Spring 2021

Essays in Health and Behavior

Zehra Çagıl Valencia Lopez

Essays in Health and Behavior

by

Zehra Çağıl Valencia Lopez

Bachelor of Science
Marmara University 2009

Master of Science
University of Alicante 2011

Master of Arts
University of South Carolina 2017

Submitted in Partial Fulfillment of the Requirements

for the Degree of Doctor of Philosophy in

Economics

Darla Moore School of Business

University of South Carolina

2021

Accepted by:

Jason M. DeBacker, Major Professor

Örgül D. Öztürk, Major Professor

Lindsey Woodworth, Committee Member

Caroline Rudisill, Committee Member

Tracey L. Weldon, Interim Vice Provost and Dean of the Graduate School

Dedication

This dissertation is gratefully dedicated to my husband, Hugo, my son, Jonas, my family in Turkey, and to important creatures that kept me always smile in South Carolina: bluebirds, southern live oaks, and southeastern five-lined skinks.

Acknowledgments

I would like to express my sincere gratitude to my advisors Dr. DeBacker and Dr. Ozturk for the continuous support of my Ph.D. study. Dr. DeBacker, has always been very helpful and encouraging. His guidance helped me in all the time of research and writing of this dissertation. He helped me both academically and emotionally through the rough road to finish this research. Dr. Ozturk was always there whenever I needed help. Not only she helped me to get all tools to be a good researcher but also helped me in critical personal situations.

Besides my advisors, I would like to thank the rest of my thesis committee: Dr. Lindsey and Dr. Rudisill, for their insightful comments and encouragement, but also for the hard question which incented me to widen my research from various perspectives. Dr. Lindsey holds a special place in my life. I learned a lot from her regarding the field. But also, she taught us how being kind and caring could be that important in the academic world. I feel so lucky to have her in my life. Dr. Rudisill is a very knowledgeable and respectful academician. I have been learning a lot from her, including, multitasking, management, and research. I can not be more thankful to have her as a supervisor. In addition to my committee, I would like to thank Prof. Alexander Matros. He is the initial professor who encouraged me for writing several papers and attending conferences. I would never forget his support. Additionally, I can not forget the rest of the professors from Darla Moore School of Business, the University of Alicante, and Marmara University - thank you so much!

My sincere thanks also go to Marcelo Frias. Who is always supportive, patient, and very helpful. The Business School is very lucky to have him. Also, Kathy

Anastes, thank you so much for always being there for us! I gratefully acknowledge the assistance of Sarah Crawford, Chris Finnes, and Kaowao Strickland from the SC Revenue and Fiscal Affairs Office.

My very special thanks also go to my dearest friend, Tuba. She is the most strong and courageous person I have ever met. She has been aside from me, every single day. I met with her at the college and our paths have crossed here in the United States. She is a 'family' to me. Also, I cannot forget to thank my other close friends from Turkey: Emre, Zubeyde, Tahire, and Hilal. They are my childhood; I own them so much! Additionally, I made great friends on my Ph.D. journey. I am so thankful to have their encouragement and friendship!

I also thank my mom, dad, sister, and brother. My hard-working parents have sacrificed their lives for my siblings and me and provided unconditional love and care. I love them so much. My sister and my brother have been my best friend all my life and I love them dearly and thank them for all their advice and support. Also, my grandparents, uncles, and aunts… Thank you all so much!

Finally, I have to thank my husband and the love of my life, Hugo, for sharing this life with me. He is my best friend, my biggest support, and the reason for my laughter. I would not have made it this far without him. The last word goes for Jonas, our baby boy, who has been the light of my life for the last two years and who has given me the extra strength and motivation to get things done. Finally - the very last: thank you my dear cats, Korsan and Mocha. You are making every minute more fun.

Abstract

I study decision-making in healthcare choices and competitions. In my analysis, I use both quasi-experimental and experimental methods. In the first chapter, I investigate the effects of C-sections on babies and their mothers. Using administrative data from South Carolina, I exploit the breech position to isolate variation in C-sections that is uncorrelated with the ex-ante health of the infant and mother. I find that a C-section increases the probability of abnormal conditions for babies immediately after birth. However, there are no significant effects on babies' future health conditions after birth. Mothers who deliver by C-section are more likely to develop complications in puerperium after birth in those marginal cases where the baby randomly stays upside-down. Mothers who deliver by C-section are more likely to develop complications in puerperium after birth, however, there is suggestive evidence that C-sections might be good for post-partum mental health. This research also documents that C-sections increase the length of hospital stays and lead to reductions in future fertility.

In the second chapter, my coauthor and I investigate how individuals behave and interact with each other in contests with entry fees in an experimental laboratory. We find overspending for all entry fees; under - participation for low entry fees; over - participation for medium and high entry fees; and the optimal entry fee for the contest designer. We find that the optimal experimental entry fee is much higher than the theoretical one.

Table of Contents

Dedication iii

Acknowledgments iv

Abstract vi

List of Tables ix

List of Figures xi

Chapter 1 The Effects of Cesarean Sections on Mothers and Babies 1

1.1 Introduction 1

1.2 Related Literature 6

1.3 Empirical Model 8

1.4 Data 14

1.5 Results 19

1.6 Conclusions 26

Chapter 2 Which Entry Fee: That Is the Question 49

2.1 Introduction 49

2.2 Model and Predictions 52

2.3 Experimental Design 55

2.4 Experimental Findings 56
2.5 Conclusion 61

Bibliography 72

Appendix A Supplementary Tables Chapter 1 77

Appendix B Experimental Instructions Chapter 2 83

List of Tables

Table 1.1 Summary Statistics for Mothers' and Babies' Characteristics . . . 28

Table 1.2 Summary Statistics for Mothers' and Babies' Characteristics (continued) . . . 29

Table 1.3 Summary Statistics for Delivery and Fertility Outcomes . . . 30

Table 1.4 Summary Statistics for Mothers' Health and Health Utilization Outcomes within 1 Year After Delivery . . . 31

Table 1.5 Summary Statistics for Babies Health and Hospital Utilization Outcomes within 1 Year After Delivery . . . 32

Table 1.6 How do Control Variables Relate to Breech Position? . . . 33

Table 1.7 Total Number of Complications Puerperium . . . 34

Table 1.8 Validity Test: Predictors of Breech Position . . . 35

Table 1.9 Mean of the Mothers' Characteristics by Position of the Fetus . . . 36

Table 1.10 First Stage Results . . . 37

Table 1.11 Any Abnormal Conditions at Birth . . . 38

Table 1.12 Fertility Outcomes . . . 39

Table 1.13 Mothers' Physical Health within One Year after First Birth . . . 40

Table 1.14 Mothers' Mental Health within One Year after First Birth . . . 41

Table 1.15 Babies' Health Outcomes within One Year after Birth . . . 42

Table 1.16 Babies' Health Outcomes within One Year after Birth (cont.) . . . 43

Table 1.17 Mothers' Health Utilization Outcomes within One Year after First Birth . . . 44

Table 1.18 Babies' Health Utilization Outcomes within One Year after Birth . 45

Table 2.1 Descriptive Statistics 62

Table 2.2 Average Bids and Participation Probabilities 63

Table 2.3 The Effect of Costs on Bids 64

Table 2.4 The Effect of Costs on Participation Probabilities 65

Table 2.5 Average Bids and Participation Probabilities by Gender 66

Table A.1 ICD codes (WHOs International Classification System for Diseases) 77

Table A.2 Any Abnormal Conditions at Birth - All Births 78

Table A.3 Fertility Outcomes - All Births 79

Table A.4 Babies' Health Outcomes within One Year after Birth - All Births 80

Table A.5 Babies' Health Outcomes within One Year after Birth - All Births (cont.) 81

Table A.6 Babies' Health Utilization Outcomes within One Year after Birth - All Births 82

List of Figures

Figure 1.1 Percent of Births by Delivery Type over Years 46

Figure 1.2 Average Total Hospital Charges (in US Dollars) within 1 Month after First Births by Delivery Type 47

Figure 1.3 Percent of Births by Position of the Fetus and Delivery Type . . . 48

Figure 2.1 Average Bids 67

Figure 2.2 Average Participation Probabilities 68

Figure 2.3 Designer's Expected Payoff 69

Figure 2.4 Gender Differences in Average Bids 70

Figure 2.5 Gender Differences in Average Participation Probabilities 71

Chapter 1

The Effects of Cesarean Sections on Mothers and Babies

1.1 Introduction

Cesarean section (C-section), a surgical procedure to deliver babies, is the most common major operation performed in many industrialized countries. In the US, there are more than one million C-section surgeries each year (Jauniaux and Grobman 2016). C-sections can save women's and babies' lives when certain complications occur during pregnancy or birth (The Lancet 2018), yet, the wide variation in C-section rates across countries points to an absence of agreement about the best way of delivering babies. The World Health Organization (WHO) recommends that the rate of C-sections should not exceed 10 to 15 percent, but only 14 countries are in this rate (Gibbons et al. 2010)[1] Given the importance of accurate policy recommendations and the high share of children born via C-section, it is important to understand the economic consequences and health impacts of C-sections on delivering mothers and infants.

C-section is major surgery and recovery usually takes more time than vaginal birth. These operations are done in situations when the baby needs to be removed immediately at birth (emergency) or other times they could have been planned (elective) in advance. Emergency c-sections are usually employed when there are health concerns related to the mother and/or baby. Planned c-sections can be done for several reasons, including

[1] A total of 54 countries had C-section rates under 10%, whereas 69 countries had rates more than 15%.

having a previous c-section, or even just due to personal reasons to pick the delivery date. Therefore, c-sections are correlated with several factors including babies' and mothers' health, mother's choices, and other characteristics.

Women who undergo a C-section usually stay at the hospital around two to four days after birth, whereas the hospital stay for a vaginal birth is typically one to two days aurora. Moreover, having a baby via a C-section is usually more expensive than having natural birth. In 2010, the average US cost for women for prenatal, intrapartum, and postpartum care after a C-section was around $10,000 more and newborn care was around $6,000 more than vaginal birth for babies (Truven Health Analytics 2013). In addition, it has been claimed that C-sections are associated with long-term women's health problems. Women who have C-sections, are more likely to have postpartum complications (Koroukian 2004) and postpartum depression (Tonei 2019). Also, there are mixed findings regarding the effects on children's health. Some studies show that newborns delivered by C-section are more likely to develop obesity, asthma, and type 1 diabetes (Blustein and Liu 2015), and an increased risk of disease associated with immune function (Kristensen and Henriksen 2016) when they get older. Some other studies show no association between C-sections and long-term type 1 diabetes, obesity, or atopic disease diagnosis (Costa-Ramón et al. 2020).[2]

This paper investigates the causal effect of C-sections on babies' and mothers' health, health utilization, and hospital costs. In particular, I study babies' neonatal health and health outcomes within one year after birth; and mothers' mental and physical health outcomes within one year after birth, and future fertility. I also study hospital costs and hospital utilization effects of C-sections. Providing credible, casual answers to these questions is not straightforward, not only because it requires detailed data but also the endogeneity concerns in the delivery mode. C-sections are

[2]Costa-Ramón et al. 2020 finds that C-sections increase the probability of having asthma.

endogenous to mothers' and babies' ex-ante health conditions and other characteristics. Even though the models control for many of the characteristics (such as mothers' age, weight, some of the pre-health conditions, baby's health at birth), there might be unobservable elements that can affect the choice of delivery, such as unobservable health conditions of mothers and babies, or issues at pregnancy and delivery.

In order to overcome these challenges, I utilize rich administrative data from South Carolina that links birth certificates to mothers' and infants' hospital records. I then exploit variations in the position of the fetus as an instrument for C-section. Having the baby in a breech position is a random reason when a C-section is requested. Breech position is a situation when the fetus presents buttocks or feet first (rather than head first – a cephalic presentation)(American College of Obstetricians and Gynecologists 2020), and the reasons why at term babies' (37–40 weeks gestational age) are at the breech position are generally unknown. I first show that breech position at delivery is independent of mothers' and babies' predetermined characteristics. I then show that the probability of C-section increases substantially if the position of the fetus is breech at the time of the delivery.[3]

This study identifies effects of C-sections on women who would have had a vaginal delivery if only their baby had been the other way around, and on their babies. The health results for these marginal mothers are mixed. C-sections lead to more complications in the post-partum period. On the other hand, there is evidence that C-sections might be beneficial for women's mental health. Controlling for time and hospital fixed effects, I find a 2.3 percentage point increase in the probability of being diagnosed with a complication of the puerperium within one year of the first birth. Regarding mental health, I find a 0.5 percentage point reduction in the probability of being diagnosed with postpartum depression within one year of the first birth. For

[3]This is not the first study that use breech position as an instrument for C-section. Tonei 2019 utilized this exogenous variation in the position to study the effects of C-section on mothers' mental health.

all births, I find a 0.9 unit percentage point reduction. These findings show results of when primary diagnoses are utilized to define postpartum depression. However, primary diagnoses are important to consider because they constitute the root cause of the visit and refers to the most serious and/or resource-intensive condition when a person was hospitalized (Clements 2019). However, the mental health results are not significant once secondary diagnoses were also taken care of. These findings are different from Tonei 2019's study, which finds that women report more sadness lasting two weeks or more after an unplanned C-section. In addition to these, I find that C-sections reduce the fertility rates for women. A C-section reduces number of births by 0.135 on average, reduces the likelihood of having one more baby after the first baby by 2.9 percentage point, and increases the gap between first and second birth by almost 3 months.

I find that babies who were quasi-randomly delivered via C-sections are more likely to have any abnormal conditions at birth. In particular, I find that, the probability of having any abnormal conditions at birth increases by 2.6 percent. However, these adverse effects at birth do not translate into a higher probability of early childhood health conditions such as obesity, immunity-related disorders, asthma, and respiratory-related disorders.

In terms of health utilization, I find that C-sections increase the total length of stay for women by 0.083 days, and for babies, it increases by 0.2 days. The total hospital charges increase by 30 percent for mothers, and 28.5 percent for babies. Although not significant, the total number of hospital visits for both mothers and children increase.

There are a number of recent papers in health economics on C-sections (Jensen and Wüst 2015; Mühlrad 2020; Costa-Ramón et al. 2018; Tonei 2019; Costa-Ramón et al. 2020). All of these studies use data from the EU countries, and their findings are mixed.[4] These papers tend to focus on the effect of delivery method on either children's or mothers' outcomes. Two studies attempt to analyze the effect of C-section for high-risk babies on both children and women's later-life effects. Jensen and Wüst 2015 find that a C-section reduces the baby's probability of having a low APGAR score and the number of family doctor visits within one year after they are born, and does not impact severe neonatal morbidity or hospitalizations. They find that the costs and hospitalizations for women increased, however, there is no maternal post-birth complications or infections for mothers. Mühlrad 2020, find similar results for babies and find no impact on women's health at birth or subsequent births. Instead of focusing either on babies or on mothers' health outcomes in short or long-term as in the previous studies, this paper investigates the effect on both. Therefore, this paper attempts to be the most comprehensive study in this area. It is also the first study that investigates this subject in the USA - which is the world's most expensive country for childbirth (Hargraves and Bloschichak 2019) and has the highest maternal mortality rate among developed countries (Tikkanen et al. 2018).

There is a continuing debate regarding the use of C-sections for breech presentation (MacFarlane et al. 2016). C-sections have spread remarkably fast in recent years. Especially after the multi-country Term Breech Trial in 2000, breech babies have higher probability of being delivered by C-sections. However, according to my findings, because of the possible post partum complications, women should be provided regular follow-up services at least 1 year after giving birth via C-section. If these considerations would be taken care of, then giving a birth via C-section could be beneficial for these marginal women's mental health. Breech births at terms constitutes a 3-4% of all births, this means this study applies to 15,400 women and babies each day. Even if this study analytically relates to breech births, it brings useful conclusion for the

[4]Card, Fenizia, and Silver 2019 investigates the health impacts of hospital practices in California, and find that hospital delivery practices at high C-section hospitals have important health benefits for newborns.

implications of C-sections. The rest of the paper is structured as follows. Section 1.2 summarises previous literature on this topic. Section 1.3 presents the empirical strategies and data are described in Section 1.4. Section 1.5 shows the main results. Section 1.6 concludes.

1.2 Related Literature

The global growth of C-sections has attracted the attention of researchers to this topic. The first studies in the economics literature study the non-medical reasons for the increase in these operations. Some studies show financial incentives as a major explanation for this. Gruber and Owings 1996 find that a 10 percent fertility decline in the US leads to a 0.6 percentage rise in the likelihood of having a C-section, suggesting that obstetrician-gynecologist may substitute patients' demand for highly reimbursed C-sections over natural births. Gruber, Kim, and Mayzlin 1999 find C-sections increased in response to an increase in the difference in fee differentials between C-section and vaginal birth for the Medicaid program.

However, it is important to understand the health effects of this procedure to assess the cost efficiency. Recent studies consider this and started to investigate the health effects of C-section. Currie and MacLeod 2008 find that reforms of joint and several liability reduce induction and stimulation of labor, C-sections, and complications of labor and delivery, while caps on non-economic damages increase them. However, they show that, this increase in procedure use and effort level does not correspond with improved infant health at birth measured as the APGAR score. Jensen and Wüst 2015 and Mühlrad 2020, study the impact of C-sections on the health of babies that are in a breech position at term and their mothers. Jensen and Wüst 2015, using Danish data, find that C-section reduce the likelihood of having low APGAR scores and the number of family doctor visits in the first year of life. They also find that mothers' post-birth hospitalizations increase in length, but C-sections are not associated with maternal post-birth complications or infections. Mühlrad 2020 exploits a sharp policy change in Sweden that led to a large increase in planned C-sections for breech births, and finds improvements in infant health at birth (measured in low APGAR score) and long term health (measured in number of hospitalizations) but no significant effect on mothers' health at birth, future fertility or labor market outcomes (measured as annual income from gainful employment, parental benefits, and sickness benefits). Halla et al. 2020 show an increase in C-section rates on days that precede a leisure day and exploit this variation in an instrumental variable framework. They document that having a C-section is associated with a reduction in fertility. Costa-Ramón et al. 2020 use the same methodology and find that unplanned C-sections in Finland are associated with low APGAR score, being admitted to the intensive care unit and receiving assisted ventilation for newborns. They also find that being born by an unplanned C-section increases the probability of having asthma, but does not have impact on probability of having asthma, obesity, type 1 diabetes, and atopic diseases. Another study using the UK Millennium Cohort Study investigates the impact on mother's mental health, using the position of fetus as an instrument for C-section, and finds that the women report more sadness lasting two weeks or more after having a childbirth via a unplanned C-section for a high-risk baby (Tonei 2019).

The previous papers either focused on baby or just on mother's health, or only focused on health or economic consequences, or only focused on mothers' mental health after birth. Mühlrad 2020 gives a broad set of results, but does not provide information on hospital costs, long run health effects of babies (except hospitalizations), and mothers' mental health. Jensen and Wüst 2015 show results for the hospital costs but do not provide detailed long run health results for babies and mothers other than hospitalizations or maternal health at future deliveries. Halla et al. 2020 only focus on future fertility, Costa-Ramón et al. 2020 only takes into account babies' outcomes, and (Tonei 2019) only explores mothers' mental health after birth. This study aims to be the most comprehensive study that explores both health and economic consequences of C-sections. In particular, I investigate babies and mothers' health at delivery, later life health (including mothers' mental health), hospitalizations, and hospital costs.

Moreover, all above-mentioned studies use data from the EU countries. However, the delivery effects in the USA is important to be explored because the USA is the most expensive country for baby birth,[5] and maternal and infant mortality is higher than many other developed countries (America's Health Rankings 2018). This study uses data from the South Carolina to investigate the effects of C-sections in the USA. More than 31% of all deliveries in the USA were by C-section in 2018 (CDC 2020). In South Carolina, the rates are similar (see Figure 1.1). The only existing health economics study in the USA is Card, Fenizia, and Silver 2019. Card, Fenizia, and Silver 2019 study the health impacts of delivery at hospitals with higher versus lower C-section rates. They find that infants birth at delivery improved when they were delivered at hospitals with higher C-section rates, and are less likely to be readmitted to the hospital.

1.3 Empirical Model

I study the economic and health effects of C-sections on mothers and their babies. Because the type of delivery is likely to be associated with pre-delivery characteristics of mothers and their babies, simple OLS estimation of C-sections on the mothers' and babies' outcomes are likely to be biased. To overcome this, I implement an instrumental variables framework where I use the breech position as an instrument for the C-section. I also complement my results with hospital and birth month/year fixed effects.

[5] This is also true for South Carolina, where average total hospital charges within one month after delivery are 6,600 USD for C-sections than vaginal births for women, and 1,532 USD higher for babies (Figure 1.2)

My econometric framework consists of linear models for C-section of mother (and C-section of baby) i (CS_i) and outcomes for the mother (and baby) (Y_i):

The structural equation:

$$Y_i = \beta_0 + \beta_1 CS_i + \beta_2 X_i' + t_{my} + h_i + \upsilon_i \tag{1.1}$$

The first stage model for C-section delivery:

$$CS_i = \alpha_0 + \alpha_1 Breech_i + \alpha_2 X_i' + t_{my} + h_i + v_i \tag{1.2}$$

The reduced form model for the effect of having breech position on outcomes:

$$Y_i = \delta_0 + \delta_1 Breech_i + \delta_2 X_i' + t_{my} + h_i + \xi_i \tag{1.3}$$

where $CS_i = 1$ if the baby was born via C-section, $Breech_i = 1$ if the position of the fetus is Breech, X_i' vector of individual controls, t_{my}, are month and year of birth fixed effects and h_i are hospital fixed effects. The individual controls include mother's demographic characteristics (age, race, ethnicity, education level), characteristics of the pregnancy (prenatal care level, baby's weight, mother's weight at birth, gestational age, payment method and WIC participation), pregnancy and pre-pregnancy risk factors (tobacco use during pregnancy, pre-pregnancy diabetes, gestational diabetes, pre-pregnancy hypertension, pregnancy hypertension, previous preterm birth, previous C-section birth) and a post-birth control (breastfeeding status).

In this setting, the covariate-adjusted IV estimator is equal to the ratio of the reduced form coefficient on the breech position (δ_1), to the first stage coefficient on the probability of C-section (α_1), scaling the reduced form effect per additional C-section. Estimates of β_1 in Equation 1.1 aim to estimate an average treatment effect (ATE). Since the variation in the breech position only effects a subset of women, the ATE will be for these women. This is known as local average treatment effect (LATE) (Angrist and Imbens 1994). Therefore, LATE is the ATE for women who had C-section because their baby was in breech position in the fetus, but would not had C-section if they had a cephalic position. These group of women are known as the compliers (Angrist and Pischke 2008).[6] Considering breech presentation occurs about 3 to 4 out of every 100 full-term birth, which translates to around 130,000 term-babies in the USA, the compliers are important group of individuals for policy making.

There are two assumptions that the instrument should satisfy. The first assumption is, the breech position is associated with C-section. According to the American College of Obstetricians and Gynecologists, most fetuses that are breech are born via a planned cesarean delivery (American College of Obstetricians and Gynecologists 2019). My data also support this. Table 1.10 provides the first stage results using $Breech_i$ as an exclusion restriction. Panel A shows results for the first births and Panel B shows the results for all births. Model (1), Model (2), Model (3), and Model(4) show results with no fixed effects, birth month-year fixed effects, hospital fixed effects and both month-year and hospital fixed effects. Accordingly, the partial correlation between the breech position and having a cesarean birth is equal to 0.658 (0.658, 0.660 and 0.661 when month-year birth date fixed effects, hospital fixed effects and both of the fixed effects are included, respectively), and it is strongly significant. For all births, the strong significance remain for all specifications (Panel B).

Additionally, the IV should meet monotonicity criteria, which implies that the breech position should have either a positive or zero treatment effect, so that C-section is more likely after the breech position but never less likely. Figure 1.3 shows the positive correlation between Breech position and cesarean delivery. Figure 1.3a shows results for first births and Figure 1.3b shows results for all births. The figures also show that if the babies' position is cephalic., i.e. ideal position (head-down) for childbirth,

[6]In the models for babies, the compliers would be the babies who were born via a C-section because their position in the fetus were breech.

then more than 70% of first births are vaginally delivered. The correlation between breech position and C-section is positive and significant at one percent level.

The second assumption is the exclusion restriction, which means that instrument can be excluded from the structural Equation 1.1, i.e. instrument is uncorrelated with v_i (Wooldridge 2010). That is, having a baby in a breech position at birth must be uncorrelated with unobserved characteristics of the mother and her baby; breech position should have no effect on their health and health utilization outcomes other than through the first-stage channel.

The second assumption can not be tested, but I will provide some evidence that this condition is mostly met. First, according to medical literature, in most of the cases, there is no clear cause for why the baby is not positioned head-down (The University of Michigan, Michigan Medicine Healthwise Staff 2019). In some cases breech position may be associated with early labor, twins or more, problems with the uterus, or problems with the baby (Cunningham et al. 2009). However, most often, breech presentation is considered to be 'simply an error of orientation' (Enkin, Keirse, and Neilson 1995). Second, the health economics literature supports the idea that breech and non-breech mothers are similar in many characteristics (Jensen and Wüst 2015; Tonei 2019). For instance, Jensen and Wüst 2015 showing the percentages of university degrees and pregnancy conditions unrelated to breech (e.g. pre-eclampsia and diabetes) are similar for these 2 group of women, and they state that '...given the observable characteristics at hand, breech pregnancies are as good as random'. Similarly, Tonei 2019 show that most characteristics such as the baby's health at birth and the mother's previous health conditions are not related to the position of the womb.

In addition to previous research, I provide some evidence from my data to support this assumption. First I regress all covariates on the breech position and esitmate LPMs. Model (1) in Table 1.6 shows results when only first firths are considered, Model (2) shows results when all births are considered. According to Model (1), among all education variables, only the indicator for having a masters degree is negatively associated with having breech position. However, the magnitude is very small and the effect goes away in Model (2). Regarding racial effects, being white increases the probability of having the baby in breech position. Peterson 2010 also confirms this, but, there is no clear evidence on why this is the case. One explanation might be related to maternal age. In my data, the average maternal age for the first child is 21.6 for black women, and it is 24.7 for white women; and breech presentation might be associated with older maternal ages (Cammu et al. 2014). Regarding prenatal care, results show that women who has their baby in breech presentation have more prenatal care. However, this finding is not surprising because women are often advised to see doctors regularly when they are pregnant to breech babies, and some doctors may try extra procedures like turning the baby in the mother's uterus (Coco and Silverman 1998). Another result from the table is, women who use tobacco during pregnancy are 0.004 (0.003) more likely to have breech baby in their first (all) birth. There are some evidences from medical literature that breech position might be associated with smoking (Amasha and Jaradeh 2014). My regressions control for this variable.

Second, I provide a balanced test in Table 1.7, which presents 2SLS etimates obtained by adding gradually different sets of controls in the regression equation. This table shows that the effect of C-section on the outcome is similar in all specifications, and this can be helpful to support the exclusion restriction. Model (1) shows results with no controls, Model (2) includes hospital fixed effects, Model (3) adds month-year fixed effects, Model (4) includes mother's demographic characteristics, Model (5) adds covariates related to characteristics of the pregnancy, Model (6) adds mother's health risk factors, finally model (7) adds post-birth controls.

Third, I regress the breech position on all mothers' and babies covariates. Table 1.8 show that, conditional on all other controls,the majority covariates are not associated with baby's position for both of the first and all births; which supports the exclusion restriction assumption. In the table, mother's age, being eligible for the WIC Program, birth weight, mothers' age, baby weight, gestational age and mothers' weight at delivery and pre-pregnancy, tobacco use, gestational diabetes, and hypertension are significant with having the fetus in breech position, although, the coefficients are generally small. This means once I control for these variables, the breech position will be exogenous in the regressions.

Fourth, Table 1.9 provides a balance test to compare the means of mothers' and babies' characteristics by position of the fetus. The difference in means for most of the variables are close to zero. Especially mothers' ethnicity, pre-pregnancy weight, and pre-pregnancy health risk factors do not differ in the two groups in the first births, and differs slightly in all births. In line with the previous literature (Jensen and Wüst 2015; Tonei 2019), I find that maternal age and education level increase the likelihood of having a baby in breech position. Another difference occurs in some of the payment source variables. Cephalic women have more Medicaid as a payment method, whereas breech women tend to use private insurance as a payment method. There is no difference in self payment or other sources of payment methods. Again, the difference might be due to the age (and therefore education) differences. The average age for women who use Medicaid is 23.2, whereas average age for women who use private insurance is 28.7. I also find that women with a breech baby tend to less participate to WIC. Although the difference is very small, most of the Kotelchuck Index variables show that women who carry breech baby have more prenatal care then cephalic babies. Also, there are differences in gestational age and baby weight. Finally, there are very small differences in gestational risk factors, probability of breastfeeding and whether or not using tobacco during pregnancy. Thus, once I control for these variables, the findings points out that the breech position is random.

1.4 Data

I use administrative data South Carolina, which comes from two sources: birth certificates data from South Carolina Department of Health and Environmental Control Vital Records and all-payer, uniform billing data for inpatient discharges from the South Carolina Revenue and Fiscal Affairs Office.

All data records were pulled by the SC Revenue and Fiscal Affairs Office (RFA) as of October 2020. The initial sample of birth certificates are characterized by 277,648 babies born between 2004 and 2018, from 139,336 first time mothers who delivered their first (live) baby between 2004 and 2009 in South Carolina. Hospital records report separately for these mothers and their babies.

Birth certificates include mothers' and their babies' encrypted identifiers. Hospital records for mothers include mothers' encrypted identifiers, whereas hospital records for babies include babies' encrypted identifiers. Using mothers' identifiers I merge birth certificates and hospital records for mothers. Each observation of this data is for a mother (and her first baby). I refer this data as *Mothers' Data* throughout the text. Similarly, using babies' identifiers, I merge birth certificates and hospital records for babies. Each observation of data is for a baby (and his/her mother). I refer this data as *All Births Data*.

1.4.1 Births Data

The South Carolina Vital Records offices provide birth certificates for births that took place in SC since 1915. It includes information on mothers' socio-economic characteristics: age, education level,[7] ethnicity (whether or not Hispanic), race (white,

[7]Whether or not the mother achieved 8th grade or less, whether or not achieved 9th-12th grade with no diploma, whether or not high school graduate or GED completed, whether or not some college credit with no degree, whether or not obtained associate degree, whether or not obtained bachelor degree, whether or not obtained master degree, and whether or not obtained doctorate or professional degree.

black, or other), payment source (Medicaid, private insurance, self-pay or other), whether or not participated in WIC, and county of residence. The vital statistics also give detailed information on mothers' health and health behavior during and pre-pregnancy: mothers' weight at delivery, mothers' weight prior to the pregnancy, whether or not mother used tobacco during pregnancy, whether or not infections occurred during pregnancy,[8] and her Kotelchuck index.[9] The data include further health related risk factors for mothers: whether or not the mother has gestational diabetes, gestational hypertension, pre-pregnancy diabetes, pre-pregnancy hypertension, a history of a previous C-section and previous preterm birth. Information on previous pregnancy outcomes is also captured: number of previous live births that are still alive, number of previous live births that are now deceased and number of other pregnancy outcomes. There are information on the fetal presentations as well: whether or not breech, whether or not cephalic, whether or not other fetal presentation. There are also information on final route of the delivery: whether or not cesarean and whether or not vaginal.

The birth certificates contain detailed information on babies. First, the data provide information on babies' characteristics: birth month and year, gender, plurality (the total number of births resulting from a single pregnancy), birth month and birth year.[10] Second, the data gives information on babies health: birth weight,[11] gestational

[8]Presence of at least one of the following infections: Gonorrhea, Syphilis, Herpes, and/or Chlamydia.

[9]This index shows the level of prenatal care. It is generated using two variables: the time prenatal care began and the number of prenatal visits during pregnancy. The Kotelchuck index has 4 categories: whether or not inadequate , whether or not intermediate, whether or not adequate and whether or not adequate plus.

[10]The exact date of birth is restricted information.

[11]Using birth weight, I generate *Extremely Low Birth Weight Very Low Birth Weight*, *Low Birth Weight*, *Normal Birth Weight*, *High Birth Weight* indicator variables *Extremely Low Birth Weight* is an indicator variable, which takes the value of 1 for the infants whose birth weight was less than 1,000 grams, and zero otherwise. *Very Low Birth Weight* is an indicator variable, which takes the value of 1 for the infants whose birth weight was less than 1,500 grams, and zero otherwise. *Low Birth Weight*

age,[12] and whether or not breastfed. Table 1.1 and Table 1.2 provides descriptive information on first births and all births. Accordingly, 32 percent of women had C-section in their first birth and 68 percent had vaginal birth in their first birth, whereas 33 per cent of the all babies were born via C-section and 67 per cent of all babies were born vaginally.

The first set of outcome variables comes from the birth certificates. I generated *Any Abnormal Conditions* to investigate abnormal conditions in infants immediately after the delivery. *Any Abnormal Conditions* is an indicator variable, which takes the value of 1 if any of these occurred immediately after delivery: assisted ventilation required right after delivery, assisted ventilation required for more than 6 hours, newborn given surfactant replacement therapy, antibiotics received by the newborn immediately following delivery, admission to NICU, seizure, and birth injury. I also construct variables to measure future fertility of the women, such as *Total Number of Babies by Mother*, *Time Gap Between 1st Baby and 2nd Baby* and *Does Mother Have More Than 1 Baby*. *Total Number of Babies by Mother* is the number of babies per mother. *Time Gap Between 1st Baby and 2nd Baby* shows the number of months between first

is an indicator variable, which takes the value of 1 for the infants whose birth weight was less then or equal to 2,500 grams, and zero otherwise. *Normal Birth Weight* is an indicator variable, which takes the value of 1 for the infants whose birth weight was between 2,500 grams and 4,000 grams, and zero otherwise. *High Birth Weight* is an indicator variable, which takes the value of 1 for the infants whose birth weight was greater than or equal to 4,000 grams, and zero otherwise.

[12]Using gestational age, I construct *Premature*, *Late Preterm*, *Early Term*, *Full Term*, *Late Term* and *Post Mature* indicator variables*Premature* is an indicator variable, which takes the value of 1 for infants who was born less then 34 completed weeks of gestation, and zero otherwise. *Late Term* is an indicator variable, which takes the value of 1 for infants who was born greater than or equal to 34 completed weeks of gestation and less than 37 completed weeks of gestation, and zero otherwise. *Early Term* is an indicator variable, which takes the value of 1 for infants who was born 37 or 38 completed weeks of gestation, and zero otherwise. *Full Term* is an indicator variable, which takes the value of 1 for infants who was born 39 or 40 completed weeks of gestation, and zero otherwise. *Late Term* is an indicator variable, which takes the value of 1 for infants who was born 41 completed weeks of gestation, and zero otherwise. *Post Mature* is an indicator variable, which takes the value of 1 for infants who was born greater than or equal to 42 completed weeks of gestation, and zero otherwise.

and second baby. *Does Mother Have More Than 1 Baby* shows whether or not the mother had another baby after the first baby. Table 1.3 provides information on the first set of outcomes derived from birth certificates.

1.4.2 Hospital Inpatient Discharge Data

I obtain inpatient discharge data for mothers and babies separately. For mothers, the data include encounter level hospitalization records for up to 10 years after their first birth. For babies, the data include encounter level hospitalization records for up to 10 years after their birth. Hospital inpatient discharge data are encounter level and have detailed information on patients' health outcomes, health utilization, and health costs. There are major diagnostic categories, procedures, patient discharge status, charges, admission month/year, and discharge month/year per encounter. I also have encrypted hospital identifiers in the data.

The second set of outcome variables are related to babies' and mothers health, and generated by using primary and secondary diagnoses categories. For instance, I generated *Obesity* which is an indicator variable that takes the value of 1 for the any of the primary or secondary diagnoses[13] show that the patient has diagnosed by obesity, and zero otherwise. I generated *Total Number of Obesity Diagnosis* by summing the number of *Obesity* diagnoses for each babies' hospital visits' diagnoses categories related to Obesity. I also generated *Any Obesity Diagnosis* which takes the value of 1 if a baby ever experienced *Obesity*, and zero otherwise.

For mothers' mental health, I generate *Are Any of the Mother's Diagnoses Post-Partum Depression (1/0)?*, *Is the Primary Diagnosis Post-Partum Depression (1/0)?*, *How Many Total Diagnoses Post-Partum Depression of Any Kind (Primary or Secondary) does the Mother Have?*, and *How Many Total Diagnoses Post-Partum Depression of Any Kind (Primary or Secondary) does the Mother Have?*. I also generated

[13] I used International Classification of Disease (ICD) codes for diagnosis.

same variables for women's physical health, measured in complications of the puerperium. All the variables constitutes within one year after the first birth. Table 1.4 provides descriptive statistics on mothers' health conditions.[14] Note that distinguishing primary and 'primary and secondary' diagnosis are important to investigate the health results more detailed. Principal diagnoses are the conditions that are mainly responsible for the patient's admission and indicates the patient condition that demands the most provider resources during the patient's stay (Agency for Healthcare Research and Quality 2001). They also play an essential role in how providers are reimbursed for services rendered (Nicoletti 2014).

For babies, I generate 'Obesity', 'Asthma', 'Diseases of the Respiratory System' and 'Diseases Related to Immunity Disorders' in a similar way. Table 1.5 provides descriptive statistics on babies' health condition. All ICD codes used are in Appendix A. Other outcome variables relate to health utilization. I generated *Total Number of Hospital Visits*, *Total Length of Stay*, which is total length of stay in hospitals, and *Total Hospital Charges* for both babies and mothers (see Table 1.4 and Table 1.5).

1.4.3 Sample Selection

Although the administrative data provide rich detail on a large sample, they have some limitations as well. First, the birth certificates do not include date of birth. This information is restricted to protect individuals' privacy. Second, the hospital data for mothers and babies do not include exact admission and discharge dates. These information are also restricted. Third, the original mothers' hospital discharge records do not include babies' identifiers. All these issues prevent me from merging babies' hospitalization records on mothers' hospital records. Therefore, for babies, I am able

[14]The hospital records for woman does not include babies' identifiers and exact birth dates. However, the hospital records were taken from the date they gave their first birth. Therefore, these outcomes meant to measure the outcomes within one year after they gave their first birth, and the date of first birth is assumed as the time of mother's first admission to the hospital.

to construct all outcome variables for first births and all births. For example, in Table 1.5, *Total Number of Hospital Visits* shows that, average number of hospital visits for first birth babies is 6.10, and average number of hospital visits for all babies (first born, second born, etc.) it is 5.58. *Total Number of Hospital Visits Within 1 Year* shows that average number of hospital visits within one year for the first born babies is 2.11, and average number of hospital visits within one year for all babies it is it is 2.06. Table 1.4 shows that for mothers, average number of hospital visits is 9.95. Average number of hospital visits within one year after the first babies is 1.80. However, the data prevent me from constructing average number of hospital visits within one year after any birth, i.e. after 2nd birth, 3rd birth, and so on. Therefore, the variable *Total Number of Hospital Visits Within 1 Year* can not be created for 'All Births' as it was generated for babies in Table 1.5. However, the available variables are sufficient to make essential analysis for both mothers and babies. Last limitation is, I would not see mother's or babies' all hospital records if they leave South Carolina after delivery.

My samples includes mothers who have singleton births; I drop twins (6,781 babies), triplets (186 babies) and quadruplets (6 babies). I also exclude pre-term births (26,643 babies).[15] The final sample for *Mothers' Data* has 122,980 mothers (and first babies), which is 88.3% of the mothers in the original birth certificates sample. In order to create *All Births Data* I follow the same process. *All Births Data* has 244,032 babies, which is the 87.9% of the babies in the original birth certificates sample.

1.5 Results

This section presents results for *first births* as the main results. The results for *all births* are in the Appendix. The reason for focusing on first births is that the outcomes for all births could be endogenous to the first births. The regressions for *all births* are the same as the regressions for *first births*, but they additionally control

[15]The births occurred before 37 gestational weeks.

for the indicator for having a previous C-section. The results for *all births* are very similar to the main results and used as a robustness check.

The results tables include both OLS and 2SLS estimations' results. Each specification; OLS and 2SLS, are presented as including full sets of controls in Model (1) and Model (2), adding hospital fixed effects in Model (3) and Model (4) and adding both hospital and birth month-year fixed effects in Model (5) and Model (6), respectively. OLS estimations treat the cesarean section as exogenous and were constructed as a benchmark model to compare with IV models.

1.5.1 Abnormal Conditions at Birth

It has been known that, compared to babies born vaginally, babies born by C-sections are more likely to have health complications, such as having difficulties in breathing on their own. One explanation is contractions of labor help to prepare the infants' lungs for respiration at birth (Stanford Children's Health 2020). My results confirm this information. The results on delivery outcomes for babies have been documented in Table 1.11. These estimates suggest that there is a negative and significant association between C-sections and conditions immediately after birth for babies.

Model (1) shows Linear Probability Model (LPM) results when a full set of covariates is added, Model (3) shows results when hospital effects are also included, and Model (5) shows results when birth month/year fixed effects are also included. Model (2), Model (4), and Model (6) show the second stage results for 2SLS estimations with the same order. Both OLS and 2SLS results show that there is a positive association between having a C-section and having any abnormal conditions at birth for babies. According to Model (5), the LPM results show that a C-section increases the likelihood of having any abnormal conditions by 2.7 percentage point for first births when the birth month/year and hospital fixed effects are included. Model (6) reports 2SLS results. I find that a C-section increases the probability of having abnormal conditions by 2.6 percentage point for first births. The results for LPM and 2SLS are similar, suggesting there are not much biases in these estimations from the selection of mothers' into C-sections. In South Carolina, 6 percent of the babies had abnormal conditions immediately after birth (Table 1.3), therefore this finding means a 43% increase from the mean. Table A.2 in the Appendix shows the results for all births, and the results are similar.

1.5.2 Effects on Women's Fertility

I investigate the impact on future fertility outcomes and present the results in Table 1.12 and Table A.3. These estimates suggest a negative and significant impact on future fertility measured by the total number of babies, a binary measure of the probability of not having another baby, and the time gap between the first and second birth (measured in months). These findings confirm previous studies' findings. Kjerulff et al. 2020 show that women who delivered their first baby via C-section were also less likely to have a subsequent live birth compared to women who gave birth vaginally. Halla et al. 2020 finds similar results and also document that the decline in fertility due to C-sections translates into a temporary increase in maternal employment.

Panel A in Table 1.12 shows the effects on the total number of babies for first births. Model (1) shows the OLS results when a full set of covariates are added. According to Model (1), a C-section generates a 0.135 unit decrease in the number of total births. It is 0.137 unit decrease when hospital fixed effects are included (see Model (4)), and is 0.134 when both fixed effects are included (see Model (6)). 2SLS models show similar results but the magnitudes are smaller. According to Model (2), a C-section generates a 0.072 unit decrease in the number of total births. It is 0.079 unit decrease when hospital fixed effects are included (see Model (4)), and is 0.081 when both fixed effects are included (see Model (6)). The average number of babies per women is 2, therefore, these results mean that the mean number of children in a family where the first baby was born by C-section would move from 2 to 1.92.

Panel B in Table 1.12 shows the effects on the likelihood of having one more baby. According to Model (1), a C-section reduces the likelihood of having one more baby by 2.9 percentage point. Model (5) includes both fixed effects and shows that the reduction is 2.9 percentage point. Model (2), Model (4), Model (6) show the 2SLS results with all covariates added. According to the 2SLS findings, the effect of C-sections on the probability of having one more baby is not significant.

Panel C in Table 1.12 shows the effects on the time gap between the first and second baby. According to Model (1), a C-section reduces 2.38 months the time between first and second baby, and is 2.4 when birth month/year and hospital fixed effects are included (Model (5)). According to the 2SLS results, a C-section reduces 2.22 months the time between first and second baby (Model (2)), is reduces 2.23 months when hospital fixed effects are included, and is reduces 2.195 months when both fixed effects are included (Model (6)). Average time gap between first and second baby is 44.8 months, therefore this result translates into 5% increase in the time between babies. A.3 in the Appendix show similar results for fertility outcomes. For fertility outcomes, both OLS and 2SLS show a reduction in the fertility. However, the effects of C-sections on fertility are a lot less in 2SLS results comparing to OLS results, suggesting that the biases in the OLS estimations lead to a higher reduction in the fertility rates.

1.5.3 Effects on Women's Health

The results on women's physical and mental health outcomes are presented in Table 1.13 and Table 1.14, respectively. The results show that having a C-section is associated with worse physical health after delivery measured in complications in puerperium, however, the findings for mental health points out some positive impacts on post-partum depression.

Panel A1 in Table 1.13 shows results for probability of having complications of the puerperim diagnosed by any (primary and secondary) diagnoses. Model (6) is the preferred 2SLS model which includes both fixed effects. Accordingly, having a C-section increases the probability of having a complication of the puerperium by 1.9 percentage point. The mean of probability of having a complication of the puerperium is 5%, therefore this results mean the percent increase from the mean is 38%. Panel A2 shows results for probability of having complications of the puerperim diagnosed by primary diagnoses. Accordingly, probability of having a complication of the puerperium increases by 1 percentage point, if the patient primarily diagnosed by complication of the puerperium. Panel A3 documents results for total number of diagnoses complication of the puerperium that a women would have. According to Model (6), total number of diagnoses complication of the puerperium increases by 0.023 units. The mean of total number of diagnoses complication of the puerperium is 0.06, therefore this result translates into 38% increase in the number of diagnoses. Finally, Panel A4 shows results for total number of primary diagnoses complication of the puerperium. The preferred model shows that total number of primary diagnoses complication of the puerperium increases by 0.023 units. These findings are important because postpartum complications can affect women's long-term health (Sparks 2018). [16] For womens' physical health outcomes, both OLS and 2SLS show an increase in the number of times that women experiences complications of the puerperium and the probability of having a complications of the puerperium. However, the biases in the OLS estimations shows that the impact of C-sections are larger.

[16] Women's physical and mental health outcomes' results are robust and available from the author, when the pregnancy risk factors are excluded from the sample.

Panel A1 in Table 1.14 shows results for probability of having post-partum depression any (primary and secondary) diagnoses. Panel B3 documents results for total number of post-partum depression that a women would have. Accordingly, when both diagnoses categories are considered, C-sections are not linked to a post-partum diagnoses. However, according to Panel B2, which shows results for probability of having post-partum depression primary diagnoses, a C-section reduces the probability of getting postpartum depression by 0.5 percentage point. Given the mean of the probabiliy of having a postpartum depression is 0.01, this results translates into a 50% increase from the mean. Panel A4, shows the results for total number of primary diagnosis post-partum depression, and confirms the positive effect on mental health for the marginal mothers.

These finding is different than (Tonei 2019) who uses self-reported survey data from English mothers after they give birth. Her findings show that mothers report having experienced a period of sadness lasting two weeks or more after childbirth. This paper, however, looks at a postpartum diagnoses , made by doctors for American mothers. Post-partum depression can be a consequence of many factors, including pain during delivery (Eisenach et al. 2008), pregnancy and delivery complications, or having a baby who has been hospitalized (CDC 2020). One explanation for these results is, C-sections due to breech positions might lead a reduction in these issues which might help women's mental health after delivery.

1.5.4 Effects on Babies' Health Outcomes

Table 1.15 and Table 1.16 (Table A.4 and A.5) show effect of cesarean section on babies health outcomes measured in obesity diagnosis, immunity-related disorders, asthma, and respiratory-related diagnosis, for first births. Overall, results show that C-sections are not associated with babies' future health outcomes. Model (1), Model (3), and Model (5) shows the results from OLS estimations; with no fixed effects, with hospital fixed effects, and both of the fixed effects, respectively. Model (2), Model (4), and Model (6) show the results of 2SLS models. Although OLS results lead to an increase in immunity-related and asthma diagnoses, they are more likely to be biased from the omitted variables at mom and baby level that would influence children's health outcomes. For example, mothers' behavior might change after having a c-sections and that would influence babies' health outcomes.

Panel A1 show whether or not the child has ever diagnosed by obesity for all births (first births), Panel A2 shows the effect of C-sections on the total number of obesity diagnosis for first births (all births). All coefficients for both OLS and second-stage estimations are zero and not statistically significant. Panel B1 and Panel B2 has a similar structure, but shows the effect on immunity-related disorders. Although the OLS results show that C-sections are positively associated with immunity-related disorders, 2SLS estimations do not confirm this. Panel C1 (Panel C2) show the effect on number of (ever) asthma diagnosis and Panel D1 (Panel D2) shows the effect on number of (ever) respiratory-related diagnosis. In both cases, OLS estimations show that C-sections are associated with these diagnoses, but the 2SLS results are not statistically significant.

1.5.5 Effects on Health Utilization Outcomes

Table 1.17 and Table 1.18 (Table A.6) show results for health utilization outcomes for mothers and first born babies, respectively. Model (1), Model (4), and Model (7) shows the results from OLS estimations; with no fixed effects, with hospital fixed effects, and both of the fixed effects, respectively. Model (2), Model (5), and Model (8) show the outcomes for all hospital visits after the baby is born each baby. Model (3), Model (6), and Model (9) show the outcome for all hospital visits within 1 year after the baby is born. The findings show that C-sections increase the total length of stay and total charges for both mothers and children. However, C-sections are not linked to the total number of hospital visits.

For mothers, a C-section increases total length of stay in the hospital within one year after the first birth by 0.111 units, does not have significant effect on number of hospitalizations, and is associated with 30 percent increase in the total charges (see Model 8 and Model 9). For first born babies, the results show that a C-section increases total length of stay in the hospital within one year after the first birth by 0.236 (0.111) units, does not have significant effect on number of hospitalizations, and is associated with 23 (28.5) percent increase in the total charges. OLS estimations and other specifications for the second-stage also confirm these findings.

1.6 Conclusions

This research investigates the implications of C-sections comprehensively. In order to overcome the endogenous issue of selection into a C-section, I use exogenous variation from the position of the fetus. In line with medical literature, I document that having an at term baby in a breech position increases the likelihood of having a C-section. By using detailed South Carolina administrative data, for the time period 2004 and 2009, I use this variation in the fetus as an instrument for a C-section. The detailed South Carolina data, which links birth certificates to hospital records, enables me to examine the impact of C-section on a broader set of outcomes for both mothers and babies.

I present evidence that an increase in C-sections, among breech births can lead to significant deterioration in women's physical health measured in complications in the puerperium, although women benefit from a C-section at delivery. However, contrary to previous literature, there is a suggestive evidence that women's mental health can be better off after a C-section. Moreover, I show that babies' future health do not affect by C-sections, even if they do impact babies' health at birth. I also find that the length of stay at the hospital and hospital charges increase with C-sections, and there is a negative association with future fertility.

My findings show that, under some circumstances (such as having the baby in an upwards position), it might be beneficial for women's mental health to have a C-section instead of vaginal birth. However, new policies, such as Term Breech Trial, should consider carefully the physical consequences of these operations. The postpartum complications can be very severe and life-threatening. Therefore, this paper provides policy recommendations such that women should have additional doctor controls at least 1 more year after giving birth.

Table 1.1 Summary Statistics for Mothers' and Babies' Characteristics

	First Births		All Births	
	Mean	Std. Dev.	Mean	Std. Dev.
Fetal Presentation				
Breech	0.03	0.16	0.02	0.15
Cephalic	0.93	0.25	0.95	0.22
Other	0.03	0.18	0.02	0.16
Final Route				
Cesarean	0.32	0.46	0.33	0.47
Vaginal	0.68	0.46	0.67	0.47
Mothers' Socio-Economic Char.				
Age	23.81	5.66	25.41	5.66
Educ. - Middle School or Less	0.04	0.19	0.03	0.18
Educ. - High School	0.20	0.40	0.19	0.39
Educ. - High School or GED	0.24	0.43	0.25	0.43
Educ. - Some College	0.23	0.42	0.23	0.42
Educ. - Associate Degree	0.06	0.24	0.07	0.26
Educ. - Bachelor Degree	0.16	0.36	0.15	0.35
Educ. - Master Degree	0.06	0.23	0.06	0.24
Educ. - PhD	0.01	0.12	0.01	0.11
Ethnicity - Hispanic	0.08	0.28	0.08	0.27
Race - White	0.67	0.47	0.65	0.48
Race - Black	0.31	0.46	0.33	0.47
Race - Other	0.02	0.15	0.02	0.14
Payment - Medicaid	0.50	0.50	0.53	0.50
Payment - Private Insurance	0.39	0.49	0.38	0.48
Payment - Self-Pay	0.06	0.24	0.05	0.22
Payment - Other	0.06	0.24	0.04	0.20
Participated to WIC? (1/0)	0.57	0.50	0.54	0.50
Observations	122,980		244,032	

Table 1.2 Summary Statistics for Mothers' and Babies' Characteristics (continued)

	First Births		All Births	
	Mean	Std. Dev.	Mean	Std. Dev.
Prenatal Care				
Kotelchuck Index - Inadequate	0.18	0.38	0.19	0.39
Kotelchuck Index - Intermediate	0.08	0.27	0.07	0.26
Kotelchuck Index - Adequate	0.31	0.46	0.31	0.46
Kotelchuck Index - AdequatePlus	0.42	0.49	0.42	0.49
Mothers' Health and Risk Factors				
Delivery Weight (pounds)	185.15	41.79	187.87	42.93
Pre-Pregnancy Weight (pounds)	154.88	41.96	159.37	43.93
Pre-Pregnancy Diabeter 0.08	0.01	0.08		
Pre-Pregnancy Hypertension	0.02	0.12	0.02	0.14
Previous Preterm Birth	0.00	0.04	0.02	0.14
Previous Cesarean	0.00	0.03	0.13	0.34
Gestational Diabetes	0.04	0.19	0.04	0.21
Gestational Hypertension	0.06	0.23	0.05	0.22
Babies' Cha.				
Babies' Gender - Female	0.49	0.50	0.49	0.50
Breastfeed	0.66	0.47	0.64	0.48
Birth Weight (grams)	3305.78	460.01	3326.68	460.74
Clinically Estimated Gestational Age	39.04	1.10	38.90	1.04
Observations	122,980		244,032	

Table 1.3 Summary Statistics for Delivery and Fertility Outcomes

	First Births		All Births	
	Mean	Std. Dev.	Mean	Std. Dev.
Delivery Outcomes				
Any Abnormal Conditions After Delivery (1/0)?	0.06	0.24	0.05	0.22
Fertility Outcomes				
Total Number of Babies	2.01	1.00	2.48	1.13
Time Gap Between 1st Baby and 2nd Baby (in months)	44.88	28.32	42.54	27.12
Does Mother Have More Than 1 Baby (1/0)?	0.64	0.48	0.82	0.38
Observations	122,980		244,032	

Table 1.4 Summary Statistics for Mothers' Health and Health Utilization Outcomes within 1 Year After Delivery

	Mean	Std. Dev.
Health		
Are Any of the Mother's Diagnoses Post-Partum Depression (1/0)?	0.04	0.19
Is the Primary Diagnosis Post-Partum Depression (1/0)?	0.01	0.07
How Many Total Diagnoses Post-Partum Depression of Any Kind (Primary or Secondary) does the Mother Have?	0.04	0.20
How Many Primary Diagnoses Post-Partum Depression does the Mother Have?	0.01	0.08
Are Any of the Mother's Diagnoses Complications of the Puerperium (1/0)?	0.05	0.22
Is the Primary Diagnosis Complications of the Puerperium (1/0)?	0.02	0.15
How Many Total Diagnoses Complications of the Puerperium of Any Kind (Primary or Secondary) does the Mother Have?	0.06	0.25
How Many Primary Diagnoses Complications of the Puerperium does the Mother Have?	0.03	0.17
Health Utilization		
Total Number of Hospital Visits	1.80	1.74
Log of Total Length of Stay (in days)	1.14	0.55
Log of Total Hospital Charges (in US Dollars)	9.26	0.58
Observations	122,023	

Because of the missing values in the outcome variables, observations do not match with sample sizes.

Table 1.5 Summary Statistics for Babies Health and Hospital Utilization Outcomes within 1 Year After Delivery

	First Births		All Births	
	Mean	Std. Dev.	Mean	Std. Dev.
Health				
Are Any of the Baby's Diagnoses Obesity (1/0)?	0.00	0.00	0.00	0.00
How Many Total Diagnoses Obesity does the Baby Have?	0.00	0.00	0.00	0.00
Are Any of the Baby's Diagnoses Immunity (1/0)?	0.04	0.19	0.03	0.18
How Many Total Diagnoses Immunity does the Baby Have?	0.04	0.24	0.04	0.24
Are Any of the Baby's Diagnoses Respiratory (1/0)?	0.25	0.43	0.25	0.43
How Many Total Diagnoses Respiratory does the Baby Have?	0.38	0.82	0.38	0.82
Are Any of the Baby's Diagnoses Asthma (1/0)?	0.01	0.08	0.01	0.08
How Many Total Diagnoses Asthma does the Baby Have?	0.01	0.10	0.01	0.10
Health Utilization				
Total Number of Hospital Visits	2.11	1.70	2.06	1.62
Log of Total Length of Stay (in days)	1.10	0.57	1.07	0.58
Log of Total Hospital Charges (in US Dollars)	7.96	0.86	8.11	0.88
Observations	121,733		241,142	

Because of the missing values in the outcome variables, observations do not match with sample sizes.

Table 1.6 How do Control Variables Relate to Breech Position?

	(1) First Births	(2) All Births
Mom Age	-0.000	-0.002***
	(0.001)	(0.001)
Mom's Educ. - High School	-0.001)	-0.001
	(0.002)	(0.002)
Mom's Educ. - Some College	-0.004	-0.001
	(0.003)	(0.002)
Mom's Educ. - Bachelor Degree	-0.005	-0.001
	(0.004)	(0.002)
Ethnicity - Hispanic	-0.003*	-0.002
	(0.002)	(0.002)
Race - White	0.014***	0.012***
	(0.001)	(0.001)
Kotelchuck - Intermediate	-0.008***	-0.006***
	(0.003)	(0.002)
Kotelchuck - Adequate	-0.002	-0.002**
	(0.001)	(0.001)
Mom's Weight Pre-pregnancy	0.000	0.000***
	(0.000)	(0.000)
Payment - Medicaid	-0.001	-0.005**
	(0.003)	(0.002)
Payment - Private Insurance	0.001	-0.001
	(0.003)	(0.002)
Pre-Pregnancy Diabetes	0.008	0.016**
	(0.007)	(0.006)
Pre-Pregnancy Hypertension	0.000	0.003
	(0.004)	(0.003)
Participated to WIC? (1/0)	-0.001	-0.000
	(0.001)	(0.001)
constant	0.005	0.024***
	(0.012)	(0.008)
R-Squared	0.008	0.005
Observations	118,756	236,470

Standard errors are robust.
Standard errors are clustered at the hospital level.
LPM estimates. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 1.7 Total Number of Complications Puerperium

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cesarean Birth	0.016**	0.015**	0.016**	0.020***	0.022***	0.023***	0.023***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Observations	122,023	122,023	122,023	121,257	118,383	118,348	118,346
Controls:							
Hospital FE		Yes	Yes	Yes	Yes	Yes	Yes
Month-Year FE			Yes	Yes	Yes	Yes	Yes
Mom's Demographic Char.				Yes	Yes	Yes	Yes
Char. of the Pregnancy					Yes	Yes	Yes
Mom's Health Risk Factors						Yes	Yes
Post-Birth Controls							Yes

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
2SLS estimations.
Models include birth month/year and hospital fixed effects
* p<0.10, ** p<0.05, *** p<0.01

Table 1.8 Validity Test: Predictors of Breech Position

	First Births		All Births	
	Coeff.	Std. Errors	Coeff.	Std. Errors
Mothers' Socio-Economic Char.				
Age	-0.038***	(0.011)	-0.004	(0.015)
Educ. - High School	-0.000***	(0.000)	0.000	(0.000)
Educ. - Some College	-0.000***	(0.000)	0.000	(0.000)
Educ. - Bachelor Degree	-0.000***	(0.000)	0.000***	(0.000)
Ethnicity - Hispanic	-0.001	(0.004)	-0.002	(0.004)
Race - White	0.000***	(0.000)	-0.000***	(0.000)
Payment - Medicaid	-0.000***	(0.000)	-0.000***	(0.000)
Payment - Private Insurance	-0.000	(0.000)	-0.000***	(0.000)
Participated to WIC? (1/0)	-0.010*	(0.005)	-0.017***	(0.006)
Prenatal Care				
Kotelchuck - Intermediate	-0.001	(0.001)	-0.001	(0.002)
Kotelchuck - Adequate	-0.000	(0.000)	0.000**	(0.000)
Mothers' Health and Risk Factors				
Mother's Weight at Delivery	1.401***	(0.247)	0.502	(0.350)
Mother's Weight Pre-Pregnancy	-0.494*	(0.000)	0.182	(0.377)
Pre-Pregnancy Diabetes	0.005**	(0.002)	0.002	(0.002)
Pre-Pregnancy Hypertension	0.001	(0.003)	-0.000	(0.000)
Babies' Char.				
Birth Weight (grams)	-41.719***	(5.489)	-30.633***	(7.144)
Gestational Age	-0.281***	(0.017)	-0.391***	(0.022)
Breastfeed	0.004	(0.007)	-0.002	(0.007)
Observations	122,980		224,032	

All controls are included. OLS estiamtes. p<0.10, ** p<0.05, *** p<0.01
Standard errors are robust and clustered at the hospital level.

Table 1.9 Mean of the Mothers' Characteristics by Position of the Fetus

	First Births		All Births	
	Breech	Cephalic	Breech	Cephalic
Mothers' Socio-Economic Char.				
Age	26.280	23.670	27.216	25.341
Educ. - High School	0.139	0.207	0.143	0.191
Educ. - Some College	0.213	0.230	0.218	0.235
Educ. - Bachelor Degree	0.212	0.152	0.193	0.144
Educ. - Hispanic	0.079	0.085	0.081	0.082
Race - White	0.814	0.663	0.788	0.645
Payment - Medicaid	0.368	0.504	0.413	0.532
Payment - Private Insurance	0.516	0.378	0.483	0.371
Participated to WIC? (1/0)	0.432	0.573	0.436	0.541
Prenatal Care				
Kotelchuck - Intermediate	0.060	0.079	0.057	0.075
Kotelchuck - Adequate	0.305	0.314	0.309	0.316
Mothers' Health and Risk Factors				
Mother's Weight Pre-Pregnancy	155.659	154.646	161.115	159.222
Pre-Pregnancy Diabetes	0.009	0.006	0.012	0.006
Pre-Pregnancy Hypertension	0.019	0.015	0.025	0.019
Babies' Char.				
Birth Weight (grams)	3247.247	3304.284	3282.142	3326.021
Gestational Age	38.559	39.057	38.545	38.909
Breastfeed	0.714	0.656	0.689	0.634
Observations	3,344	114,936	5,355	231,373

All controls are included. OLS estimates. * p<0.10, ** p<0.05, *** p<0.01
Standard errors are robust and clustered at the hospital level.

Table 1.10 First Stage Results

	(1)	(2)	(3)	(4)
	C-section	C-section	C-section	C-section
Panel A: First Births				
Breech Position	0.658***	0.658***	0.660***	0.661***
	(0.011)	(0.011)	(0.011)	(0.011)
R-Squared	0.135	0.136	0.146	0.147
Observations	118,093	118,093	118,093	118,093
Panel B: All Births				
Breech Position	0.633***	0.617***	0.635***	0.620***
	(0.008)	(0.008)	(0.008)	(0.008)
R-Squared	0.310	0.330	0.317	0.337
Observations	235,182	235,182	235,182	235,182
All Controls	YES	YES	YES	YES
Month-Year FE	NO	YES	NO	YES
Hospital FE	NO	NO	YES	YES

Standard errors in parentheses

All controls are included. * p<0.10, ** p<0.05, *** p<0.01

Standard errors are robust and clustered at the hospital level.

Table 1.11 Any Abnormal Conditions at Birth

	(1) LPM	(2) 2SLS	(3) LPM	(4) 2SLS	(5) LPM	(6) 2SLS
Cesarean Birth	0.024***	0.028**	0.027***	0.026**	0.027***	0.026**
	(0.007)	(0.013)	(0.007)	(0.012)	(0.007)	(0.012)
R-Squared	0.008	0.008	0.052	0.052	0.054	0.054
Observations	118,093	118,093	118,093	118,093	118,093	118,093
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 1.12 Fertility Outcomes

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A: Total Number of Babies						
Cesarean Birth	-0.135***	-0.072***	-0.137***	-0.079***	-0.134***	-0.081***
	(0.006)	(0.023)	(0.006)	(0.021)	(0.006)	(0.020)
R-Squared	0.124	0.123	0.130	0.130	0.136	0.136
Observations	118,093	118,093	118,093	118,093	118,093	118,093
Panel B: Does Mother Have More Than 1 Baby (1/0)?						
Cesarean Birth	-0.029***	-0.003	-0.030***	-0.007	-0.029***	-0.007
	(0.003)	(0.014)	(0.003)	(0.013)	(0.003)	(0.013)
R-Squared	0.086	0.085	0.092	0.092	0.096	0.095
Observations	118,093	118,093	118,093	118,093	118,093	118,093
Panel C: Time Gap Between First and Second Baby						
Cesarean Birth	2.389***	2.220**	2.382***	2.223**	2.409***	2.195**
	(0.225)	(0.934)	(0.211)	(0.946)	(0.211)	(0.957)
R-Squared	0.032	0.032	0.034	0.034	0.036	0.036
Observations	76,016	76,016	76,016	76,016	76,016	76,016
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table 1.13 Mothers' Physical Health within One Year after First Birth

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Panel A1: Are Any of the Mother's Diagnoses Complications of the Puerperium (1/0)?						
Cesarean Birth	0.047***	0.019***	0.047***	0.019***	0.047***	0.019***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)
Panel A2: Is the Mother's Primary Diagnoses Complications of the Puerperium (1/0)?						
Cesarean Birth	0.021***	0.009*	0.021***	0.009**	0.021***	0.010**
	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
Panel A3: How Many Total Diagnoses Complications of the Puerperium of Any Kind (Primary or Secondary) does the Mother Have?						
Cesarean Birth	0.054***	0.023***	0.053***	0.023***	0.054***	0.023***
	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.007)
Panel A4: How Many Total Primary Diagnoses Complications of the Puerperium does the Mother Have?						
Cesarean Birth	0.024***	0.010**	0.023***	0.010**	0.024***	0.010**
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Observations	118,346	118,346	118,346	118,346	118,346	118,346
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table 1.14 Mothers' Mental Health within One Year after First Birth

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A1: Are Any of the Mother's Diagnoses Post-Partum Depression (1/0)?						
Cesarean Birth	0.007***	0.000	0.007***	-0.000	0.007***	-0.000
	(0.002)	(0.006)	(0.001)	(0.005)	(0.001)	(0.005)
Panel A2: Is the Mother's Primary Diagnoses Post-Partum Depression (1/0)?						
Cesarean Birth	-0.003***	-0.005***	-0.003***	-0.005***	-0.003***	-0.005***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Panel A3: How Many Total Diagnoses Post-Partum Depression of Any Kind (Primary or Secondary) does the Mother Have?						
Cesarean Birth	0.008***	0.004	0.007***	0.003	0.007***	0.003
	(0.002)	(0.007)	(0.001)	(0.006)	(0.002)	(0.006)
Panel A4: How Many Total Primary Post-Partum Depression does the Mother Have?						
Cesarean Birth	-0.003***	-0.005**	-0.003***	-0.004**	-0.003***	-0.005**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Observations	118,346	118,346	118,346	118,346	118,346	118,346
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
* p<0.10, ** p<0.05, *** p<0.01

Table 1.15 Babies' Health Outcomes within One Year after Birth

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Panel A1: Are Any of the Baby's Diagnoses Obesity (1/0)?						
Cesarean Birth	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel A2: How Many Total Diagnoses Obesity?						
Cesarean Birth	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B1: Are Any of the Baby's Diagnoses Immunity (1/0)?						
Cesarean Birth	0.004***	-0.000	0.004***	-0.002	0.005***	-0.002
	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Panel B2: How Many Total Diagnoses Immunity Related?						
Cesarean Birth	0.004**	-0.003	0.004**	-0.005	0.004**	-0.005
	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
Observations	118,093	118,093	118,093	118,093	118,093	118,093
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table 1.16 Babies' Health Outcomes within One Year after Birth (cont.)

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A1: Are Any of the Baby's Diagnoses Asthma (1/0)?						
Cesarean Birth	0.002*	-0.000	0.001*	-0.001	0.002*	-0.001
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Panel A2: How Many Total Diagnoses Asthma?						
Cesarean Birth	0.002*	-0.003	0.002*	-0.003	0.002*	-0.003
	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)
Panel B1: Are Any of the Baby's Diagnoses Respiratory (1/0)?						
Cesarean Birth	0.013***	0.007	0.012***	0.005	0.013***	0.005
	(0.004)	(0.011)	(0.003)	(0.011)	(0.003)	(0.011)
Panel B2: How Many Total Diagnoses Respiratory?						
Cesarean Birth	0.023***	-0.010	0.022***	-0.014	0.023***	-0.015
	(0.007)	(0.021)	(0.005)	(0.021)	(0.005)	(0.022)
Observations	118,093	118,093	118,093	118,093	118,093	118,093
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
* p<0.10, ** p<0.05, *** p<0.01

Table 1.17 Mothers' Health Utilization Outcomes within One Year after First Birth

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A: Total Length of Stay						
Cesarean Birth	0.292***	0.112***	0.294***	0.110***	0.293***	0.111***
	(0.009)	(0.025)	(0.009)	(0.022)	(0.009)	(0.022)
Panel B: Total Number of Visits						
Cesarean Birth	0.096***	0.009	0.096***	0.007	0.094***	0.008
	(0.010)	(0.051)	(0.010)	(0.036)	(0.009)	(0.048)
Panel C: Log of Total Hospital Charges						
Cesarean Birth	0.519***	0.281***	0.513***	0.297***	0.507***	0.301***
	(0.021)	(0.031)	(0.020)	(0.026)	(0.020)	(0.024)
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

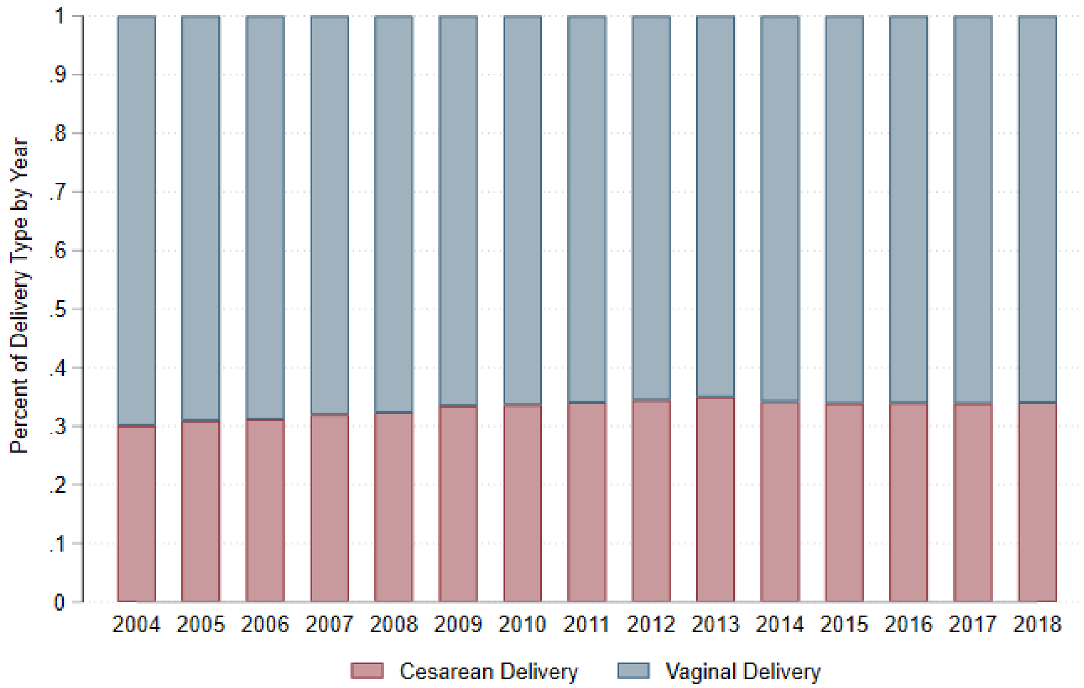
Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table 1.18 Babies' Health Utilization Outcomes within One Year after Birth

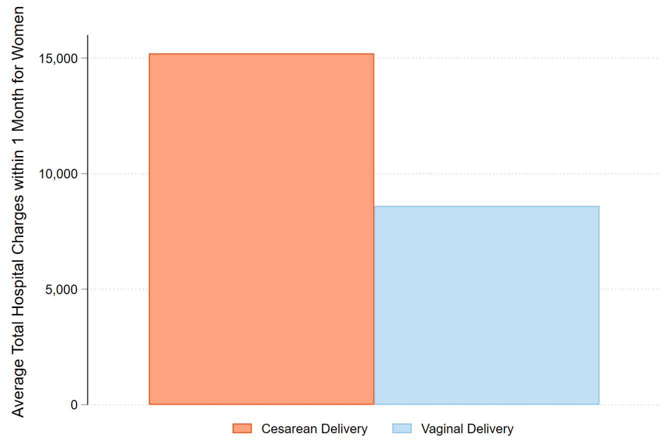
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Panel A: Total Length of Stay						
Cesarean Birth	0.279***	0.242***	0.282***	0.236***	0.281***	0.236***
	(0.011)	(0.022)	(0.011)	(0.021)	(0.011)	(0.021)
Panel B: Total Number of Visits						
Cesarean Birth	0.064***	0.020	0.060***	0.007	0.061***	0.006
	(0.015)	(0.035)	(0.012)	(0.036)	(0.011)	(0.036)
Panel C: Log of Total Hospital Charges						
Cesarean Birth	0.267***	0.233***	0.273***	0.226***	0.266***	0.229***
	(0.018)	(0.042)	(0.016)	(0.038)	(0.016)	(0.036)
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
* p<0.10, ** p<0.05, *** p<0.01

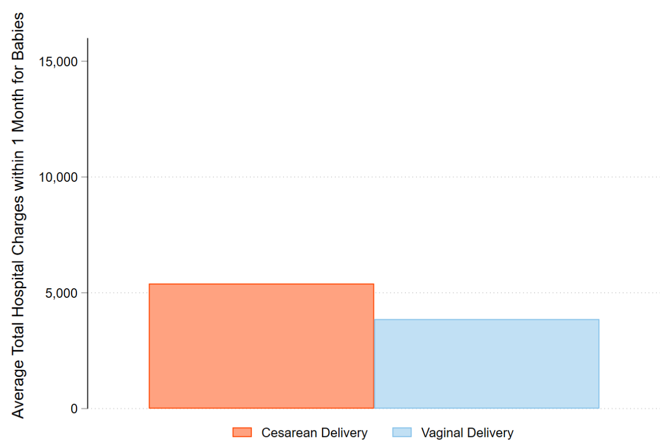


Note: The data is obtained from the South Carolina Department of Health and Environmental Control Vital Records and all-payer, uniform billing data for inpatient discharges from the South Carolina Revenue and Fiscal Affairs Office. Figures show the percent of babies by delivery type over years.

Figure 1.1: Percent of Births by Delivery Type over Years



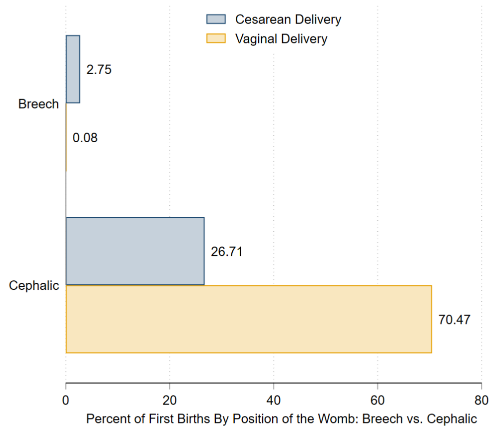
(a) Mothers



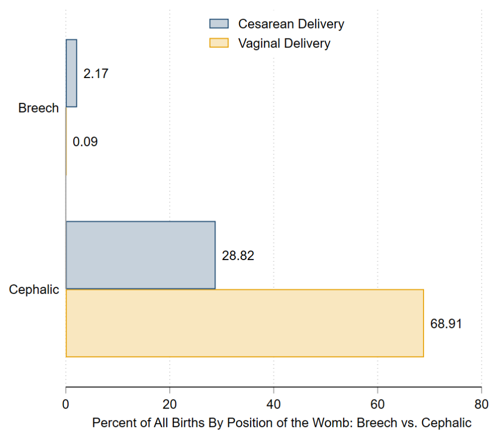
(b) Babies

Note: The data is obtained from the South Carolina Department of Health and Environmental Control Vital Records and all-payer, uniform billing data for inpatient discharges from the South Carolina Revenue and Fiscal Affairs Office. Figures show the percent of babies by delivery type over years.

Figure 1.2: Average Total Hospital Charges (in US Dollars) within 1 Month after First Births by Delivery Type



(a) First Births (N = 122,980)



(b) All Births (N = 244,032)

Note: The data is obtained from the South Carolina Department of Health and Environmental Control Vital Records and all-payer, uniform billing data for inpatient discharges from the South Carolina Revenue and Fiscal Affairs Office. Figures show the percent of babies delivered by C-section vs. naturally if they were in the breech position or in cephalic position, i.e. ideal position (head-down) for childbirth. First births are presented in Figure 1.3a, all births are presented in Figure 1.3b.

Figure 1.3: Percent of Births by Position of the Fetus and Delivery Type

Chapter 2

Which Entry Fee: That Is the Question [1]

2.1 Introduction

A contest is a game where participants exert effort to increase their probability of winning one or more prizes. There are many contests in real life which have an entry fee such as writing contests, music competitions, photography contests, marathons, dance competitions, and cooking competitions. The contest literature does not give much attention to contests with entry fees although most real-life contests have them. Moreover, contest organizers realized a long time ago that the entry fee can increase the revenue.

In this paper we experimentally investigate contests with entry fees. Based on the model of Fu, Jiao, and Lu 2015, we design an experiment to investigate how subjects' behavior and the expected total spending change with different entry fees. We consider the simplest, two - player within – subject setting, where each subject has 120 tokens (in all five treatments) and makes entry and contribution decisions for five different entry fees, and the prize value is always $V = 100$ tokens. Our experimental design provides a sharp predicted difference among the five entry fees: the theory predicts two active players in pure-strategy equilibria for low entry fees $c = 10$ and $c = 25$; mixed-strategy equilibria for medium entry fees $c = 40$ and $c = 70$; and no active players in the equilibrium for high entry fee $c = 110$. In addition, the theory predicts that the contest organizer's expected payoff or expected total equilibrium spending is

[1] Zehra Valencia with Alexander Matros.

maximized at the optimal entry fee $c = 25$. It is not feasible to test the optimal entry fee with randomized control trials, but we can test this prediction experimentally in this paper.

First, we find that theoretical equilibrium point predictions do not work for both individual participation and contributions in an experimental laboratory for all entry fees. However, the comparative statics work quite well: as the theory predicts, if the entry fee increases, then both individual participation and contributions decrease.

Second, we find that subjects spend more than the equilibrium predictions for all entry fees. This finding is consistent with experimental literature, in which most studies show significant overspending in experiments regarding theoretical predictions in contests. See, for example, Morgan, Orzen, and Sefton 2012, Fallucchi, Renner, and Sefton 2013, Sheremeta 2013, Lim, Matros, and Turocy 2014, Dechenaux, Kovenock, and Sheremeta 2015, and Sheremeta 2018.

Third, we discover under- and over- participation for low and high entry fees. On the one hand, we find that around 3% of subjects *never* gamble, which explains under-participation for low entry fees when the theory predicts full participation. On the other hand, around 13% of subjects *always* gamble, which explains over-participation for high entry fees, even if the entry fee ($c = 110$) is higher than the prize value, $V = 100$.

Finally, over-participation for high entry fees means that the designer's revenue is higher than the theoretical prediction. Indeed, we notice that medium entry fee $c = 70$ maximizes total spending in the experiment, which is different from the theoretical prediction of the low entry fee $c = 25$. This result is based on two effects: over-participation and overspending for medium entry fee c = 70. This result shows that the contest designer can increase his expected payoff by means of medium entry fees in the experiment.

We also investigated the gender differences. We find that female subjects participate more often and bid more aggressively than male subjects. However, this observation is not statistically significant.

Anderson and Stafford 2003, Boosey, Brookins, and Ryvkin 2020, and Hammond et al. 2019 study experimentally contests with entry fees. Anderson and Stafford 2003 test theoretical predictions of Gradstein 1995 using an experimental design with a variable number of players, cost heterogeneity, and a *fixed* entry fee. In the first stage, players decide whether to enter the contest and pay a fixed entry fee or not to enter. In the second stage, the contestants compete in a Tullock contest. The authors find that, consistent with theoretical predictions, cost heterogeneity and an entry fee decrease participation and effort. Our paper differs from Anderson and Stafford 2003 in two ways. First, our subjects have to make decisions about their participation and contribution at the same time. Second, and more importantly, we examine how subjects' behavior changes with different entry fees.

Boosey, Brookins, and Ryvkin 2020 experimentally test the effect of disclosing the number of active participants in contests with endogenous entry. At the first stage, participants choose between entering the contest or receiving an outside option. At the second stage, active participants choose their investment level. In the experiment, the authors manipulate the size of the outside option and the disclosure of the number of entrants at the second stage. They find more entries for lower outside options, as theory predicts. When the outside option is low, consistent with the theory, disclosing the number of entrants has no effect on aggregate investment. However, if the outside option is high, they find that there is a strong positive correlation between aggregate investment and disclosure of the number of active players. Our paper is similar to Boosey, Brookins, and Ryvkin 2020, when they do not disclose the number of entrants. However, we differ in how we model entry fees: Boosey, Brookins, and Ryvkin 2020 have the outside option, and we explicitly use entry fees. This important difference can significantly affect the experimental results due to the different framing of entry fees. This effect has been known since Kahneman and Tversky 1979. In addition, we are able to find the entry fee that maximizes total spending or the contest designer revenue. Anderson and Stafford 2003 and Boosey, Brookins, and Ryvkin 2020 do not consider this question.

Hammond et al. 2019 investigate contests with prize-augmenting entry fees both theoretically and experimentally. Moreover, their model incorporates different abilities of the players (which are their private information) and entry fees increase the winner's prize. They also investigate their theoretical predictions for a two-player case in the experimental laboratory. They set entry fees either at zero, the optimal level (the level that maximizes total effort in theory), or higher than the optimal level (three times the optimal level). They find, consistent with their theoretical predictions, that the optimal entry fee maximizes the revenue. In contrast, our optimal entry fee in the experiment is higher than the theoretical prediction. However, Hammond et al. 2019 setting is different from our model and experiment because their winner prize depends on the entry fee.

The rest of this paper is organized as follows. First, we present a theoretical model in Section 2.2. A unique equilibrium is described in which we show how entry fees affect the level of participation and individual efforts in the contest, as well as the expected payoff of the contest designer. Then, in Section 2.3, we describe our experimental design and predictions. Section 2.4 presents our main findings. Section 2.5 concludes.

2.2 Model and Predictions

This section is based on the model of Fu, Jiao, and Lu 2015. We consider only the two-player case, which is tested in our experiment. Suppose that both players 1 and 2 value the prize as $V = 100$, and there is a contest entry fee $c \geq 0$.

A strategy of each player i has two parts (p_i, x_i), where $0 \leq p_i \leq 1$ is the contest entry probability of player i and $x_i \geq 0$ is her contest contribution. If player i enters the contest, or $p_i = 1$, then she maximizes her expected payoff:

$$E\pi_i(x_i) = -c + (1 - p_j) \cdot 100 + p_j \frac{x_i}{x_1 + x_2} \cdot 100 - x_i, \tag{2.1}$$

where $i \neq j$, the first term is the entry fee, the second term is the expected payoff from winning the prize without competition, the third term is the expected payoff from winning the prize with competition, and the last term is the cost of effort.[2]

A symmetric equilibrium, (p^*, x^*), is described in the following proposition and illustrated in Figures 2.1a and 2.2a.

Suppose that $n = 2$ and $V = 100$. Then, there exists a symmetric equilibrium (p^*, x^*), where

$$p^* = \begin{cases} 1, & \text{if } 0 \leq c \leq 25, \\ \frac{100-c}{75}, & \text{if } 25 < c < V = 100, \\ 0, & \text{if } c \geq V = 100, \end{cases} \quad \text{and} \quad x^* = \begin{cases} 25, & \text{if } 0 \leq c \leq 25, \\ \frac{1}{3}(100-c), & \text{if } 25 < c < V = 100, \\ 0, & \text{if } c \geq V = 100. \end{cases}$$

The theory gives a unique symmetric equilibrium prediction for each entry fee, $c \geq 0$. In particular, if the entry fee is low, or $0 \leq c \leq 25$, then both players enter the contest for sure, $p^* = 1$, and exert the same effort, $x^* = 25$. Note that the equilibrium effort is the same for all low entry fees. If the entry fee is medium, or $25 < c < 100$, then the unique symmetric equilibrium is in mixed strategies: each player enters the contest with probability $p^* = \frac{100-c}{75}$, and exerts the same effort $x^* = \frac{1}{3}(100 - c)$. Finally, if the entry fee is high, or above the prize value, $c \geq V = 100$, then in the equilibrium both participants do not enter the contest, or $p^* = 0$.

[2]We assume that $\frac{x_i}{x_1+x_2} = \frac{1}{2}$, if $x_1 = x_2 = 0$.

The expected total equilibrium spending, or the expected payoff of the contest designer is:

$$Eu\,(c) = (p^*)^2 \times (2x^* + 2c) + 2p^*(1-p^*) \times (x^* + c) + (1-p^*)^2 \times 0, \tag{2.2}$$

where the first term is the expected payoff when both players enter the contest, the second term shows the expected payoff when exactly one player enters, and the last term gives the expected payoff when nobody enters the contest. Simplifying (2.2), we get

$$Eu\,(c) = 2p^*(x^* + c). \tag{2.3}$$

Therefore, using (2.3) and Proposition 2.2, we get the following result.

Suppose that $n = 2$ and $V = 100$. Then, the expected total equilibrium spending is

$$Eu\,(c) = \begin{cases} 2(\frac{100}{4} + c), & \text{if } 0 \leq c \leq 25, \\ \frac{8}{300}\,(100-c)\,(\frac{1}{3}\,(100-c) + c), & \text{if } 25 < c < V = 100, \\ 0, & \text{if } c \geq V = 100. \end{cases}$$

The expected total equilibrium spending is maximized at $c^* = 25$.

The contest literature usually evaluates total equilibrium spending because the contest designer typically wants to maximize it. We will also focus on the expected total spending, or the expected payoff of the designer.[3] Proposition 2.2 claims that total equilibrium spending is not monotonic in c. Moreover, total equilibrium spending is single-peaked in the entry fee, c; and entry fee $c^* = 25$ maximizes the expected total equilibrium spending. Figure 2.3a illustrates the designer's expected payoff.

[3]We consider the expected total spending instead of net spending, because the prize often cannot be taken (back) by the contest designer.

2.3 Experimental Design

We have designed a two-player experiment to test some of the comparative statics predictions developed in the previous section. Our treatment variable is the entry fee, $c > 0$. We fixed the prize value at $V = 100$ and varied the entry fee to check how the level of participation and individual efforts in the contest, as well as the expected payoff of a designer, change. The theory gives a unique equilibrium prediction for each entry fee, see Propositions 2.2 and 2.2. We consider two low entry fees, $c = 10$ and $c = 25$, two medium entry fees, $c = 40$ and $c = 70$, and a high entry fee, $c = 110$. Table 2.2 summarizes theoretical predictions for these five cases. Our experimental design provides a sharp predicted difference among the five entry fees: two active players in pure-strategy equilibria for the low entry fees; mixed-strategy equilibria for medium entry fees; and no active players in the equilibrium for the high entry fee. Additionally, the theory predicts that entry fee $c = 25$ maximizes the expected total equilibrium spending.

We conducted three experimental sessions for a total of 69 subjects in the Moore School of Business at the University of South Carolina.[4] In our experiment, two subjects with endowments of $e = 120$ tokens competed for the prize of $V = 100$ tokens. In each session, subjects were asked to make their choices of entry and contribution decisions for five different entry fees. Those entry fees were $c = 10$, $c = 25$, $c = 40$, $c = 70$, and $c = 110$ tokens. The exchange rate was 10 tokens = 1 dollar.

To test one-shot theoretical predictions, the game was repeated only two times in each session. The only information obtained by the subjects after the first round was the decision of a random pair for a particular entry fee. This entry fee was also chosen

[4]The number of subjects in each session was 25, 30, and 14, respectively. Also note that we initially had 93 subjects. However, 8 subjects did not answer some questions, and we excluded them from our observations. We also excluded 16 subjects who made at least 1 illegal bid, i.e. the sum of his/her bids and cost level was exceeding the endowments.

at random. Our approach is similar to Anderson and Stafford 2003, who conduct a one-shot game experiment.

Subjects were undergraduate students participating in our experiment for the first and only time. Table 2.1 provides descriptive statistics.[5] No subject participated in more than one experimental session. Subject interactions and decision-making were anonymous and were conducted with a pen and paper in large auditoriums at the University of South Carolina. Prior to the first round of play, subjects were given written instructions that were also read aloud in an effort to induce common knowledge of endowments, the prize, and the mechanism for winning the prize. After the instructions were read, but before the experiment, each subject had to answer four questions on a quiz about the experimental game. The quiz and instructions are given in the Appendix.

Each student received a 5-dollar Starbucks gift card for participation.[6] In addition, one pair of students was chosen at random to play for cash at the end of the session. The round and the entry fee, which determined their earnings, were selected throwing dice. Our payment scheme is what Charness, Gneezy, and Halladay 2016 called "pay only to a subset of individuals." They argue that this approach is "more effective" than "pay-all" scheme.

2.4 Experimental Findings

We present our findings in this section. First, bids are discussed. We found that average bids are (much) higher than the equilibrium bids. Secondly, we report average participation probabilities, which are different from the equilibrium probabilities.

[5]Among the 69 students, 4 of them did not complete the questionnaire. Therefore, we do not have information on their age, gender, race/ethnicity, education level and self risk assessment.

[6]This payment method was quick (we completed all experimental sessions in 50 minutes) and convenient, because Starbucks is the only coffee shop inside the business school.

Thirdly, the expected designer payoffs are discussed. We found no statistically significant difference among sessions and pooled all of them together. Finally, we discuss the differences in the participation and bidding behavior of female and male subjects. See Table 2.2 for a summary of our observations.

2.4.1 Bids

Figure 2.1a presents average bids and equilibrium predictions across treatments. Average bids are significantly higher than equilibrium predictions for each entry fee. This finding is consistent with the overspending in contest experiments for zero entry fees. See, for example, Sheremeta 2013. Figure 2.1b shows the difference between average bids and equilibrium predictions for each treatment in each round. This difference increases from the first round to the second in all sessions.

We find that several subjects use "natural" decision rules. In particular, 5 participants (7%) in the first round and 6 subjects (9%) in the second round always bid the same amount in all treatments. We also find that 5 participants (7%) in the first round and 7 subjects (10%) in the second round always spend the same amount (entry fee plus bid) in all treatments.

In order to compare how different entry fees affect subjects' bids, we estimate an OLS regression model for the bidding decision, with entry fee dummies[7] and a vector of subject-level controls which include age, education level, race and ethnicity, number of correct answers in quizzes and subjects' self risk assessment.[8] We find that the theoretical comparative statics results hold in the experiment: higher entry fees lead to lower average bids.

Table 2.3 reports results for estimated models. Model (1) is our base model without controls. Based on results of model (1), the average bid is 40.82 tokens when the

[7]Our reference entry fee is 10.

[8]This is a categorical variable that varies from 0 (not at all willing to take risks) to 10 (very willing to take risks). See also Dohmen et al. 2011.

entry fee is 10 tokens (base group), which is significantly higher than the equilibrium prediction of 25 tokens. In addition, the average bid in the base group is significantly higher than average bids for all other entry fees. In particular, average bids are about 6.1; 10.4; 17.3; and 35 tokens lower for entry fees 25; 40; 70; and 110.[9] Models (2), (3), and (4) include demographic controls, number of correct answers in quizzes, and risk attitudes. Our findings are robust to these specifications. In summary,

Result 1

(i) **Overspending:** Average bids are significantly higher than theoretical predictions for all entry fees.

(ii) **Comparative statics:** Higher entry fees result in significantly lower average bids.

We also investigate gender differences. We observe that, subject to participation in the contest, females bid more aggressively in all rounds, see Table 2.5 and Figure 2.4. Our findings are similar to Morgan, Orzen, and Sefton 2012 and Hammond et al. 2019, who also find that females make worse expenditure decisions in contests.

2.4.2 Participation Probabilities

Figure 2.2a presents average participation probabilities and the equilibrium predictions. Figure 2.2b shows the differences between participation probabilities and equilibrium predictions for each treatment in each round. We find significant under-participation when the entry fees are low (10 and 25) and significant over-participation when the entry fees are high (70 and 110).[10] How can these observations be explained?

[9]Mean bids are lower when entry fee is 40 than entry fee is 25 ($p = 0.0048$, the Wald test), it is lower when entry fee is 70 than entry fee is 40 ($p = 0.0000$), and it is lower when entry fee is 110 than entry fee is 70 ($p = 0.0000$). All other pairwise comparisons are available upon request.

[10]All differences are significant at 1 percent level.

It might be the case that each subject believes that other subjects would enter the contest when the entry fee is low, and would not enter when the entry fee is high. It turns out that 3 subjects (4.3%) in the first round and 5 subjects (7.3%) in the second round *never* enter the contest (or *never* gamble) for *any* entry fee, which explains the under-participation for low entry fees. At the same time, 12 subjects (17.4%) in the first round and 20 subjects (29.9%) in the second round *always* enter the contest (or *always* gamble) for *any* entry fee, which explains the over-participation for high entry fees. These results demonstrate that point predictions do not hold for participation probabilities. However, the theoretical comparative statics results hold in the experiment: higher entry fees lead to lower participation probabilities.

Table 2.4 show the estimated marginal effects of a Probit regression model for the participation decision. Model (1) is our base model without controls, model (2) controls for demographics (age, education level, race and ethnicity), model (3) controls for the number of correct answers, and model (4) controls for self risk assessments. Our findings are robust to these specifications. As illustrated by Figure 2.2a, we find a significant negative effect on the probability of participation when entry fee increases from 10 to other entry fee values.[11] In summary,

Result 2

(i) **Under- and Over- participation:** There is significant under-participation for low entry fees and significant over-participation for high entry fees.

(ii) **Comparative statics:** Higher entry fees result in significantly lower participation probabilities.

[11] Mean entry probabilities are lower when entry fee is 40 than entry fee is 25 ($p = 0.0001$, the Wald test), it is lower when entry fee is 70 than entry fee is 40 ($p = 0.0000$), and it is lower when entry fee is 110 than entry fee is 70 ($p = 0.0000$). All other pairwise comparisons are available upon request.

We investigated gender differences in participation probabilities as well. Our results are not statistically significant, but we have suggestive evidence that females participate more often than males, no matter what the entry fee is. See Table 2.5 and Figure 2.5.

2.4.3 Expected Total Spending

Which entry fee maximizes total spending? The theory predicts that higher entry fees (in an equilibrium) lead to lower participation and lower bids. It is not obvious which effect is stronger: more money in advance (higher entry fee) and less money later (lower participation and bids), or less money in advance (lower entry fee) and more money later (higher participation and bids). However, Proposition 2.2 specifies the entry fee that maximizes the expected designer payoff. This entry fee is $c = 25$ in theory. Figure 2.3a shows the experimental and theoretical expected total spending. Note that the expected total spending is significantly higher than the theoretical prediction in all cases, except for the optimal entry fee, $c = 25$. We find that the entry fee of 70 tokens maximizes the designer's expected payoff, which is different from the theoretical prediction. This result is based on two effects: over-participation (see Result 2) and overspending (see Result 1) for the medium entry fee $c = 70$. Figure 2.3b presents the difference between the expected designer's payoffs and theoretical predictions for each entry fee in every round. This difference increases as we move from the optimal entry fee $c = 25$ to the high entry fee $c = 110$. We also find over-dissipation when entry fees are equal to or greater than $c = 25$, or when the expected total spending exceeds the value of the prize. This is a surprising observation for two-player contests. Usually, at least four players are necessary in order to observe over-dissipation in an experimental laboratory in a contest without entry fees. See Lim, Matros, and Turocy 2014. Our result demonstrates that the contest designer can increase his expected payoff by means of medium or high entry fees.

Result 3

(i) The expected payoff of the designer in the experiment coincides with the theoretical prediction if the entry fee maximizes his theoretical expected payoff or $c = 25$. For all other entry fees, the expected total spending is significantly higher than theoretical predictions.

(ii) The entry fee of $c = 40$ maximizes the designer's expected payoff.

(iii) There is over-dissipation for entry fees equal to or greater than c = 25.

2.5 Conclusion

Many contests do not have entry fees. However, more and more contest organizers introduce entry fees in their competitions in order to increase profits. A typical example is Eyelands Short Story Contests. They did not have an entry fee before 2016. Now, they charge a 10 euros fee for participation.[12]

In this paper, contests with entry fees are analyzed. We find that the contest designer can increase the expected payoff in the experiment by increasing the theoretically optimal entry fee. This experimental finding is due to over-participation and over-bidding for medium entry fees. Future research is needed to characterize optimal entry fees in experiments. This will be important for all contest organizers.

[12] See this example at https://eyelandsawards.com/

Table 2.1 Descriptive Statistics

Variable	All Sections Mean	All Sections Std. Dev.	Section 1 Mean	Section 1 Std. Dev.	Section 2 Mean	Section 2 Std. Dev.	Section 3 Mean	Section 3 Std. Dev.
Age	19.52	1.18	19.74	1.07	19.43	1.15	19.36	1.35
Dohmen Risk	6.18	1.81	6.3	1.73	6.14	1.83	6.07	1.91
Female	0.37	0.48	0.43	0.5	0.32	0.47	0.36	0.48
African-American	0.08	0.27	0.13	0.34	0.07	0.26	0	0
Asian	0.18	0.39	0.13	0.34	0.21	0.41	0.21	0.41
White	0.74	0.44	0.74	0.44	0.71	0.45	0.79	0.41
Freshman	0.45	0.5	0.3	0.46	0.54	0.5	0.5	0.5
Junior	0.23	0.42	0.39	0.49	0.14	0.35	0.14	0.35
Senior	0.02	0.12	0	0	0	0	0.07	0.26
Sophomore	0.31	0.46	0.3	0.46	0.32	0.47	0.29	0.45
# of Correct Answers	2.72	0.87	2.76	0.91	2.7	0.82	2.71	0.88

Table 2.2 Average Bids and Participation Probabilities

	Bids	N.E. Bids	Participation Probabilities	N.E. Participation Probabilities	Designer's Expected Payoff	N.E. Designer's Expected Payoff
				All		
c=10	40.82	25	0.9	1	92.31	70
c =25	34.69	25	0.75	1	97.76	100
c =40	30.42	20	0.73	0.8	108.32	96
c = 70	23.55	10	0.54	0.4	111.51	64
c = 110	5.79	0	0.38	0	106.72	0
				Round 1		
c=10	34.63	25	0.93	1	80.26	70
c =25	31.16	25	0.71	1	83.39	100
c =40	25.31	20	0.7	0.8	95.65	96
c = 70	22.9	10	0.45	0.4	93.18	64
c = 110	5.96	0	0.35	0	87.72	0
				Round 2		
c=10	47.43	25	0.87	1	104.35	70
c =25	37.84	25	0.8	1	112.14	100
c =40	35.04	20	0.77	0.8	120.99	96
c = 70	24.02	10	0.62	0.4	129.84	64
c = 110	5.64	0	0.41	0	125.72	0

Table 2.3 The Effect of Costs on Bids

	(1)	(2)	(3)	(4)
c = 25	-6.130**	-5.493**	-5.411**	-5.578**
	(2.351)	(2.372)	(2.358)	(2.340)
c = 40	-10.407***	-10.594***	-10.504***	-10.638***
	(3.073)	(3.247)	(3.255)	(3.233)
c = 70	-17.269***	-18.452***	-18.576***	-18.783***
	(3.604)	(3.719)	(3.719)	(3.780)
c = 110	-35.034***	-32.782***	-32.988***	-33.331***
	(3.962)	(4.497)	(4.412)	(4.612)
Constant	40.823	111.551	115.764	107.926
	(4.032)	(80.230)	(80.332)	(86.531)
Demographics	No	Yes	Yes	Yes
Correct Answers	No	No	Yes	Yes
Self Risk	No	No	No	Yes
R-Squared	0.123	0.167	0.170	0.171
Observations	455	418	418	418

Standard errors in parentheses
Standard errors are robust and clustered at the student level.
OLS regression results.
* p<0.10, ** p<0.05, *** p<0.01

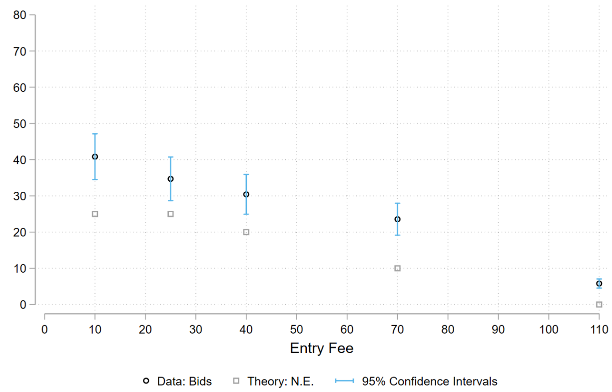
Table 2.4 The Effect of Costs on Participation Probabilities

	(1)	(2)	(3)	(4)
c = 25	-0.210***	-0.217***	0.217***	0.216***
	(0.047)	(0.050)	(0.050)	(0.050)
c = 40	-0.233***	-0.259***	-0.259***	-0.261***
	(0.052)	(0.054)	(0.053)	(0.054)
c = 70	-0.468***	-0.469***	-0.474***	
	(0.061)	(0.063)	(0.064)	(0.064)
c = 110	-0.566***	-0.629 ***	-0.630***	-0.637***
	(0.072)	(0.077)	(0.076)	(0.078)
Demographics	No	Yes	Yes	Yes
Correct Answers	No	No	Yes	Yes
Self Risk	No	No	No	Yes
Observations	690	650	650	650

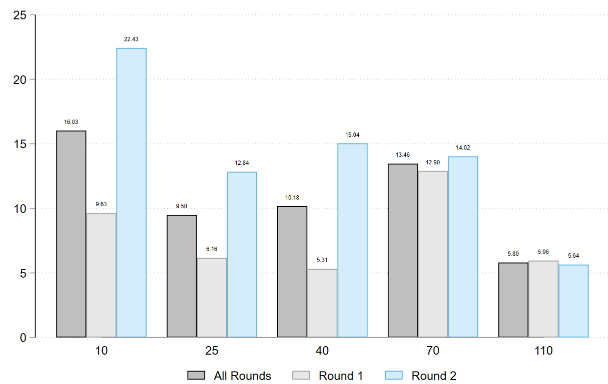
Standard errors in parentheses
Standard errors are robust and clustered at the student level.
Probit regression results.
Columns report marginal effects of a Probit regression model.
* p<0.10, ** p<0.05, *** p<0.01

Table 2.5 Average Bids and Participation Probabilities by Gender

	ALL		Round 1		Round 2	
	Female	Male	Female	Male	Female	Male
Entry Fee			c=10			
Bids	44.07	38.12	35.65	34.49	53.29	41.86
N.E. Bids	25	25	25	25	25	25
Participation Prob.	0.92	0.89	0.96	0.9	0.88	0.88
N.E. Participation Prob.	1	1	1	1	1	1
Entry Fee			c=25			
Bids	35.5	34.93	28.74	34.41	41.62	35.39
N.E. Bids	25	25	25	25	25	25
Participation Prob.	0.83	0.71	0.79	0.66	0.88	0.76
N.E. Participation Prob.	1	1	1	1	1	1
Entry Fee			c=40			
Bids	28.88	30.89	21.84	29.6	35.24	32.04
N.E. Bids	20	20	20	20	20	20
Participation Prob.	0.83	0.65	0.79	0.61	0.88	0.68
N.E. Participation Prob.	0.8	0.8	0.8	0.8	0.8	0.8
Entry Fee			c=70			
Bids	20.73	25.1	19	26.47	21.81	24.09
N.E. Bids	10	10	10	10	10	10
Participation Prob.	0.54	0.49	0.42	0.41	0.67	0.56
N.E. Participation Prob.	0.4	0.4	0.4	0.4	0.4	0.4
Entry Fee			c=110			
Bids	7.1	5.58	8.13	5.25	6.42	5.92
N.E. Bids	0	0	0	0	0	0
Participation Prob.	0.42	0.29	0.33	0.29	0.5	0.29
N.E. Participation Prob.	0	0	0	0	0	0

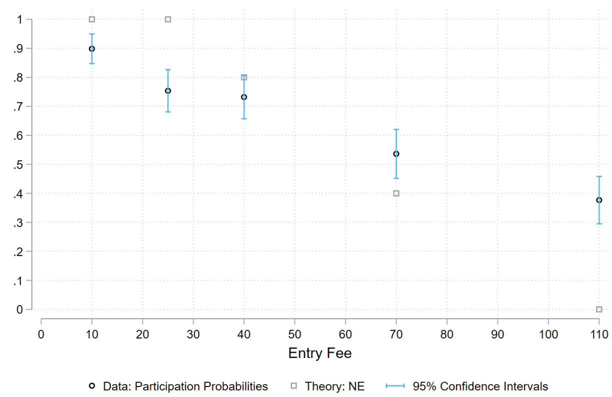


(a) All Rounds - Bids

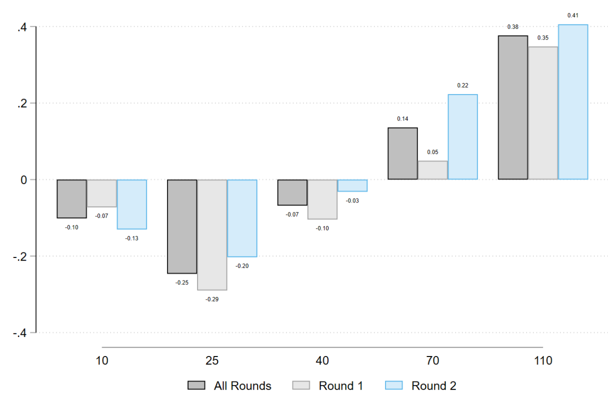


(b) Difference Between Data and Predictions

Figure 2.1: Average Bids

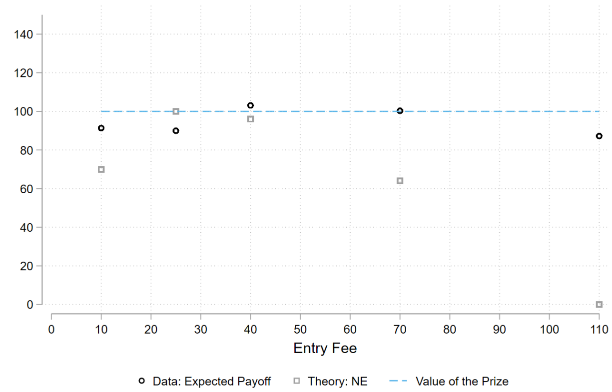


(a) All Rounds - Participation Probabilities

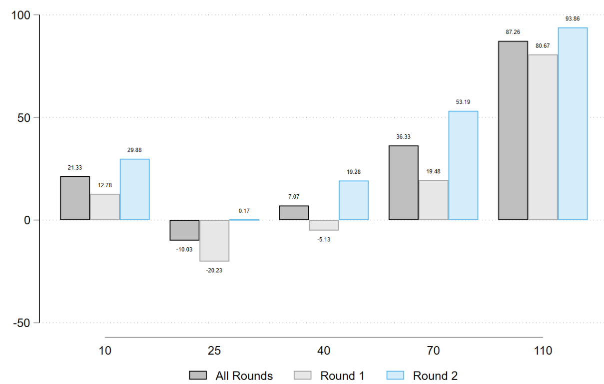


(b) Difference Between Data and Predictions

Figure 2.2: Average Participation Probabilities

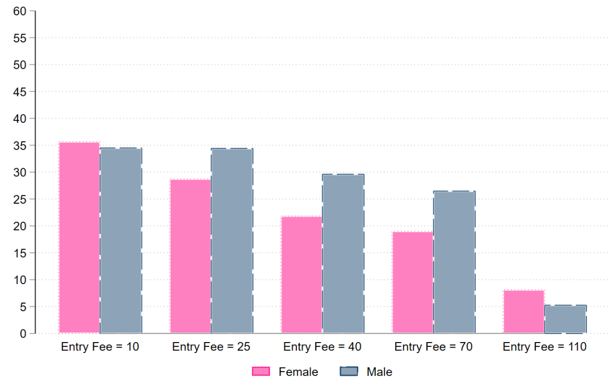


(a) All Rounds

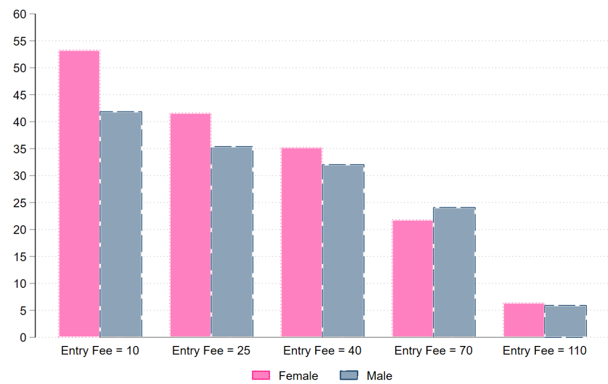


(b) Difference Between Data and Predictions

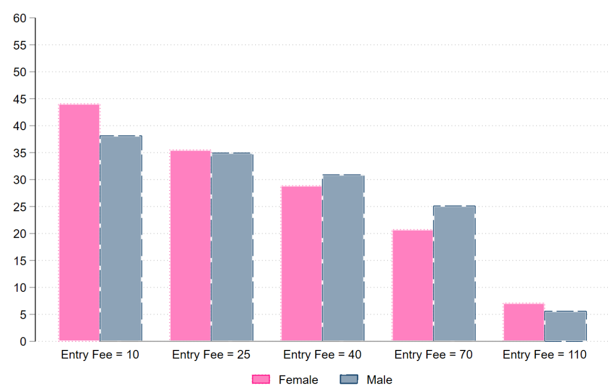
Figure 2.3: Designer's Expected Payoff



(a) Round 1

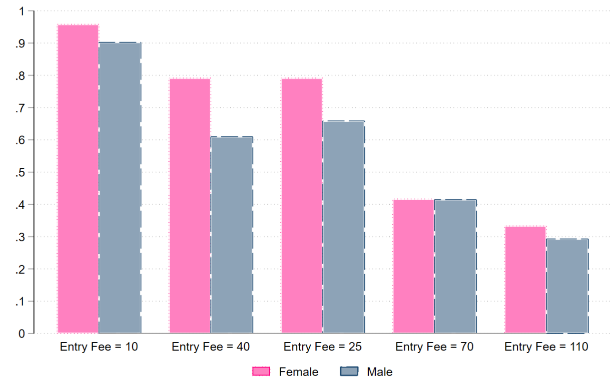


(b) Round 2

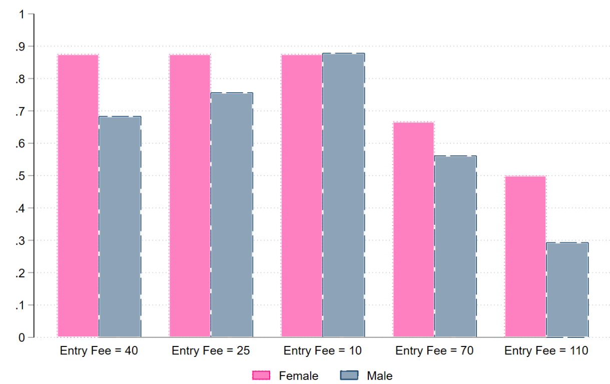


(c) All Rounds

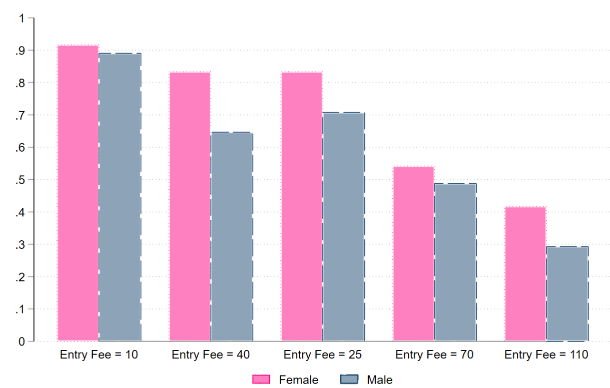
Figure 2.4: Gender Differences in Average Bids



(a) Round 1



(b) Round 2



(c) All Rounds

Figure 2.5: Gender Differences in Average Participation Probabilities

Bibliography

Agency for Healthcare Research and Quality (2001). *Primary Diagnosis*. URL: ushik.ahrq.gov/.

Amasha, Hadayat A and Malak S Jaradeh (2014). "Effect of Active and Passive Smoking During Pregnancy on its Outcomes". In:

American College of Obstetricians and Gynecologists (2019). *If Your Baby Is Breech*. URL: www.acog.org/womens-health/faqs/if-your-baby-is-breech.

— (2020). *Cesarean Birth*. URL: www.acog.org/womens-health/faqs/cesarean-birth.

America's Health Rankings (2018). *America's Health Rankings 29th Annual Report*. URL: www.americashealthrankings.org.

Anderson, Lisa and Sarah Stafford (2003). "An experimental analysis of rent seeking under varying competitive conditions". In: *Public Choice* 115.1-2, pp. 199–216.

Angrist, Joshua D and Guido W Imbens (1994). "Identification and Estimation of Local Average Treatment Effects". In: *Econometrica* 62, pp. 467–475.

Angrist, Joshua D and Jörn-Steffen Pischke (2008). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Blustein, Jan and Jianmeng Liu (2015). "Time to Consider the Risks of Caesarean Delivery for Long Term Child Health". In: *Bmj* 350.

Boosey, Luke, Philip Brookins, and Dmitry Ryvkin (2020). "Information disclosure in contests with endogenous entry: an experiment". In: *Management Science, forthcoming*.

Cammu, Hendrik et al. (2014). "Common Determinants of Breech Presentation at Birth in Singletons: A Population-Based Study". In: *European Journal of Obstetrics & Gynecology and Reproductive Biology* 177, pp. 106–109.

Card, David, Alessandra Fenizia, and David Silver (2019). *The Health Impacts of Hospital Delivery Practices*. Tech. rep. National Bureau of Economic Research.

CDC (2020). *Births - Method of Delivery*. URL: www.cdc.gov/nchs/fastats/delivery.htm.

CDC (2020). *Depression Among Women*. URL: www.cdc.gov/reproductivehealth/depression/index.htm.

Charness, Gary, Uri Gneezy, and Brianna Halladay (2016). "Experimental methods: pay one or pay all". In: *Journal of Economic Behavior & Organization* 131, pp. 141–150.

Clements, Julie (2019). *Reporting Secondary Diagnosis – Some Key Considerations*. URL: www.outsourcestrategies.com/blog/reporting-secondary-diagnosis-some-key-considerations.html.

Coco, Andrew S and Stephanie D Silverman (1998). "What Can I Do if My Baby is Breech?" In: *American Family Physician* 58.3, p. 744.

Costa-Ramón, Ana et al. (2020). "The Long-Run Effects of Cesarean Sections". In: *Journal of Human Resources*, 0719–10334R1.

Costa-Ramón, Ana María et al. (2018). "It's About Time: Cesarean Sections and Neonatal Health". In: *Journal of Health Economics* 59, pp. 46–59.

Cunningham, F. Gary et al. (2009). *Williams Obstetrics: 23rdndEdition*. 23rd ed. McGraw-Hill Professional. ISBN: 0071497013,9780071497015.

Currie, Janet and W Bentley MacLeod (2008). "First Do No Harm? Tort Reform and Birth Outcomes". In: *The Quarterly Journal of Economics* 123.2, pp. 795–830.

Dechenaux, Emmanuel, Dan Kovenock, and Roman Sheremeta (2015). "A survey of experimental research on contests, all-pay auctions and tournaments". In: *Experimental Economics* 18.4, pp. 609–669.

Dohmen, Thomas et al. (2011). "Individual risk attitudes: measurement, determinants, and behavioral consequences". In: *Journal of the European Economic Association* 9.3, pp. 522–550.

Eisenach, James C et al. (2008). "Severity of Acute Pain After Childbirth, but not Type of Delivery, Predicts Persistent Pain and Postpartum Depression". In: *Pain* 140.1, pp. 87–94.

Enkin, Murray, Marc JNC Keirse, and Neilson (1995). *A Guide to Effective Care in Pregnancy and Childbirth*. Oxford University Press.

Fallucchi, Francesco, Elke Renner, and Martin Sefton (2013). “Information feedback and contest structure in rent-seeking games”. In: *European Economic Review* 64, pp. 223–240.

Fu, Qiang, Qian Jiao, and Jingfeng Lu (2015). “Contests with endogenous entry”. In: *International Journal of Game Theory* 44.2, pp. 387–424.

Gibbons, Luz et al. (2010). “The Global Numbers and Costs of Additionally Needed and Unnecessary Caesarean Sections Performed Per Year: Overuse as a Barrier to Universal Coverage”. In: *World Health Report* 30.1, pp. 1–31.

Gradstein, Mark (1995). “Intensity of competition, entry and entry deterrence in rent seeking contests”. In: *Economics & Politics* 7.1, pp. 79–91.

Gruber, Jon, John Kim, and Dina Mayzlin (1999). “Physician Fees and Procedure Intensity: The Case of Cesarean Delivery”. In: *Journal of Health Economics* 18.4, pp. 473–490.

Gruber, Jonathan and Maria Owings (1996). “Physician Financial Incentives and Cesarean Section Delivery”. In: *Rand Journal of Economics* 27, pp. 99–123.

Halla, Martin et al. (2020). “Cutting Fertility? Effects of Cesarean Deliveries on Subsequent Fertility and Maternal Labor Supply”. In: *Journal of Health Economics*, p. 102325.

Hammond, Robert G et al. (2019). “Enhancing Effort Supply With Prize-Augmenting Entry Fees: Theory And Experiments”. In: *International Economic Review* 60.3, pp. 1063–1096.

Hargraves, John and Aaron Bloschichak (2019). “International Comparisons of Health Care Prices from the 2017 IFHP Survey”. In: *Health Care Cost Institute Report*.

Jauniaux, Eric and William A. Grobman (Apr. 2016). “Caesarean Section: Introduction to the ‘World’s No. 1’ Surgical Procedure”. In: *Textbook of Caesarean Section*. Oxford, UK: Oxford University Press. ISBN: 9780191818455. DOI: `10.1093/med/9780198758563.003.0001`. URL: `oxfordmedicine.com/view/10.1093/med/9780198758563.001.0001/med-9780198758563-chapter-1`.

Jensen, Vibeke Myrup and Miriam Wüst (2015). “Can Caesarean Section Improve Child and Maternal Health? The Case of Breech Babies”. In: *Journal of Health Economics* 39, pp. 289–302.

Kahneman, Daniel and Amos Tversky (1979). "Prospect theory: an analysis of decision under risk". In: *Econometrica* 47.2, pp. 263–291.

Kjerulff, Kristen H. et al. (Apr. 2020). "Association Between Mode of First Delivery and Subsequent Fecundity and Fertility". In: *JAMA Network Open* 3.4, e203076–e203076. ISSN: 2574-3805. DOI: 10.1001/jamanetworkopen.2020.3076. eprint: jamanetwork.com/journals/jamanetworkopen/articlepdf/2764595/kjerulff_2020_oi_200149.pdf. URL: doi.org/10.1001/jamanetworkopen.2020.3076.

Koroukian, Siran M (2004). "Relative Risk of Postpartum Complications in the Ohio Medicaid Population: Vaginal Versus Cesarean Delivery". In: *Medical Care Research and Review* 61.2, pp. 203–224.

Kristensen, Kim and Lonny Henriksen (2016). "Cesarean Section and Disease Associated with Immune Function". In: *Journal of Allergy and Clinical Immunology* 137.2, pp. 587–590.

Lim, Wooyoung, Alexander Matros, and Theodore Turocy (2014). "Bounded rationality and group size in Tullock contests: experimental evidence". In: *Journal of Economic Behavior & Organization* 99, pp. 155–167.

MacFarlane, Alison J et al. (2016). "Wide Differences in Mode of Delivery within Europe: Risk-Stratified Analyses of Aggregated Routine Data from the Euro-Peristat Study". In: *BJOG: An International Journal of Obstetrics & Gynaecology* 123.4, pp. 559–568.

Morgan, John, Henrik Orzen, and Martin Sefton (2012). "Endogenous entry in contests". In: *Economic Theory* 51.2, pp. 435–463.

Mühlrad, Hanna (2020). *Cesarean Sections for High-Risk Births: Health, Fertility, and Labor Market Outcomes*. Tech. rep. Lund University Department of Economics working paper.

Nicoletti, Betsy (2014). *Diagnosis Coding: Why It Is So Important*. URL: www.physicianspractice.com/view/diagnosis-coding-why-it-so-important.

Peterson, Caroline (2010). "Are Race and Ethnicity Risk Factors for Breech Presentation?" In: *Journal of Obstetric, Gynecologic & Neonatal Nursing* 39.3, pp. 277–291.

Sheremeta, R (2018). "Impulsive behavior in competition: Testing theories of overbidding in rent-seeking contests". In: *Available at SSRN 2676419*.

Sheremeta, Roman (2013). “Overbidding and heterogeneous behavior in contest experiments”. In: *Journal of Economic Surveys* 27.3, pp. 491–514.

Sparks, Dana (2018). *Women’s Wellness: Postpartum Complications Can Affect Long-Term Health*. URL: newsnetwork.mayoclinic.org/discussion/womens-wellness-postpartum-complications-can-affect-long-term-health/.

Stanford Children’s Health (2020). *Transient Tachypnea of the Newborn*. URL: www.stanfordchildrens.org/en/topic/default?id=transient-tachypnea-of-the-newborn-90-P02420.

The Lancet (2018). *Optimising Caesarean Section Use*. URL: www.thelancet.com/series/caesarean-section.

The University of Michigan, Michigan Medicine Healthwise Staff (2019). *Breech Position and Breech Birth*. URL: www.uofmhealth.org/health-library/hw179937.

Tikkanen, Roosa et al. (2018). *Maternal Mortality and Maternity Care in the United States Compared to 10 Other Developed Countries*. URL: www.commonwealthfund.org/publications/issue-briefs/2020/nov/maternal-mortality-maternity-care-us-compared-10-countries.

Tonei, Valentina (2019). “Mother’s Mental Health After Childbirth: Does the Delivery Method Matter?” In: *Journal of Health Economics* 63, pp. 182–196.

Truven Health Analytics (2013). “Catalyst for Payment Reform”. In: *Center for Healthcare Quality and Payment Reform*.

Wooldridge, Jeffrey M (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Appendix A

Supplementary Tables Chapter 1

Table A.1 ICD codes (WHOs International Classification System for Diseases)

Diagnosis / Procedures	ICD-9	ICD-10
Planned Cesarean Birth	O7582	64981 - 64982
Obesity	278	E65-E68
Postpartum Depression	648.44	F53
Complication of the Puerperium	670-677	O85-O92
Asthma	493	J45-J46
Atopic Dermatitis and Related Cond.	691	L20, J30.1-J30.4
		J30.8, J30.9
Diseases of the Respiratory System	460–519	J00–J99
Endocrine, Nutritional and		
Metabolic Diseases, and Immunity Disorders	240-279	E00-E89

Table A.2 Any Abnormal Conditions at Birth - All Births

	(1)	(2)	(3)	(4)	(5)	(6)
	LPM	2SLS	LPM	2SLS	LPM	2SLS
Cesarean Birth	0.031***	0.058***	0.033***	0.056***	0.030***	0.054***
	(0.007)	(0.016)	(0.007)	(0.015)	(0.006)	(0.015)
R-Squared	0.008	0.006	0.033	0.031	0.036	0.034
Observations	235,182	235,182	235,182	235,182	235,182	235,182
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table A.3 Fertility Outcomes - All Births

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Panel A: Total Number of Babies						
Cesarean Birth	-0.444***	-0.346***	-0.437***	-0.350***	-0.301***	-0.232***
	(0.013)	(0.025)	(0.013)	(0.023)	(0.010)	(0.021)
R-Squared	0.133	0.132	0.141	0.140	0.220	0.219
Observations	235,182	235,182	235,182	235,182	235,182	235,182
Panel B: Does Mother Have More Than 1 Baby (1/0)?						
Cesarean Birth	-0.119***	-0.104***	-0.117***	-0.105***	-0.073***	-0.065***
	(0.005)	(0.010)	(0.005)	(0.010)	(0.003)	(0.009)
R-Squared	0.089	0.088	0.094	0.094	0.166	0.166
Observations	235,182	235,182	235,182	235,182	235,182	235,182
Panel C: Time Gap Between First and Second Baby						
Cesarean Birth	2.924***	4.050***	2.968***	4.035***	4.610***	4.539***
	(0.226)	(0.574)	(0.232)	(0.559)	(0.209)	(0.647)
R-Squared	0.050	0.050	0.053	0.053	0.134	0.134
Observations	193,105	193,105	193,105	193,105	193,105	193,105
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table A.4 Babies' Health Outcomes within One Year after Birth - All Births

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A1: Are Any of the Baby's Diagnoses Obesity (1/0)?						
Cesarean Birth	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel A2: How Many Total Diagnoses Obesity?						
Cesarean Birth	-0.000	-0.000***	-0.000	-0.000***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B1: Are Any of the Baby's Diagnoses Immunity (1/0)?						
Cesarean Birth	0.006***	0.005	0.006***	0.004	0.005***	0.003
	(0.001)	(0.004)	(0.001)	(0.003)	(0.001)	(0.004)
Panel B2: How Many Total Diagnoses Immunity Related?						
Cesarean Birth	0.006***	0.003	0.007***	0.001	0.006***	-0.001
	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Observations	118,093	118,093	118,093	118,093	118,093	118,093
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses
Standard errors are robust and clustered at the hospital level.
* p<0.10, ** p<0.05, *** p<0.01

Table A.5 Babies' Health Outcomes within One Year after Birth - All Births (cont.)

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A1: Are Any of the Baby's Diagnoses Asthma (1/0)?						
Cesarean Birth	0.001	0.001	0.001	0.001	0.000	0.001
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Panel A2: How Many Total Diagnoses Asthma?						
Cesarean Birth	0.000	-0.003	0.000	-0.003	-0.000	-0.004
	(0.001)	(0.004)	(0.001)	(0.004)	(0.001)	(0.004)
Panel B1: Are Any of the Baby's Diagnoses Respiratory (1/0)?						
Cesarean Birth	0.007***	0.001	0.009***	-0.003	0.013***	-0.000
	(0.002)	(0.010)	(0.002)	(0.010)	(0.002)	(0.010)
Panel B2: How Many Total Diagnoses Respiratory?						
Cesarean Birth	0.014***	-0.006	0.018***	-0.012	0.024***	-0.009
	(0.004)	(0.019)	(0.004)	(0.019)	(0.004)	(0.020)
Observations	118,093	118,093	118,093	118,093	118,093	118,093
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Table A.6 Babies' Health Utilization Outcomes within One Year after Birth - All Births

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Panel A: Total Length of Stay						
Cesarean Birth	0.291***	0.288***	0.298***	0.280***	0.295***	0.277***
	(0.010)	(0.022)	(0.010)	(0.020)	(0.010)	(0.020)
Panel B: Total Number of Visits						
Cesarean Birth	0.069***	0.040	0.076***	0.022	0.082***	0.022
	(0.010)	(0.035)	(0.010)	(0.033)	(0.010)	(0.033)
Panel C: Log of Total Hospital Charges						
Cesarean Birth	0.198***	0.224***	0.203***	0.219***	0.277***	0.286***
	(0.018)	(0.040)	(0.017)	(0.036)	(0.016)	(0.035)
All Controls	YES	YES	YES	YES	YES	YES
Hospital FE	NO	NO	YES	YES	YES	YES
Month-Year FE	NO	NO	NO	NO	YES	YES

Standard errors in parentheses

Standard errors are robust and clustered at the hospital level.

* p<0.10, ** p<0.05, *** p<0.01

Appendix B

Experimental Instructions Chapter 2

Quiz

QUESTION 1:

In the end of each round, I will randomly choose 2 students and reveal their decision information. Imagine that both students choose "Participate". *Student I* buys 60 lottery tickets and *student II* buys 40 lottery tickets. What is the probability that *student II* (who bought 40 lottery tickets) will win the lottery?

My answer: . . . .

QUESTION 2:

In the end of each round, I will randomly choose 2 students and reveal their decision information. Imagine that *student I* chooses "Participate" and buys zero lottery tickets; and *student II* chooses "NOT Participate". Suppose that the Entry Fee is 10 tokens. Who will win the lottery?

My answer: . . . .

QUESTION 3:

In the end of each round, I will randomly choose 2 students and reveal their decision information. Imagine that *student I* chooses "Participate" and buys zero lottery tickets; and *student II* chooses "NOT Participate". Suppose that the Entry Fee is 10 tokens. What is the payoff of *student II* ?

My answer: . . . .

QUESTION 4:

In the end of each round, I will randomly choose 2 students and reveal their decision information. Imagine that *student I* chooses "Participate" and buys zero lottery tickets; and *student II* chooses "NOT Participate". Suppose that the Entry Fee is 10 tokens. What is the payoff of *student I*?

My answer: . . . .

Experimental Instructions[1]

Welcome! This is an experiment in strategic decision making. You get a $5 gift card from Starbucks for participating!

In addition, you can earn money for decisions you make in the experiment! Please do NOT communicate with other people during the experiment. If you have a question, please raise your hand so that I can answer you in private.

Steps in the experiment are as follows:

Step 1: Before starting the experiment, you will be asked to fill out a short questionnaire.

Step 2: Before the experiment, you will have a quiz that will NOT affect your grade.

Step 3: Experiment.

The experimental currency - tokens. The exchange rate is 1 token = 10 cents.

This means that 10 tokens = 1 dollar, 100 tokens = 10 dollars.

The experiment consists of a sequence of two **identical** rounds.

You make your choice on different papers each round. At the end of first round, I will randomly select two students (a pair) and reveal their choices.

[1]Please see *here* for complete experimental instructions.

Endowment

You will begin each round with an **endowment of 120 tokens**. You can use any number of tokens from 0 and 120 to buy lottery tickets in this round. Details will be explained below.

Structure of a round

In each round all students will be randomly paired and each one of you will choose **one** of the two options: ***Option A: "Participate"*** and ***Option B: "NOT Participate"***.

IF YOU CHOSE TO PARTICIPATE...

What is the Probability that You Will Win the Lottery?

After all students decide on the number of lottery tickets, the outcome of each lottery will be determined. Remember, there are only 2 participants in each lottery.

The probability that you win the lottery is:

$$\frac{Number\ of\ your\ lottery\ tickets}{Number\ of\ your\ lottery\ tickets\ +\ Number\ of\ your\ opponent's\ lottery\ tickets}$$

Notes:

- If both of you are **active** and if you both buy **zero** lottery tickets, then each of you will win the lottery prize with same probability, which is 50%.
- If you are the only **active** player in your pair, you will be the winner, even if you have bought **zero** lottery tickets.

Example 1:

Suppose that you and your opponent are both active. If you buy 10 lottery tickets and your opponent buys 90 lottery tickets, then the probability that you win the lottery is:

$$\frac{10}{10\ +\ 90} = \frac{10}{100} = 0.1 = 10\%$$

In other words, 10 out of 100 times you win the lottery.

Example 2:

Suppose that you and your opponent are both active. If you buy 70 lottery tickets and your opponent buys 30 lottery tickets, then the probability that you win the lottery is:

$$\frac{70}{70\ +\ 30} = \frac{70}{100} = 0.7 = 70\%$$

In other words, 70 out of 100 times you win the lottery.

Example 3:

Suppose you are active but and your opponent is not active. If you buy 80 lottery tickets, then the probability that you win the lottery is:

$$\frac{80}{80} = 1 = 100\%$$

In other words, in this case, **you will win** the lottery!

Please note that **even if you bought zero lottery** tickets, you still win the lottery!

Feedback at the end of each round

You will play two identical rounds.

In each round, you will be faced with five different **Entry Fees**. You will have to decide whether you want to **NOT Participate/ Participate** and, in the latter case, the number of your lottery tickets to buy for each **Entry Fee**.

At the end of first round, I will collect decisions of all students and randomly choose two of them.

I will announce and write the following information on the board:

- I will write the entry decisions and the number of lottery tickets (for those who entered) for the chosen students in the experiment. I will not share their names.
- I will randomly choose one **Entry Fee**. It can be **10 tokens**, **25 tokens**, **40 tokens**, **70 tokens** or **110 tokens**.
- The entry decisions made by each student: PARTICIPATE or NOT PARTICIPATE.
- The number of lottery tickets bought by the "ACTIVE" participant(s).

How will your earnings be determined?

You will participate in two identical rounds. At the end of the last round, I will randomly choose one round out of two.

The pair selected for this round will be paid in cash for their decisions.

All students will receive **$5 gift cards** from Starbucks for participating!

STEP 1: QUESTIONNAIRE

1. How old are you?

2. Your gender?

   o Male

   o Female

   o I prefer not to response.

3. Race / Ethnicity

   o White

   o African American

   o Hispanic

   o Asian

   o I prefer not to response.

4. What is your classification in college?

   o Freshman – first year

   o Sophomore

   o Junior

   o Senior

   o Graduate student

   o Unclassified

5. How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

   Please tick a box on the scale, where the value **0 means "not at all willing to take risks"** and the value **10 means "very willing to take risks"**.

6. Please write your name and e-mail, if you want to be contacted about experiments.

   I want to participate in economics experiments.

   My name is: ....

   My e-mail is: ....

7. Your id number is: ....