers and each of the education and age variables in each case. The data as the birth-year level. Standard errors are calculated using bootstrapping. CS does not provide estimates for period -5. The pooled result (ATT) is the simple average of the dynamic effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Fertility Results - One Previous Child Effect

	One Previous Child Effect	Education			Age		
		Primary	Secondary	University	Teen	Young	Adult
-4	0.015	0.279***	-0.062	-0.103	0.181	-0.010	-0.055
	(0.076)	(0.091)	(0.074)	(0.080)	(0.103)	(0.083)	(0.076)
-3	0.009	-0.224***	0.052	0.071	-0.016	-0.006	0.103
	(0.073)	(0.085)	(0.070)	(0.068)	(0.099)	(0.075)	(0.070)
-2	0.004	0.113	0.021	-0.046	-0.013	0.048	-0.049
	(0.053)	(0.072)	(0.052)	(0.056)	(0.076)	(0.060)	(0.055)
-1	0.111**	-0.075	0.072	0.116**	-0.039	0.146***	0.011
	(0.053)	(0.064)	(0.056)	(0.054)	(0.083)	(0.054)	(0.054)
0	-0.047	0.062	-0.091*	-0.066	-0.065	-0.121**	0.048
	(0.051)	(0.062)	(0.053)	(0.068)	(0.073)	(0.057)	(0.057)
+1	-0.061	-0.041	-0.090	0.003	-0.244***	-0.167**	0.100
	(0.062)	(0.074)	(0.064)	(0.068)	(0.085)	(0.068)	(0.064)
+2	-0.064	-0.064	-0.129**	0.039	-0.418***	-0.161**	0.109
	(0.056)	(0.073)	(0.061)	(0.071)	(0.086)	(0.064)	(0.061)
+3	-0.103	-0.103	-0.143**	-0.045	-0.436***	-0.218***	0.062
	(0.065)	(0.078)	(0.065)	(0.075)	(0.088)	(0.065)	(0.071)
+4	-0.187***	-0.308***	-0.271***	-0.060	-0.747***	-0.252***	-0.065
	(0.068)	(0.089)	(0.072)	(0.081)	(0.102)	(0.074)	(0.078)
+5	-0.170**	-0.507***	-0.263***	-0.073	-0.779***	-0.217***	-0.119
	(0.080)	(0.125)	(0.084)	(0.088)	(0.123)	(0.094)	(0.089)
+6	-0.370**	-0.649***	-0.391**	-0.083	-0.775***	-0.392**	-0.061
	(0.162)	(0.152)	(0.181)	(0.168)	(0.205)	(0.156)	(0.149)
Pooled Result	-0.143***	-0.230***	-0.197***	-0.041	-0.495***	-0.218***	0.011
	(0.054)	(0.065)	(0.057)	(0.063)	(0.074)	(0.058)	(0.058)
N	3,084	2,458	2,814	2,137	1,880	2,934	2,565

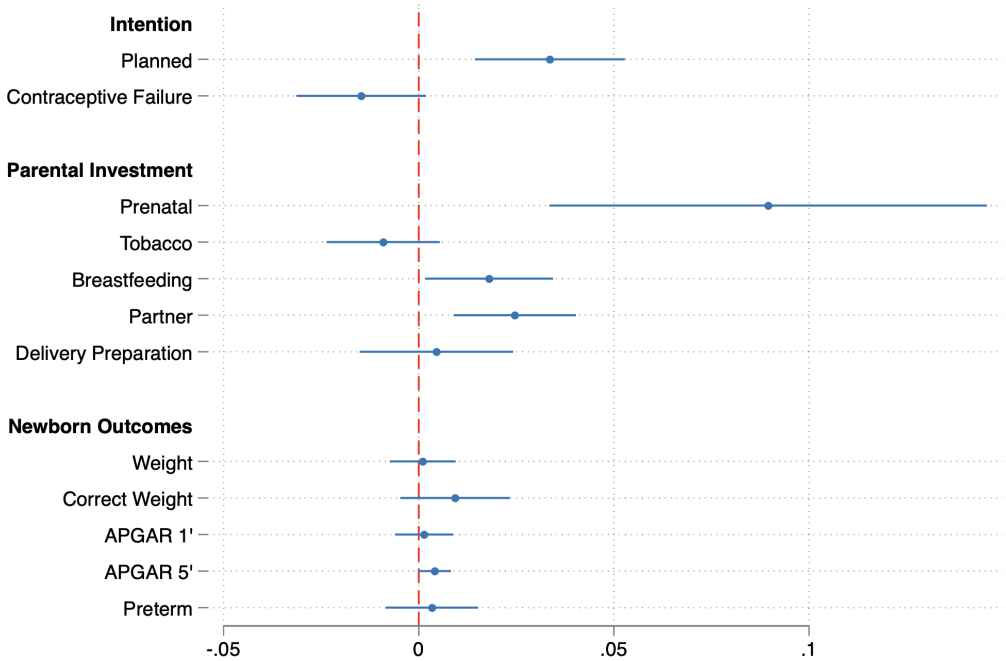
Notes: This table shows the event study results of estimating equation (1) with the CS estimator and conditioning the births of mothers with one previous child and each of the education and age variables in each case. The data as the birth-year level. Standard errors are calculated using bootstrapping. CS does not provide estimates for period -5. The pooled result (ATT) is the simple average of the dynamic effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Fertility Results - 2+ Children Effect

	2+ Children Effect	Education			Age		
		Primary	Secondary	University	Teen	Young	Adult
-4	0.160*	0.151*	0.153*	-0.181**	0.046	0.226**	0.038
	(0.082)	(0.086)	(0.080)	(0.092)	(0.090)	(0.088)	(0.083)
-3	-0.035	0.024	-0.062	0.033	0.061	-0.015	-0.017
	(0.077)	(0.076)	(0.076)	(0.075)	(0.092)	(0.078)	(0.078)
-2	0.093	0.001	0.074	-0.005	-0.018	-0.004	0.100
	(0.060)	(0.067)	(0.063)	(0.076)	(0.076)	(0.063)	(0.061)
-1	-0.060	-0.034	-0.030	-0.076	-0.069	-0.023	-0.063
	(0.058)	(0.073)	(0.060)	(0.073)	(0.081)	(0.059)	(0.062)
0	-0.068	-0.072	-0.054	-0.075	-0.107	-0.097	-0.020
	(0.054)	(0.069)	(0.056)	(0.069)	(0.075)	(0.064)	(0.058)
+1	-0.126**	-0.140**	-0.114*	-0.043	-0.371***	-0.081	-0.110*
	(0.063)	(0.066)	(0.067)	(0.076)	(0.116)	(0.063)	(0.066)
+2	-0.231***	-0.231***	-0.244***	-0.256***	-0.709***	-0.204***	-0.165**
	(0.068)	(0.077)	(0.072)	(0.080)	(0.122)	(0.073)	(0.066)
+3	-0.352***	-0.447***	-0.331***	-0.245***	-0.872***	-0.357***	-0.213***
	(0.073)	(0.076)	(0.076)	(0.085)	(0.130)	(0.079)	(0.068)
+4	-0.389***	-0.511***	-0.380***	-0.199**	-1.085***	-0.481***	-0.227***
	(0.083)	(0.088)	(0.085)	(0.102)	(0.156)	(0.093)	(0.077)
+5	-0.715***	-0.857***	-0.717***	-0.347***	-1.417***	-0.796***	-0.507***
	(0.096)	(0.112)	(0.109)	(0.129)	(0.207)	(0.123)	(0.089)
+6	-0.617***	-0.530***	-0.556***	-0.279*	-1.808***	-0.583***	-0.428***
	(0.158)	(0.196)	(0.171)	(0.151)	(0.395)	(0.182)	(0.142)
Pooled Result	-0.357***	-0.398***	-0.342***	-0.206***	-0.910***	-0.371***	-0.238***
	(0.061)	(0.068)	(0.064)	(0.070)	(0.129)	(0.069)	(0.056)
N	3,044	2,527	2,844	1,803	1,820	2,736	2,755

Notes: This table shows the event study results of estimating equation (1) with the CS estimator and conditioning the births of mothers with more than one previous child and each of the education and age variables in each case. The data as the birth-year level. Standard errors are calculated using bootstrapping. CS does not provide estimates for period -5. The pooled result (ATT) is the simple average of the dynamic effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A2: ATT Pooled Effects on outcomes



Note: This figure shows the pooled ATT of the event-study estimations using the Callaway-Sant'Anna estimator. The data is at the birth-year level. Standard errors are calculated by bootstrapping. The coefficients and bootstrapped standard errors are shown in Tables A10, A13 and A16 and are plotted in Figures 6, 7 and 8

Intention results in tables

Table A9: Intention Results - TWFE

Time Periods	Planned	Contraceptive Failure
-5	-0.024**	0.010
	(0.012)	(0.012)
-4	-0.010	0.003
	(0.009)	(0.009)
-3	-0.012*	0.007
	(0.007)	(0.006)
-2	-0.007	0.006
	(0.005)	(0.005)
-1	0.000	0.000
	(.)	(.)
0	0.007	0.004
	(0.006)	(0.005)
+1	0.003	-0.001
	(0.007)	(0.006)
+2	0.016**	-0.004
	(0.007)	(0.007)
+3	0.028***	-0.015*
	(0.009)	(0.008)
+4	0.033***	-0.018*
	(0.011)	(0.011)
+5	0.054***	-0.045***
	(0.014)	(0.014)
+6	0.070***	-0.056***
	(0.017)	(0.019)
N	216,726	216,726

Notes: This table shows the event study results of estimating a TWFE model, as in equation (2), with the OLS estimator for results on pregnancy intention (planned status and contraceptive failure). The data is at the birth-year level and standard errors are clustered at the geographic unit level. Time -1 is omitted and used as the reference period. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A10: Intention Results - CS

Time Periods	Planned	Contraceptive Failure
-4	0.033**	-0.023*
	(0.015)	(0.013)
-3	-0.017**	0.007
	(0.008)	(0.007)
-2	0.004	-0.002
	(0.007)	(0.006)
-1	0.003	-0.004
	(0.007)	(0.006)
0	0.002	0.006
	(0.007)	(0.006)
+1	-0.003	0.001
	(0.009)	(0.007)
+2	0.016	-0.000
	(0.011)	(0.010)
+3	0.034***	-0.013
	(0.012)	(0.010)
+4	0.043***	-0.009
	(0.014)	(0.012)
+5	0.065***	-0.032**
	(0.017)	(0.015)
+6	0.078***	-0.055***
	(0.025)	(0.021)
Pooled Result	0.034***	-0.015*
	(0.010)	(0.008)
N	216,726	216,726

Notes: This table shows the event study results of estimating equation (2) with the CS estimator for results on pregnancy intention (planned status and contraceptive failure). The data is at the birth-year level and standard errors are calculated by bootstrapping. CS does not provide estimates for period -5. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A11: Intention Results - BJS

Time Periods	Planned	Contraceptive Failure
-4	0.013	-0.011
	(0.009)	(0.008)
-3	0.009	-0.009
	(0.011)	(0.009)
-2	0.012	-0.014
	(0.012)	(0.011)
-1	0.016	-0.022
	(0.015)	(0.013)
0	0.004	0.002
	(0.006)	(0.006)
+1	-0.000	-0.004
	(0.007)	(0.008)
+2	0.018*	-0.008
	(0.009)	(0.010)
+3	0.035***	-0.020*
	(0.010)	(0.011)
+4	0.042***	-0.016
	(0.012)	(0.012)
+5	0.062***	-0.038***
	(0.015)	(0.014)
N	214,059	214,059

Notes: This table shows the event study results of estimating equation (2) with the BJS estimator for results on pregnancy intention (planned status and contraceptive failure). The data is at the birth-year level and standard errors are clustered at the geographic unit-level. BJS does not provide estimates for period -5 nor for period +6 as the number of treated units for that time period is too low to provide a reliable estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Parental Investment results in tables

Table A12: Parental Investment - TWFE

Time Periods	Prenatal	Tobacco	Breastfeeding	Partner	Delivery Preparation
-5	0.020	-0.000	-0.001	-0.006	0.023
	(0.053)	(0.009)	(0.018)	(0.020)	(0.020)
-4	-0.002	0.010	-0.013	0.008	0.016
	(0.038)	(0.008)	(0.014)	(0.014)	(0.013)
-3	-0.019	0.007	-0.004	0.001	0.010
	(0.024)	(0.006)	(0.009)	(0.010)	(0.009)
-2	-0.012	0.005	-0.004	0.005	0.001
	(0.021)	(0.005)	(0.006)	(0.007)	(0.007)
-1	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)
0	0.016	0.002	0.000	0.007	-0.004
	(0.017)	(0.004)	(0.006)	(0.005)	(0.007)
+1	0.028	-0.003	-0.004	0.005	-0.009
	(0.023)	(0.005)	(0.009)	(0.007)	(0.010)
+2	0.042	-0.005	0.014	0.010	-0.013
	(0.031)	(0.006)	(0.010)	(0.009)	(0.012)
+3	0.082**	-0.010	0.027**	0.012	-0.001
	(0.037)	(0.007)	(0.013)	(0.011)	(0.012)
+4	0.139***	-0.018**	0.042***	0.026*	0.002
	(0.047)	(0.009)	(0.016)	(0.014)	(0.015)
+5	0.157***	-0.032***	0.058***	0.036**	0.025
	(0.058)	(0.012)	(0.020)	(0.017)	(0.020)
+6	0.201**	-0.035***	0.064**	0.047**	0.038
	(0.082)	(0.013)	(0.026)	(0.022)	(0.030)
N	216,726	216,726	216,726	216,726	216,726

Notes: This table shows the event study results of estimating a TWFE model, as in equation (2), with the OLS estimator for results on parental investment variables (prenatal care visits, tobacco smoking behavior, breastfeeding counselling, partner present at delivery and delivery preparation). The data is at the birth-year level and standard errors are clustered at the geographic unit level. Time -1 is omitted and used as the reference period. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A13: Parental Investment - CS

Time Periods	Prenatal	Tobacco	Breastfeeding	Partner	Delivery Preparation
-4	0.068	-0.015	-0.002	-0.000	0.015
	(0.056)	(0.012)	(0.012)	(0.013)	(0.015)
-3	0.020	-0.013*	0.003	-0.019***	0.005
	(0.029)	(0.007)	(0.006)	(0.007)	(0.008)
-2	0.011	0.001	-0.001	(0.002	-0.008
	(0.024)	(0.005)	(0.005)	(0.006)	(0.007)
-1	0.024	-0.006	0.003	-0.004	0.006
	(0.023)	(0.005)	(0.005)	(0.006)	(0.007)
0	0.007	0.006	-0.004	0.009*	-0.003
	(0.022)	(0.005)	(0.005)	(0.005)	(0.007)
+1	0.026	-0.002	-0.012*	0.006	-0.004
	(0.025)	(0.007)	(0.007)	(0.007)	(0.009)
+2	0.039	-0.005	0.007	0.010	-0.014
	(0.032)	(0.008)	(0.010)	(0.009)	(0.012)
+3	0.066**	-0.011	0.016	0.011	-0.007
	(0.032)	(0.009)	(0.010)	(0.010)	(0.013)
+4	0.122***	-0.020*	0.035***	0.024**	0.003
	(0.038)	(0.010)	(0.012)	(0.011)	(0.014)
+5	0.140***	-0.023*	0.046***	0.043***	0.028
	(0.050)	(0.013)	(0.015)	(0.014)	(0.018)
+6	0.225***	-0.009	0.038*	0.070***	0.028
	(0.075)	(0.019)	(0.021)	(0.020)	(0.024)
Pooled Result	0.090***	-0.009**	0.018***	0.025	0.005
	(0.029)	(0.007)	(0.008)	(0.008)	(0.010)
N	216,726	216,726	216,726	216,726	216,726

Notes: This table shows the event study results of estimating equation (2) with the CS estimator for results on parental investment variables (prenatal care visits, tobacco smoking behavior, breastfeeding counselling, partner present at delivery and delivery preparation). The data is at the birth-year level and standard errors are calculated by bootstrapping. CS does not provide estimates for period -5. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A14: Parental Investment - BJS

Time Periods	Prenatal	Tobacco	Breastfeeding	Partner	Delivery Preparation
-4	-0.018	0.008	-0.005	0.018**	-0.009
	(0.035)	(0.006)	(0.011)	(0.008)	(0.010)
-3	-0.016	0.002	0.005	0.015	-0.015
	(0.043)	(0.007)	(0.014)	(0.010)	(0.014)
-2	0.003	-0.002	0.007	0.022*	-0.027
	(0.055)	(0.009)	(0.020)	(0.013)	(0.016)
-1	0.023	-0.007	0.013	0.020	-0.028
	(0.065)	(0.011)	(0.025)	(0.016)	(0.020)
0	0.028	0.002	0.000	0.006	-0.004
	(0.020)	(0.004)	(0.006)	(0.005)	(0.006)
+1	0.034	-0.003	-0.006	0.004	-0.011
	(0.028)	(0.005)	(0.009)	(0.008)	(0.009)
+2	0.052	-0.008	0.013	0.010	-0.019
	(0.043)	(0.008)	(0.013)	(0.011)	(0.011)
+3	0.077*	-0.015*	0.025	0.006	-0.008
	(0.043)	(0.008)	(0.017)	(0.014)	(0.015)
+4	0.122***	-0.022**	0.046***	0.016	0.005
	(0.045)	(0.010)	(0.018)	(0.018)	(0.017)
+5	0.149***	-0.028**	0.058***	0.031*	0.034*
	(0.046)	(0.012)	(0.019)	(0.016)	(0.018)
N	214,059	214,059	214,059	214,059	214,059

Notes: This table shows the event study results of estimating equation (2) with the BJS estimator for results on parental investment variables (prenatal care visits, tobacco smoking behavior, breastfeeding counselling, partner present at delivery and delivery preparation). The data is at the birth-year level and standard errors are clustered at the geographic unit-level. BJS does not provide estimates for period -5 nor for period +6 as the number of treated units for that time period is too low to provide a reliable estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Newborn outcomes results in tables

Table A15: Newborn Outcomes Results - TWFE

Time Periods	Weight	Correct Weight	APGAR 1	APGAR 5	Preterm	Days Hospital
-5	0.000	-0.003	-0.006	-0.004	-0.005	-0.061
	(0.005)	(0.010)	(0.004)	(0.003)	(0.007)	(0.250)
-4	-0.001	-0.006	-0.008***	-0.003*	0.001	-0.058
	(0.004)	(0.007)	(0.003)	(0.002)	(0.006)	(0.161)
-3	-0.004	-0.003	-0.006***	-0.003**	0.002	0.058
	(0.003)	(0.006)	(0.002)	(0.001)	(0.004)	(0.113)
-2	0.000	-0.001	-0.004**	-0.002*	-0.003	0.059
	(0.002)	(0.004)	(0.002)	(0.001)	(0.003)	(0.055)
-1	0.000	0.000	0.000	0.000	0.000	0.000
	(.)	(.)	(.)	(.)	(.)	(.)
0	-0.001	0.003	-0.002	-0.000	-0.004	-0.038
	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.056)
+1	0.000	0.002	-0.002	0.001	0.002	0.012
	(0.003)	(0.004)	(0.002)	(0.001)	(0.004)	(0.080)
+2	0.000	0.010*	-0.001	0.002*	0.003	-0.043
	(0.003)	(0.006)	(0.003)	(0.001)	(0.005)	(0.115)
+3	0.005	0.011	0.003	0.005***	-0.005	-0.082
	(0.004)	(0.007)	(0.003)	(0.002)	(0.007)	(0.143)
+4	0.001	0.021**	0.001	0.004*	0.003	-0.151
	(0.005)	(0.009)	(0.004)	(0.002)	(0.008)	(0.158)
+5	0.008	0.029***	0.005	0.007***	-0.001	-0.170
	(0.006)	(0.011)	(0.004)	(0.003)	(0.009)	(0.189)
+6	0.011	0.018	0.004	0.007**	0.006	-0.469**
	(0.007)	(0.013)	(0.007)	(0.004)	(0.013)	(0.223)
N	216,726	216,726	216,726	216,726	216,726	216,726

Notes: This table shows the event study results of estimating a TWFE model, as in equation (2), with the OLS estimator for results on newborn outcomes (weight, correct weight for gestational age, APGAR 1 and APGAR 5 scores, preterm delivery status and number of days in hospital). The data is at the birth-year level and standard errors are clustered at the geographic unit level. Time -1 is omitted and used as the reference period. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A16: Newborn Outcomes Results - CS

Time Periods	Weight	Correct Weight	APGAR 1	APGAR 5	Preterm	Days Hospital
-4	0.006	-0.003	0.000	0.000	0.005	0.276
	(0.007)	(0.011)	(0.006)	(0.004)	(0.009)	(0.172)
-3	-0.000	0.007	0.002	0.001	-0.008	0.132
	(0.004)	(0.006)	(0.003)	(0.002)	(0.005)	(0.086)
-2	0.002	-0.003	0.001	0.001	-0.003	-0.038
	(0.003)	(0.005)	(0.003)	(0.001)	(0.004)	(0.070)
-1	0.001	0.002	0.005**	0.002	0.003	0.020
	(0.003)	(0.005)	(0.002)	(0.001)	(0.004)	(0.066)
0	0.000	0.002	-0.006***	-0.002	-0.004	-0.108*
	(0.003)	(0.005)	(0.002)	(0.001)	(0.004)	(0.064)
+1	0.003	0.005	-0.004	-0.000	0.003	-0.068
	(0.004)	(0.006)	(0.003)	(0.002)	(0.005)	(0.088)
+2	0.003	0.006	-0.004	0.002	0.008	-0.188
	(0.005)	(0.008)	(0.004)	(0.003)	(0.007)	(0.128)
+3	0.002	0.006	0.003	0.005*	0.001	-0.230
	(0.005)	(0.009)	(0.005)	(0.003)	(0.007)	(0.146)
+4	-0.003	0.012	0.002	0.004	0.007	-0.238
	(0.006)	(0.010)	(0.005)	(0.003)	(0.009)	(0.173)
+5	-0.004	0.017	0.008	0.008**	0.008	-0.296
	(0.008)	(0.013)	(0.007)	(0.004)	(0.011)	(0.225)
+6	0.005	0.017	0.010	0.012**	0.001	-0.967**
	(0.011)	(0.018)	(0.010)	(0.005)	(0.015)	(0.385)
Pooled Result	0.001	0.009	0.001	0.004*	0.003	-0.299***
	(0.004)	(0.007)	(0.004)	(0.002)	(0.006)	(0.128)
N	216,726	216,726	216,726	216,726	216,726	216,726

Notes: This table shows the event study results of estimating equation (2) with the CS estimator for results on newborn outcomes (weight, correct weight for gestational age, APGAR 1 and APGAR 5 scores, preterm delivery status and number of days in hospital). The data is at the birth-year level and standard errors are calculated by bootstrapping. CS does not provide estimates for period -5. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A17: Newborn Outcomes Results - BJS

Time Periods	Weight	Correct Weight	APGAR 1	APGAR 5	Preterm	Days Hospital
-4	-0.001	-0.002	-0.002	0.001	0.006	0.056
	(0.004)	(0.005)	(0.003)	(0.002)	(0.005)	(0.109)
-3	-0.005	0.002	-0.000	0.002	0.006	0.203
	(0.005)	(0.008)	(0.003)	(0.003)	(0.007)	(0.150)
-2	-0.001	0.003	0.001	0.003	0.001	0.245
	(0.006)	(0.011)	(0.004)	(0.003)	(0.010)	(0.175)
-1	-0.001	0.007	0.005	0.005	0.003	0.221
	(0.008)	(0.014)	(0.005)	(0.004)	(0.013)	(0.183)
0	0.001	0.004	-0.002	-0.000	-0.004	-0.104
	(0.003)	(0.004)	(0.002)	(0.001)	(0.003)	(0.071)
+1	0.003	0.005	-0.002	0.001	0.003	-0.065
	(0.003)	(0.006)	(0.002)	(0.001)	(0.005)	(0.108)
+2	0.005	0.014*	-0.001	0.003	0.004	-0.161
	(0.004)	(0.008)	(0.004)	(0.002)	(0.006)	(0.153)
+3	0.006	0.012	0.005	0.006***	-0.003	-0.162
	(0.005)	(0.008)	(0.004)	(0.002)	(0.007)	(0.150)
+4	0.000	0.020**	0.003	0.004	0.003	-0.199
	(0.006)	(0.009)	(0.005)	(0.002)	(0.007)	(0.138)
+5	0.008	0.025**	0.010**	0.007**	-0.002	-0.230
	(0.006)	(0.012)	(0.005)	(0.003)	(0.010)	(0.168)
N	214,059	214,059	214,059	214,059	214,059	214,059

Notes: This table shows the event study results of estimating equation (2) with the BJS estimator for results on newborn outcomes (weight, correct weight for gestational age, APGAR 1 and APGAR 5 scores, preterm delivery status and number of days in hospital). The data is at the birth-year level and standard errors are clustered at the geographic unit-level. BJS does not provide estimates for period -5 nor for period +6 as the number of treated units for that time period is too low to provide a reliable estimate. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Missings in outcome variables

As described in the main paper, the outcome data contains missing values. Table A18 shows the percentage of missing for each dependent variable at each year and in total. There is no specific year when we observe special concerns. Table A18 shows the results from regressions where the dependent variables is a indicator if the outcome is missing and the independent variables are those in Table A18 rows. Although there are some characteristics that are statistically significant, the magnitudes are very small. In the case of Days of Hospitalization, given the large amount of missing, all variables are significant and with magnitudes that are relatively not small. Finally, we do see that delivery in public health clinics is associated with a bigger amount of missing values. Although this is a problem to further net out in to the analysis, if by any way is biasing our results, that bias should be decreasing the magnitude of the estimated coefficients.

Table A18: Randomness in missing outcome variables

	Planned Pregnancy	Cont. Failure	Prenatal	Tobacco	Breastfeeding	Partner	Preparation	APGAR 1	APGAR 5	Preterm	Days Hosp.
Age	-0.0003***	-0.0001	-0.0000*	-0.0001	-0.0003***	-0.0008***	-0.0001	-0.0000*	-0.0000	0.0000	0.0023***
	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0002)
Education	-0.0001	0.0001	-0.0000	0.0004**	-0.0003*	-0.0013***	0.0000	-0.0001	-0.0001*	0.0000	0.0069***
	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0000)	(0.0000)	(0.0000)	(0.0004)
Prev. pregnancies	0.0001	-0.0016***	0.0006***	-0.0002	0.0044***	-0.0005	0.0041***	0.0012***	0.0012***	-0.0001	-0.0117***
	(0.0003)	(0.0004)	(0.0001)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0002)	(0.0002)	(0.0001)	(0.0009)
Distance	0.0008	0.0015***	0.0003	-0.0019***	-0.0003	-0.0021***	-0.0005	0.0003	0.0003	-0.0001	0.0022
	(0.0005)	(0.0005)	(0.0003)	(0.0006)	(0.0007)	(0.0007)	(0.0007)	(0.0002)	(0.0002)	(0.0003)	(0.0016)
Public HC	0.0501***	0.0719***	0.0033***	0.0713***	0.1220***	0.0817***	0.1193***	0.0055***	0.0054***	0.0085***	-0.0525***
	(0.0009)	(0.0011)	(0.0003)	(0.0012)	(0.0014)	(0.0014)	(0.0014)	(0.0003)	(0.0003)	(0.0004)	(0.0026)
Cons.	0.0166***	0.0098***	0.0012**	0.0159***	0.0195***	0.0692***	0.0152***	0.0022***	0.0020***	0.0006	0.4741***
	(0.0017)	(0.0018)	(0.0005)	(0.0021)	(0.0023)	(0.0025)	(0.0023)	(0.0007)	(0.0007)	(0.0007)	(0.0057)
N	213,140	213,140	213,140	213,140	213,140	213,140	213,140	213,140	213,140	213,140	213,140

Notes: Robust Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Missings in geolocation

This section describes the missing observation in the data set due to impossibility to gelocate the address. Addresses were provided by the MOH in the SIP database, we cleaned them and gelocated them using two resources, GoogleMaps and the Unique Geographic Address System (IDE) API.[23] After carrying out gelocations with both tools, we identified that GoogleMaps API performs better and is more informative of the address precision. Therefore, while these tables show non-varying missing observations over time, we plan to improve the geolocation by re-geolocating with GoogleMaps the observations originally not found with the IDE API.

Table A19: Missing observations by region

Region	Correct	Missing	% Correct
ARTIGAS	7,898	2,573	0.754
CANELONES	44,374	20,438	0.685
CERRO LARGO	7,310	2,948	0.713
COLONIA	10,521	4,400	0.705
DURAZNO	4,485	2,776	0.618
FLORES	2,631	320	0.892
FLORIDA	5,361	2,244	0.705
LAVALLEJA	4,046	1,936	0.676
MALDONADO	13,603	9,449	0.590
MONTEVIDEO	149,604	20,808	0.878
PAYSANDU	11,984	3,890	0.755
RIO NEGRO	5,195	2,132	0.709
RIVERA	12,664	2,885	0.814
ROCHA	4,976	3,870	0.563
SALTO	15,302	3,490	0.814
SAN JOSE	9,870	4,585	0.683
SORIANO	7,610	2,459	0.756
TACUAREMBO	6,564	4,852	0.575
TREINTA Y TRES	3,989	2,209	0.644

Notes: This table describes the number of observations that were and were not possible to geolocate by region (“departamentos”). Source: SIP.

23 See https://www.gub.uy/infraestructura-datos-espaciales/tramites-y-servicios/servicios/sistema-unico-direcciones-geograficas for further details of this API.

Table A20: Missing observations by year

Year	Correct	Missing	% Correct
2011	32,136	10,419	0.755
2012	34,720	11,083	0.758
2013	36,067	11,107	0.765
2014	36,511	10,961	0.769
2015	37,056	10,362	0.781
2016	35,930	10,048	0.781
2017	33,309	9,050	0.786
2018	30,778	8,406	0.785
2019	26,168	9,858	0.726
2020	25,312	9,916	0.719

Notes: This table describes the number of observations that were and were not possible to geolocate by year. Source: SIP.

Live Birth Certificates and SIP database comparison

Table A21, Figure A3 and Figure A4 show the difference between the SIP data and the live birth certificates (CNV). We define the coverage rate of the SIP data set as the number of births relative to those in the CNV. As it can be observed in the figures below, coverage varies considerably in some specific regions for some years. To avoid introducing this noise into our estimations we designed a measure to arbitrarily exclude the most problematic regions.[24] This measure is defined as $(coverage_{it} - mean\_coverage_i)/mean\_coverage_i$ for each region i in period t. We then removed all those regions that had at least one year in which their coverage varied more than an arbitrary threshold of 10%. Last column of Table A21 shows the excluded regions.

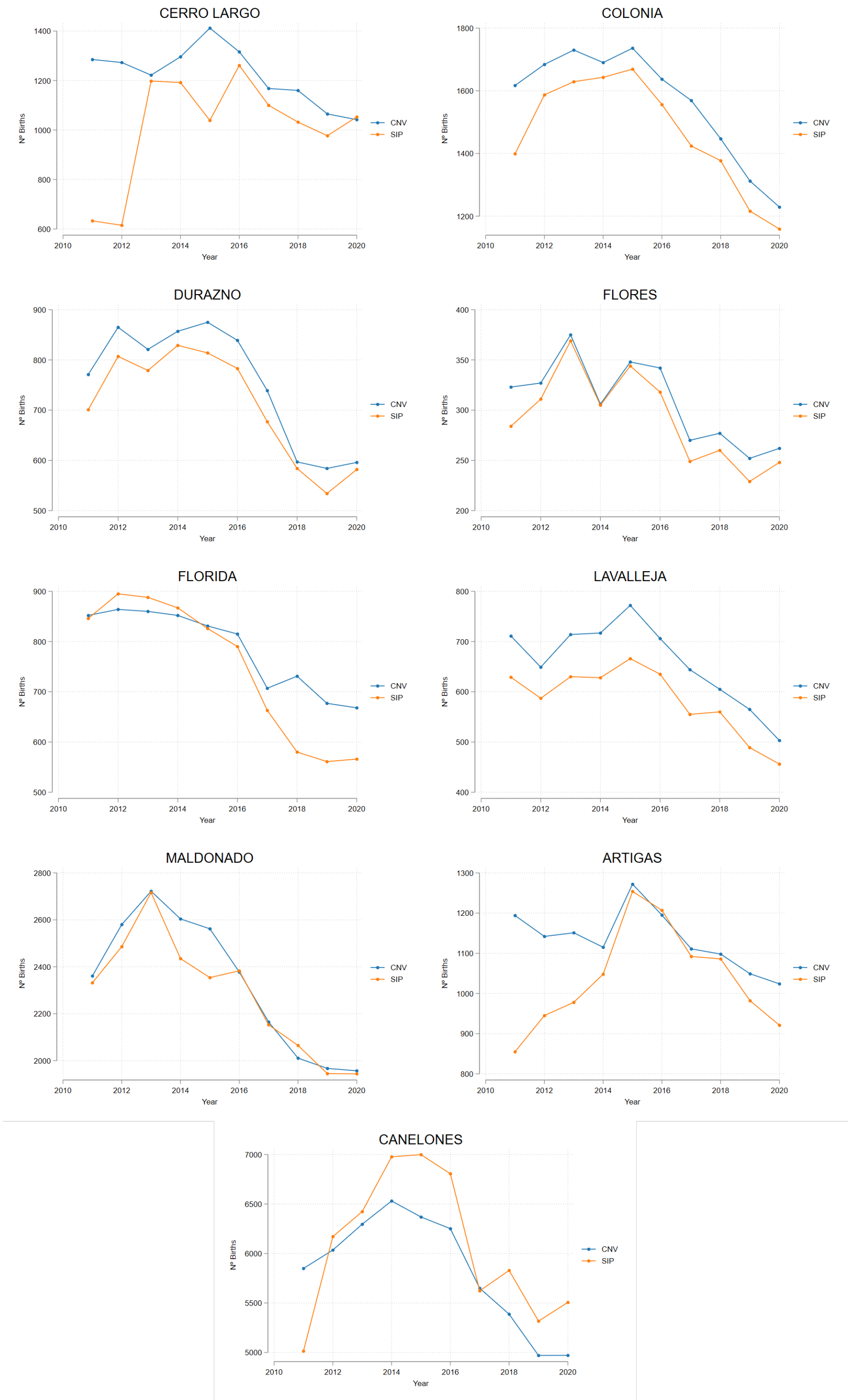
Table A21: Exclusion Criteria

Region	Avg Number Births - SIP	Avg Number Births - CNV	Mean Coverage (SIP/CNV)	Max. % variation over mean coverage	Excluded
ARTIGAS	1,036.8	1,135.1	0.914	0.216	Yes
CANELONES	6,066.6	5,830.8	1.041	0.177	Yes
CERRO LARGO	1,010	1,223.9	0.833	0.420	Yes
COLONIA	1,465.9	1,565.1	0.936	0.076	No
DURAZNO	709	754.4	0.941	0.033	No
FLORES	291.7	308.2	0.945	0.069	No
FLORIDA	748.2	785.7	0.945	0.160	Yes
LAVALLEJA	583.5	658.6	0.887	0.028	No
MALDONADO	2,281.3	2,330.7	0.981	0.063	No
MONTEVIDEO	15,693	1,6844.6	0.931	0.042	No
PAYSANDU	1,497.7	1,645.1	0.915	0.491	Yes
RIO NEGRO	725.3	778.5	0.934	0.046	No
RIVERA	1,541.5	1,591	0.969	0.113	Yes
ROCHA	866.9	914.7	0.951	0.409	Yes
SALTO	1,860.8	2,096.2	0.889	0.216	Yes
SAN JOSE	1,388.2	1,256.5	1.110	0.088	No
SORIANO	992.6	1,064.2	0.933	0.054	No
TACUAREMBO	1,124.6	1,241.1	0.907	0.098	No
TREINTA Y TRES	610.8	601.5	1.016	0.052	No

Notes: This table shows the adopted criteria to exclude regions with large year-to-year variation in the SIP coverage with respect to the births national registry (CNV). Regions that exhibited more than a 10% of variation with respect with its average coverage rate were excluded from the analysis.

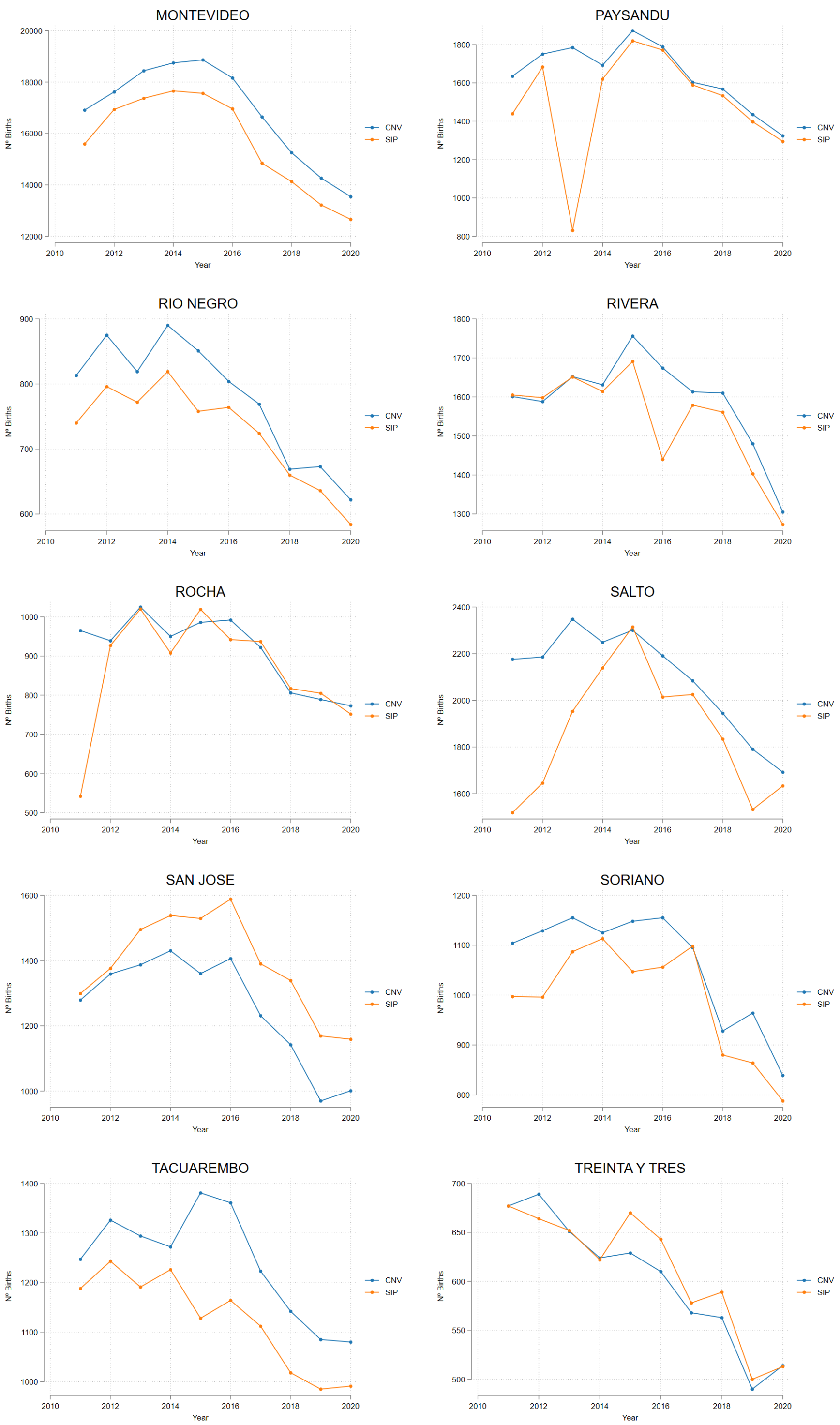
24 Note that the spurious variation would bias our results on number of births and, most likely, those related to births' characteristics.

Figure A3: Exclusion Criteria



Source: SIP and CNV.

Figure A4: Exclusion Criteria (Cont.)



Source: SIP and CNV.

3

THE FEWER THE MERRIER

EMPIRICAL EVIDENCE ON THE IMPACT OF FEWER SIBLINGS ON EARLY CHILDHOOD DEVELOPMENT

3.1 INTRODUCTION

Since the seminal work of Becker and Lewis, 1973 and Becker and Tomes, 1976, researchers have sought to understand the interaction between the number of children in a family and their observed *quality*.[1] Under the assumption that parents have strong preferences to level the investment among their children, Quantity-Quality (QQ) models show that the greater the number of children in a household, the greater the total cost of increasing the amount of resources (i.e. quality) invested in them. Similarly, the higher the desired quality of children, the higher the cost associated with having an additional child.

From an empirical perspective, these two variables have been found to be negatively correlated at both country and household levels. However, the existence and sign of a causal relationship is far from a consensus. Given the impossibility (in both moral and practical terms) of randomly assigning an extra child to a set of families to answer this question, previous studies have relied on the arguable quasi-randomness of multiple births (Black, Devereux, and Salvanes, 2007; Rosenzweig and Wolpin, 1980; Åslund and Grönqvist, 2010) and on sex composition preferences of siblings (Angrist and Evans, 1998; Angrist, Lavy, and Schlosser, 2010) and have provided mixed results on the effect of the number of children on mid- and long-term quality outcomes (i.e. educational and employment attainment).

In this paper I present evidence on the relationship between the quantity and quality of children, with a particular focus on early childhood development. Specifically, I will answer the following question: what is the impact of having fewer siblings on a child's early development? If the QQ model is a fair description of reality, one would expect that children with fewer siblings would receive more resources and thus improve their early development.

I provide answers to this question by analysing the impact of an Uruguayan public policy that, by incorporating subdermal implants into the contraceptive options available to part of the national female population, is likely to have affected their fertility rate. Due to the lack of dependence on the user for its proper functioning, this method is extremely effective (99.9%) for a period of 5 years after insertion. For this reason, mothers who have adopted this contraceptive method can be expected to reduce the number of children they give birth to

1 As described by Becker, 1960, the quality of children has to do with the amount of resources spent on them; it is not related to any moral appreciation.

after the time of implant insertion. Children from these mothers can therefore be expected to have fewer siblings.

This method was introduced for the first time in the country in June 2014 as part of a pilot program funded by the United Nations Population Fund (UNFPA) and coordinated by the Ministry of Health (MOH hereafter). By taking advantage of the staggered deployment of the program in the territory and controlling for variables that possibly determine the uptake of treatment, I shed some light on the impact of the reduction in the number of siblings on the early childhood development of existing children.

My primary data source is a nationally representative survey that collects extensive information on the development of children under five years of age. It provides the results of two comprehensive tests that capture children's developmental delays and behaviour problems: the Ages and Stages Questionnaires - Third Edition (ASQ-3) and the Child Behaviour Checklist for ages 1.5-5 (CBCL 1.5-5). In addition to providing relevant information about the child and the household, this survey is informative about the contraceptive method used by the mother. I supplement this dataset with administrative data stemming from the Perinatal Information System, which allows me to control for important characteristics of the mother and the household at the moment of the child's birth.

Under the assumption of conditional independence, I estimate the conditional probability of choosing the implant and use a weighting estimator (Inverse Probability Weighting - IPW-) to obtain the average treatment effect of the program.

My main results suggest that children who had fewer siblings as a consequence of this program are less likely to have developmental delays, especially related to problem resolution and gross and fine motor skills. No significant differences are found in behavioural problems or related to delayed development of social or communication skills. Consistent with the canonical QQ model, my findings suggest that an earlier introduction of the child in care and education centers might explain these results. In addition to this explanation, a lower probability of living in the same household with the father in a conflictual relationship with the mother may be the mechanism by which these results are achieved.

The main contribution of this study is to provide new evidence for the existence of a QQ trade-off that is already identifiable at very early stages of life. While previous studies have mainly analysed the impact of changes in the number of siblings on the quality of individuals in the medium and long term, this study focuses on early childhood developmental outcomes. Given that early childhood is acknowledged as a critical period for the development of human beings (Knudsen et al., 2006), differences at this stage of life can be seen as one of the causes for divergences later in life.

In addition, taking into account the channels suggested by the results of this study, it also provides new evidence on the importance of early childhood education in developing countries. As Dean and Jayachandran, 2020 points out, several studies have found high returns to formal pre-primary education in developed countries (Currie and Almond, 2011; Elango et al., 2015), but very little evidence is available on its benefits in developing countries.

The rest of the paper is organized as follows. Section 2 presents the most relevant literature related to my study. Section 3 describes the policy analysed. Section 4 introduces the data and methodology used. In Section 5, the main results are presented and discussed. Finally, Section 6 provides some concluding remarks.

3.2 RELATED LITERATURE AND CONTRIBUTION

This chapter is closely related to the large body of empirical studies that have analysed the existence of a quantity-quality trade-off for children. QQ models, first introduced by Becker, 1960 and subsequently refined by Becker and Lewis, 1973 and Becker and Tomes, 1976, make explicit that child quantity and quality are tightly connected through the household budget constraint. Since parents are assumed to desire similar levels of quality among their children, the shadow price of children with respect to their number increases with their quality, just as the shadow price of children with respect to their quality increases with their quantity. Therefore, an increase in income would tend to decrease fertility, since the consequent increase in desired quality would raise the shadow price of children with respect to their quantity. For this reason, these models provide a straightforward explanation for the demographic transition observed worldwide over the past centuries without appealing to shifts in preferences for the number of children, as was previously done (Doepke, 2015).

The relevance of this trade-off goes beyond the realm of demographic studies. These mechanisms have also been incorporated into macroeconomic growth models (see, for example, Barro and Becker, 1989; Cavalcanti, Kocharkov, and Santos, 2020) and have provided theoretical support for explaining long-term trends in human development (Galor and Weil, 2000). In a recent example of these applications, Klemp and Weisdorf, 2018 uses English data from the 16th to 19th centuries, and finds that children of parents with lower reproductive capacity were more likely to be literate and to work in high-level occupations. These results support the idea that the trade-off between the quality and quantity of offspring was intrinsically related to the development of the Industrial Revolution and thus of modern economic growth.

The stylized facts of the last centuries persistently confirm a negative correlation between the quantity and quality of children. As Li and Liu, 2022 indicates, countries with higher fertility rates tend to have lower schooling rates. This phenomenon is also observed when comparing households within countries. Members of larger households are more likely to attain a lower level of education, holding everything else fixed. However, as compelling and pervasive as this correlation is, it does not a priori imply a causal relationship. Unobservable differences in parental preferences about the quality of children may also explain this observed pattern.

To answer whether this causal relationship exists, numerous researchers have used exogenous factors that presumably alter the number of children in the household but are expected to be uncorrelated with parental tastes for child quality. In this regard, several papers use the birth of twins (Black, Devereux, and Salvanes, 2005; Juhn, Rubinstein, and Zuppann, 2015; Mogstad and Wiswall, 2016; Rosenzweig and Wolpin, 1980; Åslund and Grönqvist, 2010), others utilize the usual parental preference for a mixed sexual composition of siblings (Angrist and Evans, 1998; Angrist, Lavy, and Schlosser, 2010) and, more recently, some authors have exploited the stringency of population control policies (Ngo, 2020; Qian, 2017; Rosenzweig and Zhang, 2009).[2]

Results found in these studies are inconclusive. In general terms, the results depend on the level of development of the country studied. While most of the studies which analyze developed countries find no evidence of the presumed trade-off, those using data from developing countries tend to find evidence of a statistically significant negative relationship. Rosenzweig and Wolpin, 1980 is the first empirical study to analyze this issue and confirms the hypothesis postulated by Becker using data on schooling levels of Indian children. In contrast, Black, Devereux, and Salvanes, 2005, Åslund and Grönqvist, 2010 and Angrist, Lavy, and Schlosser, 2010 study the impact on a range of educational and labour market outcomes by using data from Norway, Sweden and Israel, respectively, and find no statistical evidence of such a relationship. In a more recent study, Ngo, 2020 shows how a policy in Vietnam that discouraged parents from having more than two children, improved the education of children of low-income mothers.

Unlike most of the studies mentioned above, which focus on long- and medium-term variables, the differential contribution of this paper is to analyse the impact on short-term variables, i.e. early childhood developmental outcomes. In this regard, there are some recent studies that address this question. Foster et al., 2019 concludes that denying women a desired abortion can have negative consequences for the early development of their children. Zhong et al., 2019, a study that focuses on the Chinese province of Guizhou, finds that having siblings has a negative impact on cognitive, linguistic, and socioemotional skills of infants under the age of 2. My study differentiates from the latter in two main ways. First, my empirical strategy aims to exploit variation in the adoption of a highly effective contraceptive method. At the time that the employed survey was ran, subdermal implants were not available throughout the territory or to the entire population within certain areas. This makes the identification strategy used in this study more robust to endogeneity problems than simply comparing otherwise similar children with different numbers

2 On a side note, it may be of interest to note that the validity of using the incidence of twins as an instrument for variation on number of children to draw conclusions about QQ trade-off has recently been challenged (Rosenzweig and Zhang, 2009).

of siblings, as is done in the study mentioned above. Second, in addition to having information on development delays, I also take into account behavioral problems. To the best of my knowledge, this is the first study to do so.

Early childhood is a crucial phase in a human being's life. Any shock at this stage is likely to have a substantial impact on future life outcomes, including health, education, labour market outcomes and social behaviors (Campbell et al., 2014; Currie and Almond, 2011; Heckman, 2007, 2008; Heckman, Stixrud, and Urzua, 2006). García et al., 2020 estimates an annual rate of return of 13.7% on high-quality early childhood investments. More importantly, while differences can partially fade away later in life, they tend to be persistent (Heckman, Pinto, and Savelyev, 2013).

One final comment about the current relevance of QQ models is in order. Although some recent literature suggests that the canonical QQ model is no longer applicable to high-income countries[3], it is likely to remain valid for middle- and low-income countries. Since Uruguay is a middle-income country, and the policy under study had an impact particularly on low-income households, the QQ model remains presumably a valid approximation. The absence of a welfare state that provides affordable (or free) access to pre-school education, health care and childcare makes the arrival of an additional child a heavy financial burden for the household, especially for the poorest. The external validity of the results should, in the most comprehensive scenario, be limited to countries and households of this class.

3.3 Policy and context

As it is the same policy and context as the one of the previous chapter, please see Section 2.2.

3.4 Data and methodology

3.4.1 *Data*

My main data source is the 2018 National Survey of Child Development and Health (referred as ENDIS from here on, given its Spanish acronym), a nationwide representative survey that collects extensive information on the development of children under five years of age. It was designed and implemented in collaboration between the National Statistics Institute, UNICEF and the Ministries of Health, Education and Social Development. It is defined as a survey *"oriented to the study of child development, rights to health, nutrition and food, care and access to education, the relationship between these rights and the responsibility of the State as promoter, guarantor and facilitator of these rights"* (Núñez, Martínez, and Garibotto, 2019). Its main objective was to generate official records about nutrition, health, education and development of Uruguayan children and it was designed to be represen-

3 For an extensive overview, see Doepke et al., 2022.

tative of all children under five years of age living in locations with more than 5,000 inhabitants. Interviews were held between July to October 2018. In total, 2,510 children were included in the survey.

In addition to the children's anthropomorphic characteristics, internationally standardized instruments were used to measure their developmental level and possible conduct problems. Specifically, it provides the results of two comprehensive tests: the Ages and Stages Questionnaires - Third Edition (ASQ-3) and the Child Behaviour Checklist for ages 1.5-5 (CBCL 1.5-5).

The former is a parent-responsive questionnaire that measures a child's performance in five areas: gross motor, fine motor, communication, problem solving and social skills. It is composed of 21 different questionnaires corresponding to different age ranges (e.g. 0-2 months, 3-4, etc.). Each questionnaire includes 30 questions organised in the five areas mentioned above. Each item has a response scale of three values (No= 0, Not yet= 5, Yes= 10)[4]. The total score for each area is obtained by adding up all its items. Higher scores suggest higher levels of development. At a later stage, scores are compared with the original reference population (18,000 American children) and children are classified as "At risk" if they are below two standard deviations from the mean, "Monitoring area" if they are between -2 and -1 standard deviation and "Normal" otherwise (Squires, Bricker, and Twombly, 2009).

The second test assesses social competences by measuring externalised (e.g. aggressiveness) and internalised (e.g. anxiety) behavioral problems (Núñez, Martínez, and Garibotto, 2019). It is composed by 99 items with three rating scales (0= Not true -that you know-; 1= Somewhat, sometimes; 2= Very true or true often)[5]. Higher scores are interpreted as a higher likelihood of behavioural issues. Each category is defined as "Normal", "Borderline" or "Clinical" depending on certain thresholds that vary according to the population to which the test is applied (Achenbach and Rescorla, 2000).

In addition, this survey also provides valuable information on the household composition and characteristics of the mother and father. Most importantly, it collects the contraceptive method chosen by the mother at the time of the interview. For this analysis, questionnaires without information on the chosen contraceptive methods or for individuals (mother or father) who chose a non-reversible contraceptive method were also removed from the sample (565 observations in total). This results in a provisional dataset of 1,945 observations[6].

I supplement this dataset with data from the SIP, a database that contains accurate information about the mother and the newborn for

4 An example of a question to capture communication problems is "When your baby wants something, does he or she point to you?".

5 E.g. One of the questions that would capture anxiety (internalized) problems is "He/she is overly dependent on or attached to adults". An item that would capture aggressive (externalized) behaviours is "He/she cannot wait, wants it all right away".

6 Note that some questions were not answered by all respondents, thus the number of observations may be reduced for certain variables.

Table 6: Summary statistics - Explanatory variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Newborn					
Male	0.524	0.5	0	1	1821
Age_Months	25.874	18.142	0	59	1821
Weight_Birth	3292.134	548.281	650	5000	1821
Disability	0.016	0.125	0	1	1820
Intended_Pregnancy	0.629	0.483	0	1	1821
Lives_Father_Birth	0.512	0.5	0	1	1820
Mother					
Implant	0.108	0.311	0	1	1821
Montevideo	0.473	0.499	0	1	1821
Inc. Tertile 1	0.303	0.46	0	1	1821
Inc. Tertile 2	0.34	0.474	0	1	1821
Inc. Tertile 3	0.357	0.479	0	1	1821
Primary Education	0.114	0.318	0	1	1792
Secondary Education	0.605	0.489	0	1	1792
Tertiary Education	0.281	0.449	0	1	1792
M_Age	30.16	6.707	15	52	1821
N_Prior_Births	0.774	1.041	0	9	1820
Tobacco_Birth	0.115	0.319	0	1	1821

Notes: The values of this table are not weighted for the purpose of showing the composition of the sample.
Definitions of each variable are provided in Table B3.

virtually all births in the country. This allows me to control for important information about the mother at the moment of the child's birth, such as her highest educational level achieved, whether or not she smoked during pregnancy, whether the pregnancy was planned and whether she lived with the baby's father. For greater clarity on the timing of data collection and program implementation, refer to Figure B1 in the Appendix.

Since the survey data is anonymised, I link the two datasets using the statistical technique of Probabilistic Record Linkage, also known as Fuzzy Matching (Wasi, 2015).[7] It uses a set of common variables to estimate the probability that two observations from different data sets belong to the same unit and allows merging data sets without a common record identifier. Given the small population of the country (approximately 120 births occur per day), it is relatively easy to match observations across databases. In this case, I match the observations based on the date of birth, the birth weight of the newborn, the sex of the newborn, the delivery center, whether a cesarean was performed during delivery, the mother's age, her pregnancies prior to birth and the gestational week of the newborn. For the matching procedure, greater weight was given to more unique variables (i.e. date of birth, sex of the newborn, weight of the newborn, delivery center and morther's age). Furthermore, in order to increase the accuracy of the merge, I restricted the date of birth to within 1 day of the date collected in ENDIS.[8] In total, 1,821 observations were successfully matched (93.6% of the sample), of which 737 (37.9%) were matched perfectly. Table B2, included in the Appendix, shows the summary statistics of the propensity scores of the successfully merged observations.

In Tables B3 and B4, included in the Appendix, I provide the definition of each variable used in the analysis.

Tables 6 and 7 show the summary statistics for the explanatory and outcome variables, respectively. Note that in the latter table, in addition to the test scores, I include some variables that are suggestive of the mechanisms by which the analysed policy may have operated (i.e. living in a conflicting environment, amount of time spent with the mother, extensive and intensive differences in care center attendance[9], etc.).

Table Table 8 displays the mean differences between mothers with and without subdermal implants (i.e. treated vs. non-treated). *Treated*

---

7 At the time of submitting this thesis - March 2024 - an agreement is about to be made with the National Statistics Institute to have access to the linked ENDIS-SIP administrative records.

8 Most of the differences were due to different ways of writing the same delivery center, weight typos (i.e. 350 grams, which arguably should be 3,500), among others.

9 To be precise, the information collected in the survey is whether the child is sent to education or care. Within these centres there are a variety of public and private institutions that offer different services according to the age of the children (for example, at very early ages the services are basically care services, while for older ages the services provided by these centres are more associated with initiating the child in the process of education). Unfortunately, given the available information I am not able to distinguish between these different types of centres. Therefore, for the sake of simplicity, I will refer to them with the term "care centres".

mothers are more likely to be younger, poorer, less educated, to have had more children prior to the birth of the observed child, and less likely to be living in Montevideo and to be living with the child's father at the moment of birth than *non-treated* ones. Additionally, they are more prone to have smoked during the observed child's pregnancy and not to have intended to become pregnant at that time. No statistical significant differences emerge for sex, weight or age of the child.

Table 7: Summary statistics - Outcome variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Behavioral Problems					
CBCL Int	0.093	0.29	0	1	1821
CBCL Ext	0.081	0.272	0	1	1821
CBCL Tot	0.079	0.269	0	1	1821
Developmental Delays					
ASQ Comm	0.115	0.319	0	1	1821
ASQ Gross M	0.167	0.373	0	1	1821
ASQ Fine M	0.227	0.419	0	1	1821
ASQ Prob Sol	0.173	0.378	0	1	1821
ASQ Social	0.176	0.381	0	1	1821
ASQ Tot	0.858	1.248	0	5	1821
Possible Mechanisms					
Births_After_Child	0.126	0.332	0	1	1820
Lives_Father	0.76	0.427	0	1	1821
Shared_Raise	0.374	0.484	0	1	1438
Conflict_Couple	0.222	0.416	0	1	1434
Hours_Care_Mother	0.701	0.196	0	1	1791
Care_Center	0.539	0.499	0	1	1821
Months_Care_Center	16.155	12.344	0	53	981

Notes: The values of this table are not weighted for the purpose of showing the composition of the sample.
Definitions of each variable are provided in Table B4.

Table 8: Mean difference between treated and non treated observations

Variable	**Mean-Treated** (With Implant)	**Mean-Comparison** (Without Implant)	**Difference**	**P-Value**
Newborn				
Male	0.522	0.523	-0.001	0.970
Age Months	29.094	28.215	0.879	0.472
Weight Birth	3256.145	3298.085	-41.940	0.318
Disability	0.025	0.017	0.009	0.464
Intended Pregnancy	0.415	0.652	-0.237	0.000
Lives Father Birth	0.295	0.533	-0.239	0.000
Mother				
Montevideo	0.364	0.464	-0.100	0.007
Inc Tertile 1	0.590	0.275	0.315	0.000
Inc Tertile 2	0.347	0.339	0.008	0.839
Inc Tertile 3	0.063	0.385	-0.322	0.000
Primary Education	0.282	0.095	0.186	0.000
Secondary Education	0.688	0.604	0.083	0.023
Tertiary Education	0.030	0.300	-0.270	0.000
M Age	25.414	30.818	-5.404	0.000
N Prior Births	0.996	0.756	0.240	0.018
Tobacco Birth	0.261	0.097	0.163	0.000
Observations	197	1624		

Notes: Definitions of each variable are provided in Table B3.

3.4.2 *Methodology*

A naïve comparison between the mean child development of treated and untreated mothers would surely lead to invalid conclusions. Given the disparities between treated and non-treated mothers shown in Table 8, it seems important to control for these factors in order to avoid obtaining biased results. Note that since these characteristics are captured *before* the implant was placed (even before the child was actually born), it seems reasonable to claim that they are not affected by the policy and can therefore be considered as exogenous. If one has a strong intuition of the functional form that affects the dependent variable, the most traditional way of eliminating these differences would be to run a regression of the variable of interest on an informative variable of treatment status, while controlling for all these other characteristics.

An alternative way would be to apply a matching process and construct a control group that is similar to the treated group according to a set of matching variables. In a similar manner, one could use the conditional probability of treatment (i.e. propensity scores) given a set of observed covariates to assign weights to each observation[10]. In particular, this approach calculates the probability of being treated for each observation and then weights it by the inverse of the probability that it belongs to the group to which it actually belongs (Hirano, Imbens, and Ridder, 2003; Horvitz and Thompson, 1952). Treated observations with high propensity scores and untreated observations with low ones are weighted down and those in the opposite case are weighted up. While unobservable differences between treated and control groups remain, those related to the included observable characteristics are removed.

As noted by Abadie and Cattaneo, 2018 and Angrist and Pischke, 2009, an OLS estimator (as the one proposed as the first option) differs from capturing the Average Treatment Effect (ATE) except for special cases, since it "*puts the most weight on covariate cells where the conditional variance of treatment status is largest*". IPW, on the contrary, provides a clearer and more suitable way of introducing weights for this case.[11] For this reason, and because IPW provides a more flexible way of introducing the covariates' functional form, I rely on the results of this estimator as a valid approximation to the ATE in this study.

10 Following the findings depicted by King and Nielsen, 2019, I do not use propensity scores to find the most comparable observation(s) for each treated unit (i.e. Propensity Score Matching) as the inherent pruning may lead to an increase in the imbalance relative to the original data. On the contrary, using propensity scores to weight all observations in order to obtain comparable groups, even with its own drawbacks, is less likely to lead to this problem.

11 In particular, there are numerous observations in the control group that are not comparable to those of the treatment group.

Under the conditional independence (CI)[12] and common support assumptions, the estimated result can be interpreted as the ATE. The first assumption relies on a certain degree of exogeneity in the adoption of the treatment as the policy roll-out was staggered across the country. In other words, at the moment of the survey, as seen in Chapter 2 not all women who wanted to get an implant were equally able to do so.

The decision of getting the subdermal implant can naturally be formulated as binary. For any mother, there are two possible options: to choose the implant as a contraceptive method or to choose another method (or none at all). I interpret this decision as an expression of a latent (unobserved) variable. To be more precise, I describe this latent variable (D_i^*) as the net present value of the utility of getting the implant. When this value is higher than a personally determined threshold (c_i), the mother prefers to get the implant inserted ($D_i = 1$) rather than not to ($D_i = 0$).

Formally,

$$D_i = \begin{cases} 1 \text{ if } D_i^* > c_i \\ 0 \text{ if } D_i^* < c_i \end{cases}$$

Notice that c_i can be thought of as a parameter indicating how *costly* it is for each mother to get the implant (i.e. distance to closest treated health center, idiosyncratic preferences associated with the implant compared to other methods, etc.).

Assuming that D^* depends on a set of variables (X), the probability of mother i of choosing the implant ($D_i = 1$) can be modelled in the following way:

$$Pr(D_i = 1|X_i) = Pr(D_i^* > c_i) = Pr(X_i'\beta + \epsilon_i > c_i) \tag{3}$$

Under a Logistic distribution, the selection into treatment model is defined as follows:

$$Pr(D_i = 1|X_i) = \Lambda(X_i'\beta) \tag{4}$$

being $\Lambda(.)$ a Logistic distribution.

In order to flexibly and accurately select the subset of all linear, second-order terms and their interactions, I follow the data-driven stepwise regression method proposed by Imbens, 2015. After including as possible covariates those variables depicted in Table 8, this approach returns an optimal functional form to estimate the propensity score which regression output is shown in Table B6 in the Appendix.

For the second stage I weight each observation as described previously and linearly regress the set of variables of interest on the variable informative of the treatment status D:

$$Y_i = D_i'\tau + \epsilon_i \tag{5}$$

12 ($Y^0, Y^1 \perp D|X$). This implies that, after controlling for all characteristics included in X, the treatment assignment is assumed to be as good as random. In other words, there are no unobservable variables left out that are correlated with Y and are driving the treatment assignment.

Under the conditional independence and common support assumptions, τ retrieves the average treatment effect ($E[Y_1 - Y_0]$).

The main drawback of the methodology used in this study is that the CI assumption may be too strong. In other words, there may be some factors correlated with the outcome variables that determine treatment that are not being controlled for. Endogeneity due to selection bias would arise if there were intrinsic differences between treated and untreated women that affect selection into treatment (i.e. this would be the case if more responsible or caring mothers are more likely to choose the subdermal implant as a contraceptive method).

Moreover, given the available data, another limitation of this study is that it is not possible to obtain the precise time at which the mother got the implant placed. These two caveats should be taken into account when considering the conclusiveness of the results.

3.5 RESULTS AND DISCUSSION

The first set of results I present is related to the weighting procedure. In Table 9, I show the standard differences and variance ratios of the covariates before and after weighting each observation by the inverse of the probability estimated in the first step.[13] After weighting the sample, standard differences in covariates between treated and control are considerably reduced. Although there is no agreed threshold for classifying two samples as properly balanced, almost all mean differences fall below the 0.25 cutoff proposed by Rubin, 2001. Furthermore, the variance ratios also "improve" after applying the weighting procedure, as almost all covariates fall within the accepted range of 0.7-1.3. Finally, it should be noted that the overidentification test does not reject the null hypothesis that the covariates are balanced.

Table B5, included in the Appendix, provides further information on the quality of the weighting process. It shows the mean differences of the control variables after the IPW adjustment. Consistent with what is exhibited in Table 9, there are no statistically significant differences between the two groups, with the exception of the probability of living with the father at the time of birth, region and sex of the newborn.

Figure 11 shows the kernel and histogram density estimations of the propensity score. Both representations are presented because common support problems might be difficult to detect in (smoothed) kernel estimations. These figures, while not a formal test for common support, provide a visual approximation to it. It is important to note that there is considerable overlap between the densities of the two groups at low values of the propensity score.

Finally, Table B6, included in the Appendix, shows the coefficients of the first-stage Logit regressions. As expected from the differences between treated and non-treated mothers, shown in Table 8, most

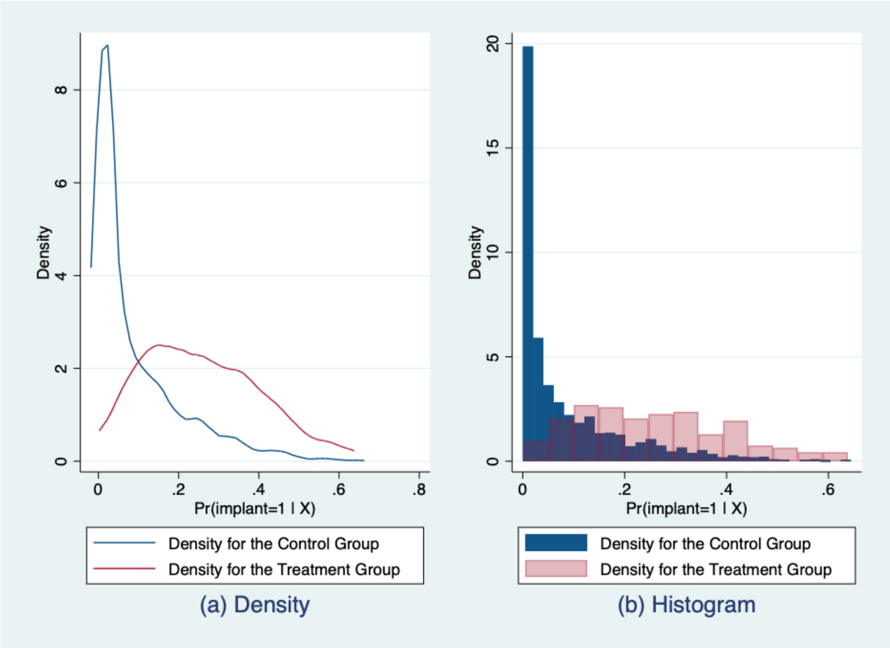
13 To be more precise, treated observations are weighted by $\frac{1}{p}$ and untreated ones by $\frac{1}{1-p}$, where p is the predicted probability of being treated.

Table 9: Covariate Balance Summary

	Standard differences		**Variance ratio**	
	Raw	Weighted	Raw	Weighted
Newborn				
Male	-0.028	0.109	1.007	0.978
Age Months	0.178	0.174	0.769	1.141
Weight Birth	-0.080	0.079	0.941	0.775
Disability	0.079	-0.033	1.741	0.758
Intended Pregnancy	-0.504	0.029	1.076	0.984
Lives Father Birth	-0.514	-0.290	0.841	0.936
Mother				
Montevideo	-0.168	-0.265	0.966	0.905
Inc Tertile 2	0.044	-0.025	1.033	0.983
Inc Tertile 3	-0.862	-0.031	0.248	0.981
Secondary Education	0.184	0.049	0.902	0.977
Tertiary Education	-0.773	-0.093	0.167	0.903
M Age	-0.893	-0.144	0.720	1.059
N Prior Births	0.181	0.082	1.660	1.606
Tobacco Birth	0.472	0.235	2.322	1.582
Svy Weights	0.376	0.082	0.910	0.766
Obs. Treated (Raw)	190	Obs. Treated (Weighted)		995.1
Obs. Control (Raw)	1599	Obs. Control (Weighted)		793.9
Overidentification test for covariates balance				
$\chi^2(17) = 17.2319$			P-value	0.4388

Notes: Definitions of each variable are provided in Table B3. Note that the total number of raw observations is 1,789 because of some covariates' missing values as presented in Table 6.

Figure 11: Kernel and histogram density estimations of the propensity score - IPW Imbens



Note: Kernel-density estimation details: Bandwith=0.0186, Kernel=Epanechnikov.

of the included characteristics associated to the mother before the birth of the child are statistically significant as predictors of subdermal implant choice. Note that, following the suggestion of Dugoff, Schuler, and Stuart, 2013 and Dong et al., 2020, I include survey sample weights not only to weight the observations but also as a regressor in the selection-into-treatment regression.

Table 10 includes the main results of this chapter.[14] Each row refers to the estimation of the implant's average treatment effect on a different outcome variable. While the first two columns show the results of applying a regression adjustment approach (OLS), the last two depict the results when using IPW. In particular, column (1) is the result of regressing each variable of interest on the treatment status indicator without any controls. In the results of the second column, covariates are linearly included (Table 8). The third column shows the results when using a linear functional form to estimate the propensity score to build weights. Finally, the last column presents the results of the preferred estimation approach described in the previous section (IPW Imbens).

The first relevant result worth noting is that no estimation approach finds statistically significant effects on behavioural problems; neither in relation to internalised nor externalised behaviours. Given the expected increase in resources allocated to these children, this result is not, a priori, what would be expected under the QQ model. However, previous studies have found that family environment and maternal

14 The majority of the results presented are robust to the Bonferroni correction.

Table 10: Main Regressions - Outcomes

	(1) OLS	(2) OLS Cov	(3) IPW Linear	(4) IPW Imbens
Behavioral Problems				
CBCL Int	0.855***	0.020	0.038	-0.016
	(0.207)	(0.026)	(0.032)	(0.025)
CBCL Ext	0.517**	-0.004	0.009	-0.029
	(0.237)	(0.026)	(0.027)	(0.020)
CBCL Tot	0.815***	0.007	0.021	-0.020
	(0.225)	(0.022)	(0.027)	(0.022)
Developmental Delays				
ASQ Comm	0.234	0.042	0.037	-0.016
	(0.227)	(0.054)	(0.044)	(0.035)
ASQ Gross M	0.215	-0.035	-0.038	-0.089***
	(0.199)	(0.030)	(0.030)	(0.025)
ASQ Fine M	0.122	-0.061	-0.070**	-0.131***
	(0.182)	(0.037)	(0.030)	(0.027)
ASQ Prob Sol	0.175	-0.026	-0.019	-0.072**
	(0.195)	(0.037)	(0.033)	(0.030)
ASQ Social	0.149	-0.027	0.007	-0.066*
	(0.198)	(0.037)	(0.043)	(0.034)
ASQ Tot	0.141	-0.075	-0.083	-0.373***
	(0.103)	(0.140)	(0.122)	(0.122)

Notes: Definitions of each variable are provided in Table B4.
Robust standard errors are reported in brackets.
The number of observations for all rows is 1789.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

and paternal characteristics are the main determinants of behavioural problems in early childhood (Anselmi et al., 2004; Shaw and Shelleby, 2014; Webster-Stratton, 1998). As the policy studied is unlikely to have affected these factors, at least in the short term, the lack of impact on these outcome variables does not argue against the above-mentioned model.

Second, the most robust estimation approaches provide evidence for a decrease in developmental delays related to gross motor, fine motor and problem solving skills. The impact is not negligible; implant insertion would lead to a 8.9, 13.1 and 7.2 percentage points reduction of having these delays, in each case.[15] Regarding social skills developmental delays, not very sound conclusions can be taken given the low statistical significance of the test needed to reject its related null hypothesis. Overall, these children are expected to have a total of 0.37 developmental delays less (of a total of 5), which represents a 38% reduction on the expected number of delays[16]. These results are consistent with canonical QQ models, where a reduction in the number of children in a household would increase the absolute resources allocated to each existing child. If this is the case, it would arguably enhance the development of the child.

The main mechanism by which this policy is expected to act is through a reduction in the number of children that the treated women gave birth to after getting the implant inserted. As mentioned above, notice that, since there is no information about the date of implant insertion, the variable included in the dataset captures the number of children that women had *after the birth of the observed child, not after the implant insertion*. This can certainly introduce some noise in the results. Nevertheless, in line with the findings presented in Chapter 2, results on the first row of Table 11 suggest a statistically significant reduction in fertility for these women. Specifically, according to the point estimate, they were 6.5% less likely to give birth after the birth of the observed child.

To better understand the mechanisms through which this policy may have operated it is relevant to interpret the rest of the effects shown in Table 11.

According to the results in the second row, treated mothers are less likely to live with the father of the observed child at the moment of the survey. Probably related to this point, according to results in row three, they are also less likely to have a conflictual partner. This could be thought of as a first pathway; having fewer children with the father of the observed child may have reduced the "attachment" to him and, as a consequence, facilitated the break-up of a problematic couple. The potential benefits to the child of not living in a troubled home environment have been widely proved in previous studies (Carneiro, Meghir, and Parey, 2013; Francesconi and Heckman, 2016; Todd and Wolpin, 2007). However, one must be cautious about the

15 These figures represent 40%, 54% and 36% reduction in the probability of having these delays if one takes into account the raw mean of the treated newborns (19.9%, 24% and 19%, respectively).

16 The raw mean of the treated individuals is 0.98 developmental delays.

conclusiveness of these findings as we cannot control for the mother's employment status prior to the birth of the child. It is clear that the employment status of women directly affects their bargaining power within the couple and thus their ability to live independently from the father of the children (Manser and Brown, 1980; McElroy and Horney, 1981).

Table 11: Main Regressions - Possible Mechanisms

	(1) OLS	(2) OLS Cov	(3) IPW Linear	(4) IPW Imbens	(5) Obs
Births After Child	0.160	-0.028	-0.031	-0.065***	1812
	(0.220)	(0.024)	(0.026)	(0.023)	
Lives Father	-1.107***	-0.104*	-0.194**	-0.382***	1818
	(0.160)	(0.060)	(0.079)	(0.118)	
Shared Raise	0.470**	-0.063	0.019	-0.030	1435
	(0.203)	(0.054)	(0.062)	(0.065)	
Conflict Couple	0.384*	-0.067*	-0.055	-0.079**	1433
	(0.228)	(0.038)	(0.039)	(0.034)	
Hours Care Mother	0.118***	0.047**	0.076***	0.077***	1789
	(0.015)	(0.023)	(0.025)	(0.022)	
Care Center	0.009	-0.031	0.004	0.130	1820
	(0.158)	(0.067)	(0.071)	(0.100)	
Months Care Center	-0.185*	-4.738***	-2.739***	-1.947***	981
	(0.095)	(1.512)	(0.971)	(0.636)	

Notes: Definitions of each variable are provided in Table B4.
Robust standard errors are reported in brackets.
Note that the number of observations for each row may vary as there are some missing values for some dependent variables (as highlighted in previous tables.)
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A second way by which the implant program may have affected children development is whether and when they were referred to care. My results indicate that there is no effect on the likelihood of being sent to a care center, but that there is a consistent effect with respect to the time at which this occurred. Children of mothers who received the implant are likely to be referred to care earlier. The point estimate of the treatment effect indicates a difference of approximately 2 months of difference in comparison to the control group.[17] Earlier initiation in the formal education system may help explain the improvement in children's development. This finding is consistent with the context of countries such as Uruguay, where sending infants to care depends strongly on the level of household income. According to an official report (Gómez et al., 2018), in 2018, 79% and 95% of 2- and 3-year-old, respectively, from the highest income quintile attended a care centre. The same values for children from the

17 This represents a 14% time anticipation in the referral to care centers - raw mean of treated group is 13.8 months old.

lowest income quintile were 40% and 61%, in each case. Certainly, these figures reflect not only barriers to access early childhood care centers, but also low take up from families' self-selection (Berlinski and Schady., 2015).

In line with these findings, a recent article concludes that early referral of Indian children to formal schooling (e.g. pre-K) lead to significant improvements in cognitive skills, but not in socio-emotional ones (Dean and Jayachandran, 2020).

Unfortunately, I do not have information on the employment status of mothers at the time of the observed child's birth to estimate an effect on the probability of being employed in order to have a more complete picture of the policy mechanisms. Understanding whether these results are related to the mechanical increase in resources available to the existing child, as there are fewer children in the household, to changes in mothers' labour market participation that force earlier referral to care, or just a selection-into-the-policy effect, would be important for policy implications.

Finally, a positive impact on the proportion of childcare hours allocated to the mother relative to the father is observed. Consistent with this result, in a related study (Del Bono et al., 2016), it has been shown that maternal time is a quantitatively important determinant of skills formation.

All these results and mechanisms hold when performing a few robustness tests, which are shown in Tables B7 and B8 included in the Appendix. In the first column of these tables I restrict the sample to only those observations that were matched in the Probabilistic Record Linkage stage with a probability higher than 0.8 (hence dropping 103 observations) in order to clear potential concerns about the least accurate linkages. The second column of these tables shows the results considering only observations which suffice the common support assumption.[18]

Overall, these results suggest that ensuring women's right to decide if and when to have children has an impact not only on the lives of the women themselves and their future offspring, but also on the lives of existing children. There are positive positive externalities in the reduction of the number of siblings as a result of more effective contraception, already in children under 5 years of age. The impacts refer to improvements in skills related to gross motor, fine motor and problem solving. Because treated women are significantly poorer than untreated women, these results are consistent with the implications of Becker's original model; families with tighter economic constraints would be more affected by a variation in the number of children.

A possible mechanism through which the program operates is by bringing forward the time at which the child is placed in care and education centers. Given the Uruguayan context, this outcome provides further incentives to expand access to early childhood care and edu-

18 I trim control group observations with a higher or lower probability of being treated than the maximum or minimum probability of being treated for treated group observations, respectively. This procedure results in the elimination of 138 observations from the control group.

cation services for low-income families. Other possible mechanisms point to an increase of maternal childcare time and a less conflicting home environment.

3.6 CONCLUSION

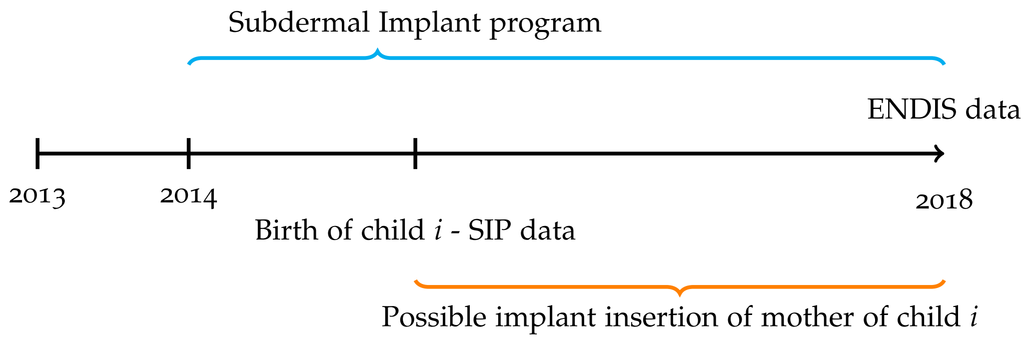
Since the formalisation of the trade-off between quantity and quality of children (Becker and Lewis, 1973), several researchers have attempted to validate or refute this relationship in various aspects associated with educational and labour performance.

In the present chapter I analysed the impact of a public policy that improved contraceptive access to test the predictions of the canonical QQ model in early childhood outcomes. Subdermal implants, a novel contraceptive method characterised by its very high effectiveness, were added to the contraceptive options of a group of women and thus affected the number of siblings of their sons and daughters. In line with the increased resource allocation argued for in Becker's seminal model, the results point to significant improvements in areas related to problem solving and gross and fine motor skills. One possible mechanism suggested by the results is through earlier referral to care and education centers. Since early childhood is a crucial stage in people's lives, policy makers may find these results useful in justifying improvements in contraceptive provision as well as in expanding the coverage of and incentivise the attendance at early childhood care and education centres.

3.7 APPENDIX

Figures

Figure B1: Data sources and program implementation timeline



Notes: The exact moment of implant insertion is unknown given the available data. Children included in the ENDIS survey were born between Oct-2013 and Oct-2018.

Tables

Table B1: Policy Deployment Summary.

Year	Nº Treated Health Centers	Nº Women (Age between 15-44)	Nº Female Public Health Users (Age between 15-44)	Subdermal Implants Stock
Dec-14	62	740,423	286,069	4,900
Dec-15	102	743,555	280,311	16,800
Dec-16	189	746,111	277,634	45,600
Dec-17	277	748,311	289,767	62,500
Dec-18	296	750,117	307,399	74,600

There is a total of 873 public health centers considering primary, secondary and tertiary care.
Source and implants stock: Ministry of Public Health.
Source number of women in the country: National Statistics Institute.
Source number of treated health centers and female public health users: ASSE (State Health Services Administration).

Table B2: Summary statistics - Fuzzy Matching

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**P25**	**P50**	**P75**
pmatch	1,821	.919	.078	.654	1	.873	.873	1

Notes: This table shows the summary statistics of the estimated probability of all successful matches between the ENDIS and SIP datasets.

Table B3: Definition of *explanatory* variables

Newborn	
Male	Binary. 1 if the child is male, 0 otherwise.
Age_Months	Age of the child at the moment of the ENDIS survey (in months).
Weight_Birth	Weight of the child when he/she was born (in grams).
Disability	Binary. 1 if the child has a permanent disability, 0 otherwise.
Intended_Pregnancy	Binary. 1 if the pregnancy was intended, 0 otherwise.
Lives_Father_Birth	Binary. 1 if the father lived in the same dwelling with the child at the moment of birth, 0 otherwise.
Mother	
Montevideo	Binary. 1 if the child lives in Montevideo - main metropolitan area of the country -, 0 otherwise.
Implant	Binary. 1 if the mother uses the subdermal implant as contraceptive method, 0 otherwise.
Inc. Tertile	Categorical. Household income tertile group at the moment of the ENDIS survey.
M_Age	Mother's age at the moment of the ENDIS survey.
N_Prior_Births*	Mother's number of previous births prior to the birth of the child included in the ENDIS.
Ed_Level_Birth*	Categorical. Highest educational level obtained by the mother at the moment of birth of the child included in the ENDIS. Takes the value 1 if is primary school, 2 if it is secondary school, and 3 if it is a Tertiary degree (university or similar).
Tobacco_Birth*	Binary. 1 if the mother smoked during the pregnancy of the observed child, 0 otherwise.

Notes: * The source of these variables is the SIP data base. The rest of the variables are taken from ENDIS.

Table B4: Definition of *outcome* variables

Behavioral Problems	
CBCL Int	Binary. 1 if the child is characterized as "Borderline" or "Clinical" regarding **internalized** behaviour problems, 0 otherwise.
CBCL Ext	Binary. 1 if the child is characterized as "Borderline" or "Clinical" regarding **externalized** behaviour problems, 0 otherwise.
CBCL Tot	Binary. 1 if the child is characterized as "Borderline" or "Clinical" regarding **internalized or externalized** behaviour problems, 0 otherwise.
Developmental Delays	
ASQ Comm	Binary. 1 if the child is characterized as "At risk" or "Monitoring area" regarding **communication skills**, 0 otherwise.
ASQ Gross M	Binary. 1 if the child is characterized as "At risk" or "Monitoring area" regarding **gross motor skills**, 0 otherwise.
ASQ Fine M	Binary. 1 if the child is characterized as "At risk" or "Monitoring area" regarding **fine motor skills**, 0 otherwise.
ASQ Prob Sol	Binary. 1 if the child is characterized as "At risk" or "Monitoring area" regarding **problem solving skills**, 0 otherwise.
ASQ Social	Binary. 1 if the child is characterized as "At risk" or "Monitoring area" regarding **social skills**, 0 otherwise.
ASQ Tot	**Number of areas** in which the child is characterized as "At risk" or "Monitoring area".
Possible Mechanisms	
Births_After_Child**	Binary. 1 if the mother had at least one more child after the birth of the observed child, 0 otherwise.
Lives_Father	Binary. 1 if the father lives in the same dwelling with the child at the moment that the ENDIS was implemented.
Shared_Raise	Binary. 1 if the mother and father disagree "Frequently", "Often" or "Always" about basic child raising issues, 0 otherwise.
Conflict_Couple	Binary. 1 if the climate of the conversation in the couple is said to be tense "Frequently", "Often" or "Always" about basic childbearing issues, 0 otherwise.
Hours_Care_Mother	Child care hours attributed to the mother as a share of those attributed to the father and mother.
Care_Center	Binary. 1 if the child assists to a care center, 0 otherwise.
Months_Care_Center	Child's month of age when he/she began to assist to a care center.

Notes: ** Variable created by combining information from ENDIS and SIP datasets.

Table B5: Mean difference between treated and non treated after IPW Imbens adjustment

Variable	Mean-Treated (With Implant)	Mean-Comparison (Without Implant)	Difference	P-Value
Newborn				
Male	0.749	0.519	0.230	0.042
Age Months	39.822	28.284	11.538	0.155
Weight Birth	3387.475	3299.957	87.518	0.051
Disability	0.008	0.018	-0.010	0.128
Intended Pregnancy	0.766	0.623	0.143	0.173
Lives Father Birth	0.233	0.509	-0.276	0.009
Mother				
Montevideo	0.235	0.451	-0.216	0.057
Inc. Tertile 1	0.223	0.306	-0.083	0.408
Inc. Tertile 2	0.205	0.344	-0.139	0.139
Inc. Tertile 3	0.572	0.350	0.222	0.240
Primary Education	0.098	0.119	-0.021	0.648
Secondary Education	0.401	0.613	-0.212	0.232
Tertiary Education	0.501	0.268	0.233	0.286
M Age	32.850	30.221	2.629	0.326
N Prior Births	0.599	0.780	-0.181	0.512
Tobacco Birth	0.115	0.117	-0.003	0.961
Observations	197	1624		

Notes: Definitions of each variable are provided in Table B3.

Table B6: Matching regression coefficients - Implant Insertion (IPW Imbens)

	Logit
M_Age	-0.14***
	(0.021)
Tertiary Education	-3.02***
	(0.89)
N_Prior_Births	-0.25
	(0.32)
Tobacco_Birth	0.64***
	(0.23)
Lives_Father_Birth	-0.65***
	(0.19)
Age_Months	0.043**
	(0.021)
Inc. Tertile 3	-0.80**
	(0.34)
Secondary Education	-0.75***
	(0.23)
Intended_Pregnancy	-0.032
	(0.23)
Disability	0.38
	(0.53)
Age_Months × Age_Months	-0.00064*
	(0.00035)
Tobacco_Birth × Tertiary Education	2.29**
	(1.07)
N_Prior_Births × Tertiary Education	0.99***
	(0.38)
N_Prior_Births × M_Age	0.018*
	(0.0094)
Intended_Pregnancy × N_Prior_Births	-0.19
	(0.15)
Svy_Weights	0.013**
	(0.0053)
Constant	1.13*
	(0.65)
Observations	1789
Pseudo R^2	0.226
AIC	73852.8

Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B7: Robustness Tests - Outcomes

	(1) IPW Match	(2) IPW Overlap
Behavioral Problems		
CBCL Int	0.003	-0.019
	(0.025)	(0.026)
CBCL Ext	-0.018	-0.031
	(0.020)	(0.021)
CBCL Tot	-0.007	-0.023
Developmental Delays		
	(0.021)	(0.022)
ASQ Comm	0.007	-0.012
	(0.039)	(0.036)
ASQ Gross M	-0.077***	-0.085***
	(0.023)	(0.025)
ASQ Fine M	-0.113***	-0.130***
	(0.025)	(0.027)
ASQ Prob Sol	-0.046	-0.072**
	(0.034)	(0.031)
ASQ Social	-0.052	-0.064*
	(0.032)	(0.035)
ASQ Tot	-0.281***	-0.362***
	(0.106)	(0.124)
Observations	1686	1651

Notes: Definitions of each variable are provided in Table B4.
Robust standard errors are reported in brackets.
In column (1) I restrict the sample to only the observations that were matched in the Probabilistic Record Linkage stage with a probability higher than 0.8 (hence dropping 103 observations) and in column (3) I consider only observations which suffice the common support assumption (hence dropping 138 observations).
Note that the number of observations for each row may vary as there are some missing values for some dependent variables (as highlighted in previous tables.) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B8: Robustness Tests - Possible Mechanisms

	(1) IPW Match	(2) Obs (1)	(3) IPW Overlap	(4) Obs (3)
Births After Child	-0.043**	1704	-0.061***	1674
	(0.021)		(0.024)	
Lives Father	-0.315***	1713	-0.367***	1680
	(0.099)		(0.118)	
Shared Raise	0.008	1332	-0.034	1297
	(0.072)		(0.065)	
Conflict Couple	-0.076**	1334	-0.080**	1299
	(0.036)		(0.034)	
Hours Care Mother	0.075***	1682	0.074***	1651
	(0.024)		(0.022)	
Care Center	0.082	1712	0.115	1682
	(0.087)		(0.100)	
Months Care Center	-2.172***	906	-2.091***	874
	(0.767)		(0.651)	

Notes: Definitions of each variable are provided in Table B4.
Robust standard errors are reported in brackets. In column (1) I restrict the sample to only the observations that were matched in the Probabilistic Record Linkage stage with a probability higher than 0.8 (hence dropping 103 observations) and in column (3) I consider only observations which suffice the common support assumption (hence dropping 138 observations). The initial number of observations for column (1) is 1718 and for column (2) 1683. Note that the number of observations for each row may vary as there are some missing values for some dependent variables (as highlighted in previous tables). Columns (2) and (4)) show the number of observations for each regression of column (1) and (3), respectively.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B9: Mean difference between treated and non treated after IPW Linear adjustment

Variable	Mean-Treated (With Implant)	Mean-Comparison (Without Implant)	Difference	P-Value
Newborn				
Male	0.590	0.521	0.069	0.339
Age Months	30.316	28.278	2.038	0.613
Weight Birth	3331.680	3299.004	32.677	0.496
Disability	0.012	0.018	-0.005	0.471
Intended Pregnancy	0.629	0.623	0.006	0.929
Lives Father Birth	0.382	0.508	-0.126	0.073
Mother				
Montevideo	0.324	0.453	-0.129	0.061
Inc Tertile 1	0.343	0.310	0.033	0.595
Inc Tertile 2	0.336	0.340	-0.003	0.960
Inc Tertile 3	0.321	0.350	-0.030	0.777
Primary Education	0.145	0.119	0.026	0.436
Secondary Education	0.631	0.613	0.018	0.849
Tertiary Education	0.224	0.269	-0.044	0.695
M Age	29.305	30.220	-0.915	0.508
N Prior Births	0.890	0.783	0.107	0.544
Tobacco Birth	0.175	0.116	0.058	0.163
Observations	197	1624		

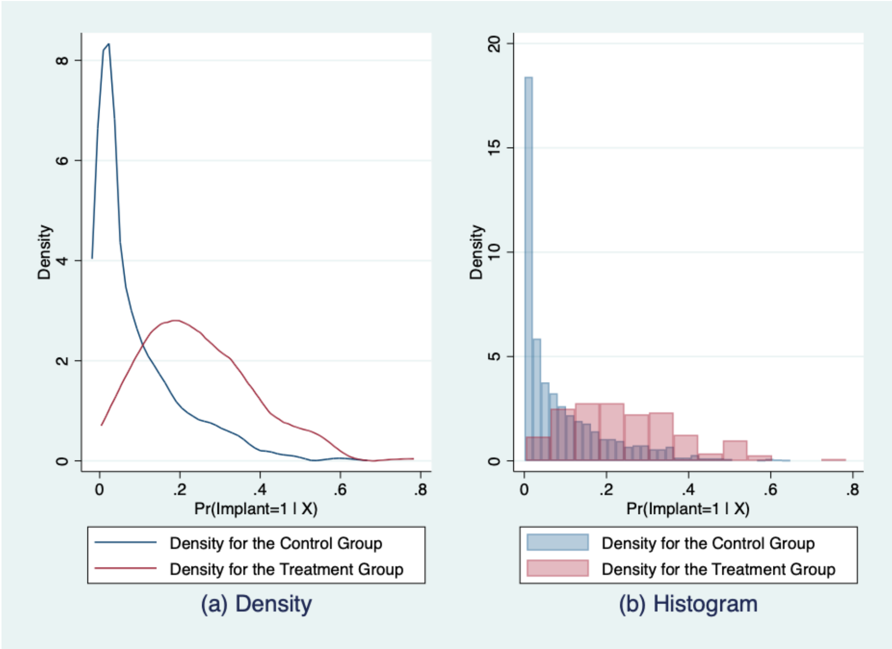
Notes: Definitions of each variable are provided in Table B3.

Table B10: Matching regression coefficients - Implant Insertion (IPW Linear)

	Logit
Male	0.060
	(0.18)
Age_Months	0.0051
	(0.0058)
Weight_Birth	-0.000032
	(0.00016)
Disability	0.46
	(0.52)
Intended_Pregnancy	-0.24
	(0.18)
Lives_Father_Birth	-0.63***
	(0.19)
Montevideo	0.092
	(0.19)
Inc. Tertile 2	-0.16
	(0.20)
Inc. Tertile 3	-1.02***
	(0.38)
Secondary Education	-0.68***
	(0.23)
Tertiary Education	-1.54***
	(0.50)
M_Age	-0.13***
	(0.021)
N_Prior_Births	0.26***
	(0.10)
Tobacco_Birth	0.60***
	(0.22)
Svy_Weights	0.014***
	(0.0050)
Constant	1.10
	(0.86)
Observations	1789
Pseudo R^2	0.212
AIC	75116.3

Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure B2: Kernel and histogram density estimations of the propensity score - IPW Linear



Note: Kernel-density estimation details: Bandwith=0.0192, Kernel=Epanechnikov.

4 COVID-19 VACCINE UPTAKE

THE ROLE OF CIVIC CAPITAL TO OVERCOME THE FREE RIDER PROBLEM.

4.1 INTRODUCTION

The proportion of the population that agreed to be vaccinated against Covid-19 varies greatly from country to country. At the time of writing this article[1], the European continent offers a concrete example of these sharp differences. While in Portugal 91% of the population has already received the full vaccination schedule, this figure is only 30% for the case of Bulgaria. These contrasts at the national level may reflect problems in vaccination campaign roll-outs, people's perception regarding the safety of different vaccines, or even cultural and historical traits (D'Alessandro et al., 2012; Vu, 2021).

Nevertheless, when one compares vaccination rates across regions within a country, the previous factors are presumably less likely to be the main reasons behind the observed divergence.

These territorial differences in vaccination rates are the result of the interplay of several factors such as indirect measures of civic capital (Guiso, Sapienza, and Zingales, 2011a) and/or different social norms driving the equilibria of public good games. On the one hand, as noted by Agranov, Elliott, and Ortoleva, 2021, as more individuals get vaccinated, the social pressure to do it increases. On the other hand, individuals will have greater incentives to free ride as a larger share of the population is already vaccinated (Hershey et al., 1994).

The existing literature on vaccine uptake (Brewer et al., 2017) has emphasised the importance of measures such as the sense of belonging to the community, trust in authorities and health institutions, as well as social processes that in general are expected to differ at the local level. Several investigations (see Larson et al., 2014 for a review) indicate that vaccination behaviours are mainly determined by social norms and by the willingness to protects others by one's own vaccination (i.e. collective responsibility, Betsch et al., 2018). The positive effect of altruism is, however, counterbalanced in the Nash equilibria of public good games by the incentive to free ride as a larger share of the population is already vaccinated. More efficient equilibria may be attained if social norms are present and social pressure is exerted by other members of the community (Agranov, Elliott, and Ortoleva, 2021) or if agents cooperate and/or internalize positive externalities of getting vaccinated (Cooter, 2000). De Donder et al., 2021 finds that vaccination decisions are more coherent with a Kantian concept of equilibrium - based on individual preferences on the action that

1 March, 2022

agents would like others to take - than with the Nash type of equilibrium characterized by free riding.

In most of the analyses of vaccination acceptance, social norms and social ties are typically elicited though surveys and/or experiments (Brewer et al., 2017) and the geographical location of respondents refer to aggregate regions. Similarly, investigations on the role of social capital on social distancing (Barrios et al., 2021; Ding et al., 2020; Durante, Guiso, and Gulino, 2021) and on the reduction of fatalities (Borgonovi and Andrieu, 2020) have relied on real data at an aggregate level higher than municipalities. These studies employ several indirect measures of civic capital such as blood donation, trust in others, trust in institutions and civic engagement (e.g. electoral turnout and census responses). Each of these aspects may have a distinct role on individuals' vaccination behaviour: the effect of measures more closely linked to altruism may not be related to the role of social norms or to the Kantian concept of equilibrium (De Donder et al., 2021) and can coexist with the negative effect induced by free-riding (Hershey et al., 1994).

In this brief chapter we use data on real decision-making to predict the differences in vaccination rates between local communities and to distinguish the impact of distinct civic capital proxies at the municipality level.

4.2 DATA AND RESULTS

We employ official Covid-19 vaccination data from the Italian region of Lombardy, which is the most populous and productive region of the country. Likewise, it was also the first Italian region to experience a Covid-19 outbreak, and the one most affected in terms of cases and deaths.

As Mohan et al., 2004 points out, most studies analyzing civic capital use large spatial units, which fail to capture the real context of the communities where individuals live. Our analysis addresses this issue by using data from the 1,506 Lombard municipalities (i.e. *comuni*), which are one level of aggregation below NUTS 3. Moreover, we consider data on certain variables frequently used in the literature as proxies for civic capital. Following Bracco, De Paola, and Green, 2015, the share of non-delinquency associated with the national TV tax is deemed as a reasonable approximation to civic capital since, even if its payment was compulsory, its enforcement was considered practically non-existent. Therefore, payment of this service may reflect certain values related to community ties rather than the fear of being caught and fined and can be interpreted as a proxy of the willingness to contribute to a public good.

We also consider the proportion of the population that agreed to donate organs, which is associated with the level of civic capital (Ladin et al., 2015). In the literature, organ donation is considered both as collective action and civic engagement (i.e. like electoral behaviour) (Healy, 2004) and as an expression of pro-social behaviour (Merz, Hurk, and De Kort, 2017). As noted by Sharp and Randhawa, 2012, organ donation can be seen as a gift induced by sheer altruism, as opposed to other forms of prosocial behaviours that rely on reciprocity.

Lastly, we also include the December 2016 national referendum voter turnout and the average electoral turnout of the three most recent referenda before the Covid-19 pandemic as proxies for cooperation and political participation (Guiso and Pinotti, 2013).

Table 13: Summary statistics

Variable	Mean	Std. Dev.	25^{th} p.	75^{th} p.	Min.	Max.	N
Vax_share	0.821	0.044	0.802	0.845	0.184	1.043	1506
Tv licence share	0.288	0.035	0.267	0.310	0.057	0.435	1475
Elect. turnout	0.744	0.04	0.722	0.77	0.541	0.917	1496
Avg. Elect. turnout	0.525	0.039	0.503	0.55	0.32	0.707	1488
Organ donors share	0.757	0.123	0.682	0.846	0.23	1	1359
Unemployment	0.083	0.028	0.066	0.093	0	0.239	1506
Density	0.570	0.811	0.096	0.746	0.002	7.743	1506
Higher education	0.463	0.061	0.424	0.505	0.112	0.703	1501
Excess mortality	0.208	0.411	-0.038	0.41	-1	3.375	1506
Income per capita	20.533	3.158	18.695	22.387	6.243	45.22	1506

Table 13 provides important information about the data set. Firstly, it exhibits the ample range of Covid-19 vaccination uptake across Lombard municipalities.[2] They go from very low levels (18%) to slightly above 100%.[3] Figure 13 displays the vaccination shares across Lombard municipalities and allows to localize areas with high and low uptake.

Secondly, the three proxies of civic capital used also show considerable differences across spatial units. After removing missing values in Tv licence share, Elect. turnout and Organ donors share (31, 10 and 147, respectively), we retain 1,328 municipalities in the sample.

To control for factors that may affect vaccination decisions at the municipality level, we include unemployment rates, population density, higher education shares, excess mortality (compared to the 2015-2019 average) and income per capita.

The cross-correlations and principal component analysis shown in Tables C2 and C3 indicate that the three variables of interest capture different aspects of civic capital. In particular, since in Italy being an organ donor is a private decision, it can be seen as an expression of altruism (Sharp and Randhawa, 2012). The non-delinquency share of the national TV tax may capture the willingness to contribute to a public good, and participation in elections can be interpreted as a measure of civic engagement.

2 As highlighted by Durante, Guiso, and Gulino, 2021; Guiso, Sapienza, and Zingales, 2011b, Italian regions offer a good case for this analysis as they exhibit large civic capital variation across provinces.

3 The only two municipalities with a vaccination uptake above 100% are Dizzasco and Cingia de' Botti, which vaccinated 628 and 1,149 individuals, respectively (compared to their 2020 residents; 602 and 1,147.)

Figure 13: Vaccination share in Lombardy

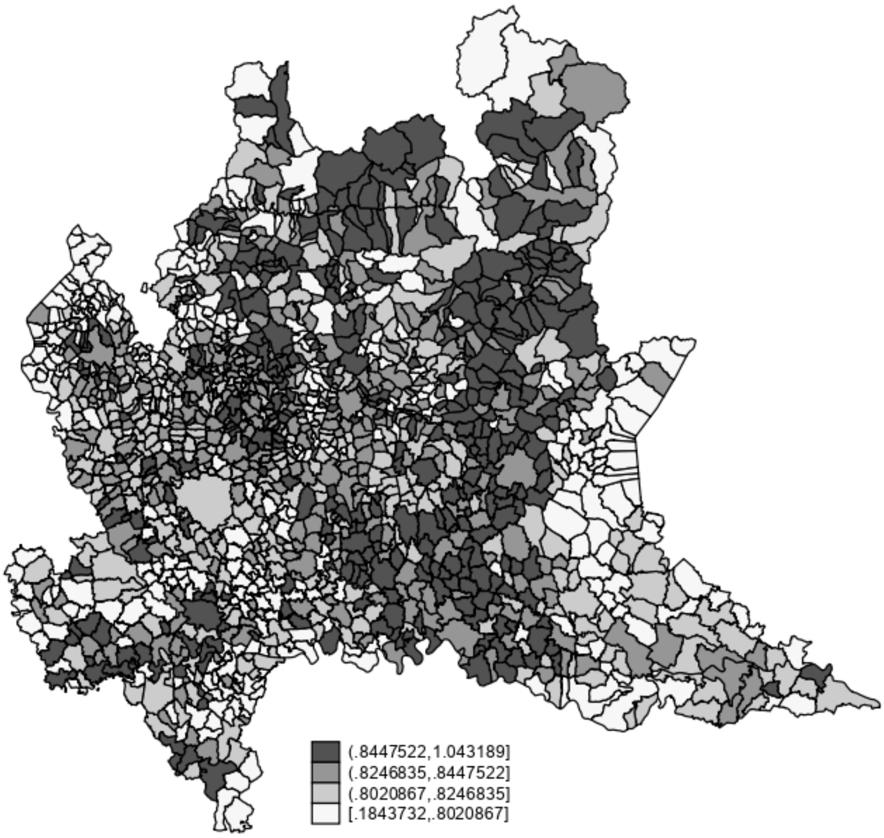


Figure 13 depicts vaccination share quartiles across Lombard municipalities and allows to locate areas with high and low uptake. Results presented in Table 14 show that communities with higher civic capital were able to vaccinate a larger proportion of their population. A one percentage point (p.p.) increase in the share of organ donors and in the share of television licences is associated with an increase of 0.031 and 0.201 p.p. in the vaccination uptake, respectively. The non-delinquency share of the national TV tax is the main aspect of civic capital that leads to high vaccination shares. These results are in line with the study by Basili, Muscillo, and Pin, 2022 indicating that anti-vaxxers contribute less to public good games. The two measures of political participation, on the contrary, are not significant and do not seem to be associated with higher vaccination shares. The results of columns 7 and 8 indicate that grouping these regressors into a single variable delivers a worse goodness of fit than if they are included separately.

As for the introduced controls, only unemployment and excess mortality rates turn out to be statistically significant. Interestingly, the coefficient and sign associated to the Higher Education variable suggest that, conditional on all other covariates, civic capital is more important than human capital for the vaccination decision. Results hold if municipality-level controls are not included (Table C5).

4.3 CONCLUSION

The findings presented in this chapter, supported by two other similar studies conducted later for Lombardy (Buonanno, Galletta, and Puca, 2023) and Italy (Montresor and Schiavon, 2024), confirm that civic capital may represent a key element in overcoming the free rider problem in the provision of a public good, in this case high vaccination coverage. In particular, the empirical results indicate that information on local communities regarding pro-social behaviours (such as altruism) and willingness to contribute for the provision of a public good can be used to identify areas that should be specifically targeted by vaccination campaigns.

Table 14: Main regressions - with municipality level controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Vax_share	Vax_share	Vax_share	Vax_share	Vax_share	Vax_share	Vax_share	Vax_share
Tv licence share	0.185***				0.201***	0.192***		
	(0.0306)				(0.0375)	(0.0369)		
Elect. turnout		0.0575			0.0563			
		(0.0491)			(0.0602)			
Avg. Elect. turnout			-0.00420			0.0122		
			(0.0618)			(0.0737)		
Organ donors share				0.0273*	0.0309**	0.0317**		
				(0.0124)	(0.0106)	(0.0106)		
PCA							-0.00120	
							(0.00130)	
PCA*								-0.000946
								(0.00130)
Unemployment	-0.589***	-0.545***	-0.567***	-0.607***	-0.601***	-0.624***	-0.639***	-0.631***
	(0.0787)	(0.0732)	(0.0713)	(0.0785)	(0.0875)	(0.0852)	(0.0951)	(0.0906)
Density	0.00144	0.00205	0.00210	0.00296	0.00221	0.00231	0.00247	0.00249
	(0.00188)	(0.00180)	(0.00182)	(0.00194)	(0.00173)	(0.00181)	(0.00197)	(0.00193)
Higher education	-0.109	-0.0805	-0.0806	-0.0853	-0.122*	-0.122*	-0.0746	-0.0726
	(0.0648)	(0.0735)	(0.0708)	(0.0707)	(0.0675)	(0.0669)	(0.0688)	(0.0716)
Excess mortality	0.00483*	0.00533*	0.00511*	0.00551**	0.00523**	0.00506**	0.00502*	0.00509*
	(0.00261)	(0.00266)	(0.00267)	(0.00246)	(0.00237)	(0.00229)	(0.00245)	(0.00241)
Income per capita	0.00203	0.00164	0.00188	0.00135	0.00136	0.00151	0.00130	0.00126
	(0.00127)	(0.00126)	(0.00124)	(0.00113)	(0.00117)	(0.00110)	(0.00115)	(0.00118)
Constant	0.824***	0.825***	0.866***	0.860***	0.774***	0.811***	0.880***	0.879***
	(0.0224)	(0.0274)	(0.0314)	(0.0217)	(0.0348)	(0.0263)	(0.0215)	(0.0220)
Observations	1470	1491	1483	1357	1327	1327	1327	1327
R^2	0.203	0.189	0.184	0.213	0.232	0.230	0.205	0.205
Adjusted R^2	0.200	0.186	0.181	0.209	0.228	0.226	0.202	0.201

Note: The number of observations varies across regressions according to the number of municipalities with missing information for each variable. PCA is the predicted value of the principal component analysis using the three main explanatory variables, while PCA* is the same but using Avg. Elect. turnout instead of Elect. turnout. Standard errors are clustered at province level and reported in brackets. *** significant at 1% or less; ** significant at 5%; * significant at 10%.

4.4 APPENDIX

Tables

Table C1: Definition of variables

Vax_share	Share of the population with a complete vaccination schedule at the municipality level.[a] Information updated until 27 January 2022. Source: Regione Lombardia - Open Data.
Tv licence share	Share of the population that payed the national TV tax at the municipality level. Average from 2006 to 2014. Source: ISTAT.
Elect. turnout	Share of electors that voted at the national referendum of December 2016 at the municipality level. Source: Ministero dell'Interno.
Avg. Elect. turnout	Average share of electors that voted at the national referenda of December 2016, April 2016 and June 2011 at the municipality level. Source: Ministero dell'Interno.
Organ donors share	Share of the population that agreed to donate their organs at the municipality level by 2019. Source: Centro Nazionale Trapianti.
Unemployment	Unemployment rate at the municipality level in 2019. Source: ISTAT.
Density	Population density at the municipality level (people per 1,000 sq. km. of land area). Source: 2011 Census.
Higher education	Share of the population over 6 years who completed a higher education degree at the municipality level (*laurea triennale, laurea magistrale* and *dottorato di ricerca*.) Source: 2011 Census.
Excess mortality	% variation of deaths of 2020 vs. 2015-2019 average at the municipality level. Yearly data from January to Novemeber. Source: ISTAT.
Income per capita	Income per capita at the municipality level in 2019 (expressed in thousands of euros). Source: ISTAT.

[a]It is calculated as the number of vaccinated residents by 27 January 2022 over the number of residents in 2020. For this reason, as in the case of the municipalities of Dizzasco and Cingia de' Botti, the share may exceed 100%.

Table C2: Cross-correlation table

Variables	Vax_share	Tv licence share	Elect. turnout	Avg. Elect. turnout	Organ donors share	Unemployment	Density	Higher education	Excess mortality
Vax_share	1.000								
Tv licence share	0.062	1.000							
Elect. turnout	0.224	-0.170	1.000						
Avg. Elect. turnout	0.115	-0.021	0.707	1.000					
Organ donors share	0.099	-0.090	0.113	0.063	1.000				
Unemployment	-0.416	0.155	-0.402	-0.208	-0.092	1.000			
Density	0.038	0.152	0.150	0.253	-0.062	0.058	1.000		
Higher education	-0.052	0.233	0.175	0.311	0.141	0.110	0.370	1.000	
Excess mortality	0.049	0.023	-0.005	0.049	-0.015	0.025	0.104	0.063	1.000
Income per capita	0.185	0.078	0.421	0.452	0.063	-0.289	0.442	0.627	0.069

Table C3: Principal Component Analysis - Municipality level

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.255	0.333	0.418	0.418
Comp2	0.922	0.098	0.307	0.725
Comp3	0.823	.	0.274	1.000
N				1,328
Overall Kaiser-Meyer-Olkin measure				0.546

The three variables included in the analysis are: TV licence share, Elect. turnout and Organ donors share.

Table C4 is included to show that the proportion of common variance among the three proxies for civic capital used in this paper is considerably higher when using data at the province level, in contrast to the results presented at the municipality level (Table C3). This result confirms the importance of using local-level-aggregated civic capital data.

Table C4: Principal Component Analysis - Province level

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.300	1.916	0.766	0.766
Comp2	0.383	0.67	0.127	0.894
Comp3	0.315	.	0.105	1.000
N				103
Overall Kaiser-Meyer-Olkin measure				0.727

The three variables included in the analysis are: TV licence share, Electoral turnout (in this case the referenda included are those from 1974 to 1999)and Organ donors share.

Table C5: Main regressions without controls

	(1)	(2)	(3)	(4)
	Vax_share	Vax_share	Vax_share	Vax_share
Tv licence share	0.0791*			0.116***
	(0.0431)			(0.0352)
Elect. turnout		0.251***		0.251***
		(0.0664)		(0.0703)
Organ donors share			0.0341**	0.0268**
			(0.0117)	(0.0108)
Constant	0.798***	0.634***	0.795***	0.581***
	(0.0112)	(0.0510)	(0.0111)	(0.0497)
Observations	1475	1496	1359	1328
R^2	0.004	0.050	0.010	0.062

The table shows regressions of municipality vaccination shares on three proxies of civic capital. The first three columns report the results of each of these variables as only explanatory variable, while the last one includes the three of them together. The number of observations varies across regressions according to the number of municipalities with missing information for each variable. Standard errors are adjusted for clustering at province level and reported in brackets. *** significant at 1% or less; ** significant at 5%; * significant at 10%.

BIBLIOGRAPHY

Abadie, Alberto and Matias D. Cattaneo (2018). "Econometric Methods for Program Evaluation." In: *Annual Review of Economics* 10.1, pp. 465–503. DOI: 10.1146/annurev-economics-080217-053402. eprint: https://doi.org/10.1146/annurev-economics-080217-053402. URL: https://doi.org/10.1146/annurev-economics-080217-053402.

Achenbach, Thomas and Leslie Rescorla (Jan. 2000). "Manual for the ASEBA Preschool forms profiles." In: *Burlington: University of Vermont, Research Center for Children, Youth Families*.

Agranov, Marina, Matt Elliott, and Pietro Ortoleva (2021). "The importance of Social Norms against Strategic Effects: The case of Covid-19 vaccine uptake." In: *Economics Letters* 206, p. 109979. ISSN: 0165-1765. DOI: https://doi.org/10.1016/j.econlet.2021.109979. URL: https://www.sciencedirect.com/science/article/pii/S0165176521002561.

Altfeld, Susan, Arden Handler, Dee Burton, and Leatrice Berman (Jan. 1998). "Wantedness of Pregnancy and Prenatal Health Behaviors." In: *Women & Health* 26.4, pp. 29–43. ISSN: 0363-0242. DOI: 10.1300/J013v26n04_03. URL: https://doi.org/10.1300/J013v26n04_03.

Ananat, Elizabeth Oltmans and Daniel M. Hungerman (Feb. 2012). "The Power of the Pill for the Next Generation: Oral Contraception's Effects on Fertility, Abortion, and Maternal and Child Characteristics." In: *The Review of Economics and Statistics* 94.1, pp. 37–51. ISSN: 0034-6535. DOI: 10.1162/REST_a_00230. eprint: https://direct.mit.edu/rest/article-pdf/94/1/37/1916882/rest_a_00230.pdf. URL: https://doi.org/10.1162/REST_a_00230.

Angrist, Joshua D. and Jörn-Steffen Pischke (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Economics Books 8769. Princeton University Press. URL: https://ideas.repec.org/b/pup/pbooks/8769.html.

Angrist, Joshua and William Evans (1998). "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size." In: *The American Economic Review* 88.3, pp. 450–477. ISSN: 00028282. URL: http://www.jstor.org/stable/116844.

Angrist, Joshua, Victor Lavy, and Analia Schlosser (2010). "Multiple Experiments for the Causal Link between the Quantity and Quality of Children." In: *Journal of Labor Economics* 28.4, pp. 773–824. ISSN: 0734306X, 15375307. URL: http://www.jstor.org/stable/10.1086/653830.

Anselmi, Luciana, Cesar Piccinini, Fernando Barros, and Rita de Sobreira Lopes (June 2004). "Psychosocial determinants of behaviour problems in Brazilian preschool children." In: *Journal of child psychology and psychiatry, and allied disciplines* 45, pp. 779–88. DOI: 10.1111/j.1469-7610.2004.00271.x.

Baicker, Katherine, Sendhil Mullainathan, and Joshua Schwartzstein (2015). "BEHAVIORAL HAZARD IN HEALTH INSURANCE." In: *The Quarterly Journal of Economics* 130.4, pp. 1623–1668. ISSN: 00335533, 15314650. URL: https://www.jstor.org/stable/26372636.

Bailey, Marth, Olga Malkova, and Zoe McLaren (Oct. 2019). "Does Access to Family Planning Increase Children's Opportunities?: Evidence from the War on Poverty and the Early Years of Title X." In: *Journal of Human Resources* 54, pp. 825–856. DOI: 10.3368/jhr.54.4.1216-8401R1.

Bailey, Martha J. (Feb. 2006). "More Power to the Pill: The Impact of Contraceptive Freedom on Women's Life Cycle Labor Supply*." In: *The Quarterly Journal of Economics* 121.1, pp. 289–320. ISSN: 0033-5533. DOI: 10.1093/qje/121.1.289. URL: https://doi.org/10.1093/qje/121.1.289.

Bailey, Martha J., Brad Hershbein, and Amalia R. Miller (July 2012). "The Opt-In Revolution? Contraception and the Gender Gap in Wages." en. In: *American Economic Journal: Applied Economics* 4.3, pp. 225–254. ISSN: 1945-7782. DOI: 10.1257/app.4.3.225. URL: https://www.aeaweb.org/articles?id=10.1257/app.4.3.225.

Bailey, Martha J, Vanessa Wanner Lang, Alexa Prettyman, Iris Vrioni, Lea J Bart, Daniel Eisenberg, Paula Fomby, Jennifer Barber, and Vanessa Dalton (2023). *How Costs Limit Contraceptive Use among Low-Income Women in the U.S.: A Randomized Control Trial*. Working Paper 31397. National Bureau of Economic Research. DOI: 10.3386/w31397. URL: http://www.nber.org/papers/w31397.

Bailey, Martha (Mar. 2013). "Fifty Years of Family Planning: New Evidence on the Long-Run Effects of Increasing Access to Contraception." In: *Brookings Papers on Economic Activity* Spring. DOI: 10.1353/eca.2013.0001.

Baker, D, S Keogh, G Luchsinger, et al. (2022). "Seeing the unseen: the case for action in the neglected crisis of unintended pregnancy." In: *State of World Population 2022*.

Barham, Tania et al. (2021). "Thirty-five years later: Long-term effects of the Matlab maternal and child health/family planning program on older women's well-being." In: *Proceedings of the National Academy of Sciences* 118.28, e2101160118. DOI: 10.1073/pnas.2101160118. eprint: https://www.pnas.org/doi/pdf/10.1073/pnas.2101160118. URL: https://www.pnas.org/doi/abs/10.1073/pnas.2101160118.

Barrios, John M., Efraim Benmelech, Yael V. Hochberg, Paola Sapienza, and Luigi Zingales (2021). "Civic capital and social distancing during the Covid-19 pandemic." In: *Journal of Public Economics* 193, p. 104310. ISSN: 0047-2727. DOI: https://doi.org/10.1016/j.jpubeco.2020.104310. URL: https://www.sciencedirect.com/science/article/pii/S0047272720301742.

Barro, Robert J. and Gary S. Becker (1989). "Fertility Choice in a Model of Economic Growth." In: *Econometrica* 57.2, pp. 481–501. ISSN: 00129682, 14680262. URL: http://www.jstor.org/stable/1912563.

Basili, Marcello, Alessio Muscillo, and Paolo Pin (Mar. 2022). "Anti-vaxxers are different in public good games." Mimeo. Università di Siena.

Becker, Gary S. (1960). "An Economic Analysis of Fertility." In: *Demographic and Economic Change in Developed Countries*. Columbia University Press, pp. 209–240. URL: http://www.nber.org/chapters/c2387.

— (1962). "Investment in Human Capital: A Theoretical Analysis." In: *Journal of Political Economy* 70.5, pp. 9–49. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/1829103.

— (1993). "Nobel Lecture: The Economic Way of Looking at Behavior." In: *Journal of Political Economy* 101.3, pp. 385–409. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/2138769.

Becker, Gary S. and H. Gregg Lewis (1973). "On the Interaction between the Quantity and Quality of Children." In: *Journal of Political Economy* 81.2, S279–S288. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/1840425.

Becker, Gary S. and Nigel Tomes (1976). "Child Endowments and the Quantity and Quality of Children." In: *Journal of Political Economy* 84.4, S143–S162. ISSN: 00223808, 1537534X. URL: http://www.jstor.org/stable/1831106.

Ben-Porath, Yoram (1967). "The Production of Human Capital and the Life Cycle of Earnings." In: *Journal of Political Economy* 75.4, Part 1, pp. 352–365. DOI: 10.1086/259291. eprint: https://doi.org/10.1086/259291. URL: https://doi.org/10.1086/259291.

Berlinski, Samuel and Norbert Schady. (2015). *The Early Years: Child Well-Being and the Role of Public Policy*. Springer Nature.

Betsch, Cornelia, Philipp Schmid, Dorothee Heinemeier, Lars Korn, Cindy Holtmann, and Robert Böhm (Dec. 2018). "Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination." In: *PLOS ONE* 13.12, pp. 1–32. DOI: 10.1371/journal.pone.0208601. URL: https://doi.org/10.1371/journal.pone.0208601.

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes (2005). "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." In: *The Quarterly Journal of Economics* 120.2, pp. 669–700. ISSN: 00335533, 15314650. URL: http://www.jstor.org/stable/25098749.

— (Feb. 2007). "From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes." In: *The Quarterly Journal of Economics* 122.1, pp. 409–439. ISSN: 0033-5533. DOI: 10.1162/qjec.122.1.409. eprint: https://academic.oup.com/qje/article-pdf/122/1/409/5426511/122-1-409.pdf. URL: https://doi.org/10.1162/qjec.122.1.409.

Bloom, Nicholas, Raffaella Sadun, and John Van Reenen (Nov. 2012). "The Organization of Firms Across Countries*." In: *The Quarterly Journal of Economics* 127.4, pp. 1663–1705. ISSN: 0033-5533. DOI: 10.1093/qje/qje029. eprint: https://academic.oup.com/qje/article-pdf/127/4/1663/30624099/qje029.pdf. URL: https://doi.org/10.1093/qje/qje029.

Borgonovi, Francesca and Elodie Andrieu (2020). "Bowling together by bowling alone: Social capital and COVID-19." In: *Social Science Medicine* 265, p. 113501. ISSN: 0277-9536. DOI: https://doi.org/10.1016/j.socscimed.2020.113501. URL: https://www.sciencedirect.com/science/article/pii/S0277953620307206.

Borusyak, Kirill, Xavier Jaravel, and Jann Spiess (Apr. 2022). *Revisiting Event Study Designs: Robust and Efficient Estimation*. en. SSRN Scholarly Paper. Rochester, NY. DOI: 10.2139/ssrn.2826228. URL: https://papers.ssrn.com/abstract=2826228.

Bracco, E., M. De Paola, and C.P. Green (2015). "Long lasting differences in civic capital: Evidence from a unique immigration event in Italy." In: *Journal of Economic Behavior & Organization* 120, pp. 160–173. ISSN: 0167-2681. DOI: https://doi.org/10.1016/j.jebo.2015.10.003. URL: https://www.sciencedirect.com/science/article/pii/S016726811500270X.

Brewer, Noel T, Gretchen B Chapman, Alexander J Rothman, Julie Leask, and Allison Kempe (2017). "Increasing vaccination: putting psychological science into action." In: *Psychological Science in the Public Interest* 18.3, pp. 149–207.

Brunet, Nicolás et al. (Dec. 2020). "Intencionalidad del embarazo y cuidados prenatales en Uruguay." es. In: *Revista Médica del Uruguay* 36.4, pp. 52–82. ISSN: 1688-0390. DOI: 10.29193/rmu.36.4.4. URL: http://www.scielo.edu.uy/scielo.php?script=sci_abstract&pid=S1688-03902020000400052&lng=es&nrm=iso&tlng=es.

Buonanno, Paolo, Sergio Galletta, and Marcello Puca (2023). "The role of civic capital on vaccination." In: *Health Economics* 32.5, pp. 993–999. DOI: https://doi.org/10.1002/hec.4662. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1002/hec.4662. URL: https://onlinelibrary.wiley.com/doi/abs/10.1002/hec.4662.

Cabella, W, M Nathan, and I Pardo (2019a). *La caída de la fecundidad en Uruguay entre 2015 y 2018*. Working Paper Series. UNFPA-MSP-UdelaR.

Cabella, Wanda, Mathías Nathan, and Ignacio Pardo (2019b). "La caída de la fecundidad en Uruguay entre 2015 y 2018." es. In: *Descenso acelerado de la fecundidad en Uruguay entre 2015 y 2018: tres estudios para su análisis*, pp. 35–70. URL: https://pesquisa.bvsalud.org/portal/resource/pt/biblio-1341933.

Cabella, Wanda and Cecilia Velázquez (2022). "Abortion Legalization in Uruguay: Effects on Adolescent Fertility." In: *Studies in Family Planning* 53.3, pp. 491–514. DOI: https://doi.org/10.1111/sifp.12204. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/sifp.12204. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/sifp.12204.

Callaway, Brantly and Pedro H. C. Sant'Anna (Dec. 2021). "Difference-in-Differences with multiple time periods." en. In: *Journal of Econometrics*. Themed Issue: Treatment Effect 1 225.2, pp. 200–230. ISSN: 0304-4076. DOI: 10.1016/j.jeconom.2020.12.001. URL: https://www.sciencedirect.com/science/article/pii/S0304407620303948.

Campbell, Frances, Gabriella Conti, James J Heckman, Seong Hyeok Moon, Rodrigo Pinto, and Elizabeth Pungello (Mar. 2014). "Early childhood investments substantially boost adult health." In: *Science* 343(6178), pp. 1478–85. DOI: 10.1126/science.1248429.

Carneiro, Pedro, Costas Meghir, and Matthias Parey (2013). "Maternal education, Home environments, and the Development of Children and Adolescents." In: *Journal of the European Economic Association* 11.s1, pp. 123–160. DOI: https://doi.org/10.1111/j.1542-4774.2012.01096.x. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1542-4774.2012.01096.x. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1542-4774.2012.01096.x.

Cavalcanti, Tiago, Georgi Kocharkov, and Cezar Santos (June 2020). "Family Planning and Development: Aggregate Effects of Contraceptive Use." In: *The Economic Journal* 131.634, pp. 624–657. ISSN: 0013-0133. DOI: 10.1093/ej/ueaa070. eprint: https://academic.oup.com/ej/article-pdf/131/634/624/36443351/ueaa070.pdf. URL: https://doi.org/10.1093/ej/ueaa070.

Chaisemartin, Clément de and Xavier D'Haultfœuille (Sept. 2020). "Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects." en. In: *American Economic Review* 110.9, pp. 2964–2996. ISSN: 0002-8282. DOI: 10.1257/aer.20181169. URL: https://www.aeaweb.org/articles?id=10.1257/aer.20181169.

Cooter, Robert (Jan. 2000). "Three Effects of Social Norms on Law: Expression, Deterrence, and Internalization." In: *Oregon Law Rev.* 79.

Currie, Janet and Douglas Almond (2011). "Chapter 15 - Human capital development before age five." In: ed. by David Card and Orley Ashenfelter. Vol. 4. Handbook of Labor Economics. Elsevier, pp. 1315–1486. DOI: https://doi.org/10.1016/S0169-7218(11)02413-0. URL: https://www.sciencedirect.com/science/article/pii/S0169721811024130.

D'Alessandro, Eugénie, Dominique Hubert, Odile Launay, Laurence Bassinet, Olivier Lortholary, Yannick Jaffre, and Isabelle Sermet-Gaudelus (2012). "Determinants of Refusal of A/H1N1 Pandemic Vaccination in a High Risk Population: A Qualitative Approach." In: *PLoS ONE* 7.4, e31054. DOI: 10.1371/journal.pone.0034054. URL: https://hal.archives-ouvertes.fr/hal-01415075.

De Donder, Philippe, Humberto Llavador, Stefan Penczynski, John E. Roemer, and Roberto Vélez (Dec. 2021). *A game-theoretic analysis of childhood vaccination behavior: Nash versus Kant*. Economics Working Papers 1808. Department of Economics and Business, Universitat Pompeu Fabra. URL: https://ideas.repec.org/p/upf/upfgen/1808.html.

Dean, Josua and Seema Jayachandran (2020). *Attending kindergarten improves cognitive development in India, but all kindergartens are not equal*. Working Paper.

Dehlendorf, Christine, Maria Isabel Rodriguez, Kira Levy, Sonya Borrero, and Jody Steinauer (Mar. 2010). "Disparities in family planning." English (US). In: *American Journal of Obstetrics and Gyne-

cology 202.3, pp. 214–220. ISSN: 0002-9378. DOI: 10.1016/j.ajog.2009.08.022.

Del Bono, Emilia, Marco Francesconi, Yvonne Kelly, and Amanda Sacker (2016). "Early Maternal Time Investment and Early Child Outcomes." In: *The Economic Journal* 126.596, F96–F135. DOI: https://doi.org/10.1111/ecoj.12342. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/ecoj.12342. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/ecoj.12342.

Ding, Wenzhi, Ross Levine, Chen Lin, and Wensi Xie (2020). *Social Distancing and Social Capital: Why U.S. Counties Respond Differently to COVID-19*. Working Paper 27393. National Bureau of Economic Research. DOI: 10.3386/w27393. URL: http://www.nber.org/papers/w27393.

Doepke, Matthias (2015). "Gary Becker on the Quantity and Quality of Children." In: *Journal of Demographic Economics* 81.1, 59–66. DOI: 10.1017/dem.2014.8.

Doepke, Matthias, Anne Hannusch, Fabian Kindermann, and Michèle Tertilt (2022). *The Economics of Fertility: A New Era*. Working Paper 29948. National Bureau of Economic Research. DOI: 10.3386/w29948. URL: http://www.nber.org/papers/w29948.

Dong, Nianbo, Elizabeth A. Stuart, David Lenis, and Trang Quynh Nguyen (2020). "Using Propensity Score Analysis of Survey Data to Estimate Population Average Treatment Effects: A Case Study Comparing Different Methods." In: *Evaluation Review* 44.1. PMID: 32672113, pp. 84–108. DOI: 10.1177/0193841X20938497. eprint: https://doi.org/10.1177/0193841X20938497. URL: https://doi.org/10.1177/0193841X20938497.

Dugoff, Eva, Megan Schuler, and Elizabeth Stuart (July 2013). "Generalizing Observational Study Results: Applying Propensity Score Methods to Complex Surveys." In: *Health services research* 49. DOI: 10.1111/1475-6773.12090.

Durante, Ruben, Luigi Guiso, and Giorgio Gulino (2021). "Asocial capital: Civic culture and social distancing during COVID-19." In: *Journal of Public Economics* 194, p. 104342. ISSN: 0047-2727. DOI: https://doi.org/10.1016/j.jpubeco.2020.104342. URL: https://www.sciencedirect.com/science/article/pii/S0047272720302061.

Eggleston, Elizabeth, Amy Tsui, and Milton Kotelchuck (June 2001). "Unintended pregnancy and low birthweight in Ecuador." In: *American Journal of Public Health* 91, pp. 808–10. DOI: 10.2105/AJPH.91.5.808.

Elango, Sneha, Jorge Luis García, James Heckman, and Andrés Hojman (2015). *Early Childhood Education*. Working Paper 21766. National Bureau of Economic Research. DOI: 10.3386/w21766. URL: http://www.nber.org/papers/w21766.

Finer, Lawrence B. and Mia R. Zolna (2016). "Declines in Unintended Pregnancy in the United States, 2008–2011." In: *New England Journal of Medicine* 374.9. PMID: 26962904, pp. 843–852. DOI: 10.1056/NEJMsa1506575. eprint: https://doi.org/10.1056/NEJMsa1506575. URL: https://doi.org/10.1056/NEJMsa1506575.

Foster, Diana Greene, Sarah E. Raifman, Jessica D. Gipson, Corinne H. Rocca, and M. Antonia Biggs (2019). "Effects of Carrying an Unwanted Pregnancy to Term on Women's Existing Children." In: *The Journal of Pediatrics* 205, 183–189.e1. ISSN: 0022-3476. DOI: https://doi.org/10.1016/j.jpeds.2018.09.026. URL: https://www.sciencedirect.com/science/article/pii/S0022347618312976.

Francesconi, Marco and James Heckman (Dec. 2016). "Child Development and Parental Investment: Introduction." In: *The Economic Journal* 126.596, F1–F27. ISSN: 0013-0133. DOI: 10.1111/ecoj.12388. eprint: https://academic.oup.com/ej/article-pdf/126/596/F1/26375915/ej00f1.pdf. URL: https://doi.org/10.1111/ecoj.12388.

Gallen, Yana, Juanna Schrøter Joensen, Eva Rye Johansen, and Gregory F Veramendi (2023). "The Labor Market Returns to Delaying Pregnancy." In: *Available at SSRN 4554407*.

Galor, Oded and David N. Weil (2000). "Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond." In: *American Economic Review* 90.4, pp. 806–828. DOI: 10.1257/aer.90.4.806. URL: https://www.aeaweb.org/articles?id=10.1257/aer.90.4.806.

García, Jorge Luis, James Heckman, Duncan Ermini Leaf, and María José Prados (2020). "Quantifying the Life-Cycle Benefits of an Influential Early-Childhood Program." In: *Journal of Political Economy* 128.7, pp. 2502–2541. DOI: 10.1086/705718. eprint: https://doi.org/10.1086/705718. URL: https://doi.org/10.1086/705718.

Goldin, Claudia (May 2006). "The Quiet Revolution That Transformed Women's Employment, Education, and Family." en. In: *American Economic Review* 96.2, pp. 1–21. ISSN: 0002-8282. DOI: 10.1257/000282806777212350. URL: https://www.aeaweb.org/articles?id=10.1257/000282806777212350.

— (2016). "Human Capital." In: *Handbook of Cliometrics*. Heidelberg, Germany: Springer Verlag.

Goldin, Claudia and Lawrence F. Katz (Aug. 2002). "The Power of the Pill: Oral Contraceptives and Womens Career and Marriage Decisions." In: *Journal of Political Economy* 110.4, pp. 730–770. ISSN: 0022-3808. DOI: 10.1086/340778. URL: https://www.journals.uchicago.edu/doi/full/10.1086/340778.

Goodman-Bacon, Andrew (Dec. 2021). "Difference-in-differences with variation in treatment timing." en. In: *Journal of Econometrics*. Themed Issue: Treatment Effect 1 225.2, pp. 254–277. ISSN: 0304-4076. DOI: 10.1016/j.jeconom.2021.03.014. URL: https://www.sciencedirect.com/science/article/pii/S0304407621001445.

Guiso, Luigi and Paolo Pinotti (2013). "Democratization and Civic Capital." In: *The Oxford Handbook of the Italian Economy Since Unification*. Ed. by Gianni Toniolo. Oxford Handbooks.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales (2004). "The Role of Social Capital in Financial Development." In: *The American Economic Review* 94.3, pp. 526–556. ISSN: 00028282. URL: http://www.jstor.org/stable/3592941.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales (2011a). "Civic capital as the missing link." In: *Handbook of social economics* 1, pp. 417–480.

— (2011b). "Civic capital as the missing link." In: *Handbook of social economics* 1, pp. 417–480.

Gómez, Gabriel, Leandro Pereira, Daniel Zoppis, Maria Thove, and Maria Rodríguez (2018). *Panorama de la Educación en Primera Infancia e Inicial 2018*. Working Paper Series. MEC - División de Investigación y Estadística.

Healy, Kieran (2004). "Altruism as an organizational problem: The case of organ procurement." In: *American Sociological Review* 69.3, pp. 387–404.

Heckman, James (2007). "The economics, technology, and neuroscience of human capability formation." In: *Proceedings of the National Academy of Sciences* 104.33, pp. 13250–13255. DOI: 10.1073/pnas.0701362104. eprint: https://www.pnas.org/doi/pdf/10.1073/pnas.0701362104. URL: https://www.pnas.org/doi/abs/10.1073/pnas.0701362104.

— (2008). "Schools, Skills, and Synapses." In: *Economic Inquiry* 46.3, pp. 289–324. URL: https://EconPapers.repec.org/RePEc:bla:ecinqu:v:46:y:2008:i:3:p:289-324.

Heckman, James, Rodrigo Pinto, and Peter Savelyev (2013). "Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes." In: *American Economic Review* 103.6, pp. 2052–86. DOI: 10.1257/aer.103.6.2052. URL: https://www.aeaweb.org/articles?id=10.1257/aer.103.6.2052.

Heckman, James, Jora Stixrud, and Sergio Urzua (July 2006). "The Effects of Cognitive and Non-Cognitive Abilities on Labor Market Outcomes and Social Behavior." In: *Journal of Labor Economics* 24, pp. 411–482. DOI: 10.1086/504455.

Hershey, John C, David A Asch, Thi Thumasathit, Jacqueline Meszaros, and Victor V Waters (1994). "The roles of altruism, free riding, and bandwagoning in vaccination decisions." In: *Organizational behavior and human decision processes* 59.2, pp. 177–187.

Hirano, Keisuke, Guido Imbens, and Geert Ridder (Feb. 2003). "Efficient Estimation of Average Treatment Effects Using the Estimated Propensity Score." In: *Econometrica* 71, pp. 1161–1189. DOI: 10.1111/1468-0262.00442.

Hock, Heinrich (Oct. 2007). *The Pill and the College Attainment of American Women and Men*. Working Papers 10_01. Department of Economics, Florida State University. URL: https://ideas.repec.org/p/fsu/wpaper/wp2007_10_01.html.

Horvitz, D. G. and D. J. Thompson (1952). "A Generalization of Sampling Without Replacement From a Finite Universe." In: *Journal of the American Statistical Association* 47.260, pp. 663–685. ISSN: 01621459. URL: http://www.jstor.org/stable/2280784.

Imbens, Guido W. (2015). "Matching Methods in Practice: Three Examples." In: *The Journal of Human Resources* 50.2, pp. 373–419. ISSN: 0022166X. URL: http://www.jstor.org/stable/24735990.

Juhn, Chinhui, Yona Rubinstein, and C. Andrew Zuppann (Dec. 2015). *The Quantity-Quality Trade-off and the Formation of Cognitive and Non-cognitive Skills*. NBER Working Papers 21824. National Bureau of Economic Research, Inc. URL: https://ideas.repec.org/p/nbr/nberwo/21824.html.

Kelly, Andrea, Jason M. Lindo, and Analisa Packham (Dec. 2020). "The power of the IUD: Effects of expanding access to contraception through Title X clinics." en. In: *Journal of Public Economics* 192, p. 104288. ISSN: 0047-2727. DOI: 10.1016/j.jpubeco.2020.104288. URL: https://www.sciencedirect.com/science/article/pii/S0047272720301523.

King, Gary and Richard Nielsen (2019). "Why Propensity Scores Should Not Be Used for Matching." In: *Political Analysis* 27.4, pp. 435–454. URL: https://doi.org/10.1017/pan.2019.11.

Klemp, Marc and Jacob Weisdorf (Feb. 2018). "Fecundity, Fertility and The Formation of Human Capital." In: *The Economic Journal* 129.618, pp. 925–960. ISSN: 0013-0133. DOI: 10.1111/ecoj.12589. eprint: https://academic.oup.com/ej/article-pdf/129/618/925/28846312/ecoj12589.pdf. URL: https://doi.org/10.1111/ecoj.12589.

Knack, Stephen and Philip Keefer (1997). "Does Social Capital Have an Economic Payoff? A Cross-Country Investigation." In: *The Quarterly Journal of Economics* 112.4, pp. 1251–1288. ISSN: 00335533, 15314650. URL: http://www.jstor.org/stable/2951271.

Knudsen, Eric, James Heckman, Judy Cameron, and Jack Shonkoff (July 2006). "Economic, neurobiological, and behavioral perspectives on building America's future workforce." In: *Proceedings of the National Academy of Sciences* 103.27, pp. 10155–10162.

Kost, Kathryn and Laura Lindberg (Jan. 2015). "Pregnancy Intentions, Maternal Behaviors, and Infant Health: Investigating Relationships With New Measures and Propensity Score Analysis." In: *Demography* 52. DOI: 10.1007/s13524-014-0359-9.

Ladin, K, R Wang, A Fleishman, M Boger, and J R Rodrigue (2015). "Does Social Capital Explain Community-Level Differences in Organ Donor Designation?" In: *Milbank Quarterly* 93, p. 609.

Larson, Charles P (Oct. 2007). "Poverty during pregnancy: Its effects on child health outcomes." In: *Paediatrics & Child Health* 12.8, pp. 673–677. ISSN: 1205-7088. DOI: 10.1093/pch/12.8.673. URL: https://doi.org/10.1093/pch/12.8.673.

Larson, Heidi J., Caitlin Jarrett, Elisabeth Eckersberger, David M.D. Smith, and Pauline Paterson (2014). "Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012." In: *Vaccine* 32.19, pp. 2150–2159. ISSN: 0264-410X. DOI: https://doi.org/10.1016/j.vaccine.2014.01.081. URL: https://www.sciencedirect.com/science/article/pii/S0264410X14001443.

Li, Li and Haoming Liu (Dec. 2022). *The quantity–quality fertility–education trade-off*. IZA World of Labor 143. IZA. DOI: 10.15185/izawol.143.v2.

Lindo, Jason M. and Analisa Packham (Aug. 2017). "How Much Can Expanding Access to Long-Acting Reversible Contraceptives Reduce Teen Birth Rates?" en. In: *American Economic Journal: Economic Policy* 9.3, pp. 348–376. ISSN: 1945-7731. DOI: 10.1257/pol.20160039. URL: https://www.aeaweb.org/articles?id=10.1257/pol.20160039.

López Gómez, A, N Pascoll, C Farías, and R Micol (2016). *Estudio sobre experiencias de uso de implantes anticonceptivos subdérmicos desde la perspectiva de profesionales y mujeres usuarias de servicios públicos de salud en Uruguay*. Working Paper Series. MSP-ASSE-UNFPA.

Manser, Marilyn and Murray Brown (1980). "Marriage and Household Decision-Making: A Bargaining Analysis." In: *International Economic Review* 21.1, pp. 31–44. URL: https://EconPapers.repec.org/RePEc:ier:iecrev:v:21:y:1980:i:1:p:31-44.

Marie, Olivier and Esmée Zwiers (July 2022). *Religious Barriers to Birth Control Access*. CEPR Discussion Papers 17427. C.E.P.R. Discussion Papers. URL: https://ideas.repec.org/p/cpr/ceprdp/17427.html.

Mayol, Joaquín Paseyro and Tiziano Razzolini (2022). "Covid-19 vaccine uptake: the role of civic capital to overcome the free rider problem." In: *Applied Economics Letters* 0.0, pp. 1–7. DOI: 10.1080/13504851.2022.2146647.

McElroy, Marjorie B. and Mary Jean Horney (1981). "Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand." In: *International Economic Review* 22.2, pp. 333–349. ISSN: 00206598, 14682354. URL: http://www.jstor.org/stable/2526280.

Merz, Eva-Maria, Katja Van den Hurk, and Wim LAM De Kort (2017). "Organ donation registration and decision-making among current blood donors in the Netherlands." In: *Progress in Transplantation* 27.3, pp. 266–272.

Mestad, Renee, Gina Secura, Jenifer E. Allsworth, Tessa Madden, Qiuhong Zhao, and Jeffrey F. Peipert (2011). "Acceptance of long-acting reversible contraceptive methods by adolescent participants in the Contraceptive CHOICE Project." In: *Contraception* 84.5, pp. 493–498. ISSN: 0010-7824. DOI: https://doi.org/10.1016/j.contraception.2011.03.001. URL: https://www.sciencedirect.com/science/article/pii/S0010782411001016.

Miller, Grant (June 2010). "Contraception as Development? New Evidence from Family Planning in Colombia." In: *The Economic Journal* 120.545, pp. 709–736. ISSN: 0013-0133. DOI: 10.1111/j.1468-0297.2009.02306.x. URL: https://doi.org/10.1111/j.1468-0297.2009.02306.x.

Miller, Sarah, Laura R. Wherry, and Diana Greene Foster (2023). "The Economic Consequences of Being Denied an Abortion." In: *American Economic Journal: Economic Policy* 15.1, pp. 394–437. DOI: 10.1257/pol.20210159. URL: https://www.aeaweb.org/articles?id=10.1257/pol.20210159.

Mincer, Jacob (1984). "Human capital and economic growth." In: *Economics of Education Review* 3.3, pp. 195–205. ISSN: 0272-7757. DOI:

https://doi.org/10.1016/0272-7757(84)90032-3. URL: https://www.sciencedirect.com/science/article/pii/0272775784900323.

Mogstad, Magne and Matthew Wiswall (2016). "Testing the quantity–quality model of fertility: Estimation using unrestricted family size models." In: *Quantitative Economics* 7.1, pp. 157–192. DOI: https://doi.org/10.3982/QE322. eprint: https://onlinelibrary.wiley.com/doi/pdf/10.3982/QE322. URL: https://onlinelibrary.wiley.com/doi/abs/10.3982/QE322.

Mohan, J., Steve Barnard, K. Jones, and Liz Twigg (2004). *Social capital, place and health: creating, validating and applying small-area indicators in the modelling of health outcomes*. English. Working Paper. Health Development Agency.

Montresor, Giulia and Lucia Schiavon (Feb. 2024). *Social capital and vaccination compliance: Evidence from Italy*. Ca' Foscari University of Venice, Department of Economics Research Paper Series No. 04/2024. DOI: 10.3386/w30237. URL: https://ssrn.com/abstract=4740265.

Ngo, Anh P (July 2020). "Effects of Vietnam's two-child policy on fertility, son preference, and female labor supply." In: *Journal of Population Economics* 33.3, pp. 751–794.

Núñez, S, N Martínez, and G Garibotto (2019). *Primeros resultados de la Encuesta de Nutrición, Desarrollo Infantil y Salud. Cohorte 2018*. Working Paper Series. MIDES-MSP-MEC-INAU-INE-CEIP. DOI: http://dspace.mides.gub.uy:8080/xmlui/handle/123456789/1796.

Ong, Jason, Meredith Temple-Smith, William CW Wong, Kathleen McNamee, and Christopher Fairley (Dec. 2012). "Contraception matters: indicators of poor usage of contraception in sexually active women attending family planning clinics in Victoria, Australia." In: *BMC Public Health* 12.1, p. 1108. ISSN: 1471-2458. DOI: 10.1186/1471-2458-12-1108. URL: https://doi.org/10.1186/1471-2458-12-1108.

Pagnini, Deanna L. and Nancy E. Reichman (2000). "Psychosocial Factors and the Timing of Prenatal Care among Women in New Jersey's HealthStart Program." In: *Family Planning Perspectives* 32.2, pp. 56–64. ISSN: 0014-7354. DOI: 10.2307/2648213. URL: https://www.jstor.org/stable/2648213.

Qian, Nancy (2017). *The effect of China's One Child Policy on sex selection, family size, and the school enrolment of daughters*. WIDER Working Paper Series wp-2017-159. World Institute for Development Economic Research (UNU-WIDER). URL: https://ideas.repec.org/p/unu/wpaper/wp-2017-159.html.

Rau, Tomás, Miguel Sarzosa, and Sergio Urzúa (Sept. 2021). "The children of the missed pill." en. In: *Journal of Health Economics* 79, p. 102496. ISSN: 0167-6296. DOI: 10.1016/j.jhealeco.2021.102496. URL: https://www.sciencedirect.com/science/article/pii/S0167629621000813.

Rosenzweig, Mark R. and Kenneth I. Wolpin (1980). "Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural

Experiment." In: *Econometrica* 48.1, pp. 227–240. ISSN: 00129682, 14680262. URL: http://www.jstor.org/stable/1912026.

Rosenzweig, Mark R. and Junsen Zhang (2009). "Do Population Control Policies Induce More Human Capital Investment? Twins, Birth Weight and China's "One-Child" Policy." In: *The Review of Economic Studies* 76.3, pp. 1149–1174. ISSN: 00346527, 1467937X. URL: http://www.jstor.org/stable/40247636.

Roth, Jonathan (Sept. 2022). "Pretest with Caution: Event-Study Estimates after Testing for Parallel Trends." en. In: *American Economic Review: Insights* 4.3, pp. 305–322. DOI: 10.1257/aeri.20210236. URL: https://www.aeaweb.org/articles?id=10.1257/aeri.20210236.

Roth, Jonathan, Pedro H. C. Sant'Anna, Alyssa Bilinski, and John Poe (Apr. 2023). "What's trending in difference-in-differences? A synthesis of the recent econometrics literature." en. In: *Journal of Econometrics*. ISSN: 0304-4076. DOI: 10.1016/j.jeconom.2023.03.008. URL: https://www.sciencedirect.com/science/article/pii/S0304407623001318.

Rubin, Donald (Dec. 2001). "Using Propensity Scores to Help Design Observational Studies: Application to the Tobacco Litigation." In: *Health Services and Outcomes Research Methodology* 2, pp. 169–188. DOI: 10.1023/A:1020363010465.

Sable, Marjorie R. and Deborah Schild Wilkinson (2000). "Impact of Perceived Stress, Major Life Events and Pregnancy Attitudes on Low Birth Weight." In: *Family Planning Perspectives* 32.6, pp. 288–294. ISSN: 00147354. URL: http://www.jstor.org/stable/2648197.

Sawhill, Isabel V., Quentin C Karpilow, and Joanna Venator (2014). "The Impact of Unintended Childbearing on Future Generations." In.

Seshadri, Ananth and Anson Zhou (July 2022). "Intergenerational mobility begins before birth." en. In: *Journal of Monetary Economics* 129, pp. 1–20. ISSN: 0304-3932. DOI: 10.1016/j.jmoneco.2022.03.005. URL: https://www.sciencedirect.com/science/article/pii/S0304393222000368.

Sharp, Chloe and Gurch Randhawa (2012). "Social capital and deceased organ donation." In: *Organ Donation and Transplantation—Public Policy and Clinical Perspectives. InTech Open Access*, pp. 115–140.

Shartzer, A, B Courtot, S McMorrow, S Benatar, and G. M. Kenney (2016). "Knowledge gaps and misinformation about birth control methods persist in 2016." In.

Shaw, Daniel and Elizabeth Shelleby (Jan. 2014). "Early-Starting Conduct Problems: Intersection of Conduct Problems and Poverty." In: *Annual review of clinical psychology* 10. DOI: 10.1146/annurev-clinpsy-032813-153650.

Squires, J, D Bricker, and E Twombly (2009). *Ages & Stages Questionnaires*. Baltimore, MD: Paul H. Brookes.

Stevens, Jack and Elise D. Berlan (2014). "Applying Principles from Behavioral Economics To Promote Long-Acting Reversible Contraceptive (LARC) Methods." In: *Perspectives on Sexual and Re-*

productive Health 46.3, pp. 165–170. ISSN: 1538-6341. URL: https://www.jstor.org/stable/48576678.

Sun, Liyang and Sarah Abraham (Dec. 2021). "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects." en. In: *Journal of Econometrics*. Themed Issue: Treatment Effect 1 225.2, pp. 175–199. ISSN: 0304-4076. DOI: 10.1016/j.jeconom.2020.09.006. URL: https://www.sciencedirect.com/science/article/pii/S030440762030378X.

Than, Lara C, Margaret A Honein, Margaret L Watkins, Paula W Yoon, Katherine Lyon Daniel, and Adolfo Correa (June 2005). "Intent to become pregnant as a predictor of exposures during pregnancy: is there a relation." eng. In: *The Journal of Reproductive Medicine* 50.6, pp. 389–396. ISSN: 1943-3565.

Todd, Petra E. and Kenneth I. Wolpin (2007). "The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps." In: *Journal of Human Capital* 1.1, pp. 91–136. DOI: 10.1086/526401. eprint: https://doi.org/10.1086/526401. URL: https://doi.org/10.1086/526401.

Vu, Trung (2021). *Long-term cultural barriers to sustaining collective effort in vaccination against COVID-19*. Economics Discussion papers 2106. University of Otago. URL: http://hdl.handle.net/10523/12350.

Wasi, N. (2015). "Record linkage using Stata: Preprocessing, linking, and reviewing utilities." In: *Stata Journal* 15.3, 672–697(26).

Webster-Stratton, Carolyn (Nov. 1998). "Preventing Conduct Problems in Head Start Children: Strengthening Parenting Competencies." In: *Journal of consulting and clinical psychology* 66, pp. 715–30. DOI: 10.1037/0022-006X.66.5.715.

Weller, Robert H., Isaac W. Eberstein, and Mohamed Bailey (1987). "Pregnancy Wantedness and Maternal Behavior During Pregnancy." In: *Demography* 24.3, pp. 407–412. ISSN: 0070-3370. DOI: 10.2307/2061306. URL: https://www.jstor.org/stable/2061306.

Zhong, Jingdong, Jingjing Gao, Chengfang Liu, Jie Huang, and Renfu Luo (2019). "Quantity–Quality Trade-Off and Early Childhood Development in Rural Family: Evidence from China's Guizhou Province." In: *International Journal of Environmental Research and Public Health* 16.7. ISSN: 1660-4601. DOI: 10.3390/ijerph16071307. URL: https://www.mdpi.com/1660-4601/16/7/1307.

Åslund, Olof and Hans Grönqvist (2010). "Family size and child outcomes: Is there really no trade-off?" In: *Labour Economics* 17.1, pp. 130–139. ISSN: 0927-5371. DOI: https://doi.org/10.1016/j.labeco.2009.05.003. URL: https://www.sciencedirect.com/science/article/pii/S0927537109000645.

COLOPHON

This document was typeset using the typographical look-and-feel `classicthesis` developed by André Miede. The style was inspired by Robert Bringhurst's seminal book on typography "*The Elements of Typographic Style*". `classicthesis` is available for both LaTeX and LyX:

https://bitbucket.org/amiede/classicthesis/

Final Version as of March 25, 2024 (`classicthesis`).