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## Essays in Applied Public Policy and Health Economics

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Essays in Applied Public Policy and Health Economics

by

Stephen W. Poteet

A dissertation submitted in partial fulfillment  
Of the requirements for the degree of  
Doctor of Philosophy in Economics  
Department of Economics  
College of Arts and Sciences  
University of South Florida

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## Table of Contents

List of Tables .....	iii
List of Figures .....	iv
Abstract .....	v
Chapter One: Marijuana Legislation and the Effect on Adolescents .....	1
1. Introduction .....	1
2. Literature Review .....	3
2.2. Legislation and the Impact on Adult Usage .....	5
2.3. Punishment and Taxation .....	5
2.4. Price Elasticity and Demand of Illegal Drugs .....	6
2.5. Perception of Marijuana .....	7
2.6. Spillover Effect .....	8
3. Theoretical Model .....	8
4. Data and Empirical Strategy .....	12
4.1. Data .....	12
5. Analysis .....	14
6. Results .....	15
6.1. Respondent Characteristics .....	15
6.2. Marijuana Usage .....	16
6.3. Group-time Average Treatment Effect .....	17
6.4. Sensitivity Analysis .....	18
7. Discussion .....	20
7.1. Limitations .....	22
7.2. Future Research .....	22
8. Conclusion .....	22
9. References .....	23
Chapter Two: Background and Theoretical Model of Health Insurance Demand and Pooling .....	50
1. Introduction .....	50
2. Literature Review .....	51
2.1. Health Insurance Premiums and Insurance Selection .....	51
2.2. Health Insurance Preferences .....	52
2.3. DCE: Health Insurance .....	53
3. Theoretical Framework .....	54
3.1. Demand for Health Insurance .....	54
3.2. Health Insurance Pooling and Administration Costs .....	56
4. References .....	58

Chapter Three: Health Insurance Premiums of Single Employees at Small Firms: Are They Getting a Raw Deal?.....	61
1. Introduction .....	61
1.1. Health insurance premiums and insurance selection .....	64
2. Methods .....	66
2.1. National Survey of Single Adults with Employer-based Insurance Coverage.....	66
2.2. Analysis of Monthly Out-of-pocket Premiums .....	67
3. Results.....	68
3.1. Analysis of Monthly Out-of-pocket Premiums .....	69
4. Discussion.....	70
5. Conclusions .....	72
6. References .....	73
 Chapter Four: The Value Employees Place on Health Insurance Plans: A Discrete Choice Experiment.....	 82
1. Introduction .....	82
2. Method .....	84
2.1. Attributes and levels .....	84
2.2. DCE Design (Pair Selection, Task, Choice Sets).....	85
2.3. Survey Instrument/Questionnaire .....	86
2.4. Sampling and Data Collection .....	87
2.5. Analysis .....	88
3. Results.....	89
3.1. Respondent Characteristics.....	89
3.2. Preferences Between Health Insurance Plans.....	90
4. Discussion.....	91
4.1. Limitations.....	93
5. Conclusion.....	94
6. References .....	95
 Appendix A: Discrete Choice Experiment Information .....	 105
 Appendix B: Springer License .....	 111

## List of Tables

Table 1	Descriptive Statistics .....	35
Table 2	Observations by State and Year .....	37
Table 3	Non-linear Generalized Diff-in-Diff .....	39
Table 4	Group Treatment Diff-in-Diff .....	40
Table 5	Sensitivity Analysis Difficulty Obtaining .....	45
Table 6	Sensitivity Analysis Maximum Penalty .....	46
Table 7	Respondent Demographic and SES Characteristics.....	78
Table 8	Respondent Firm and Health Characteristics.....	79
Table 9	Monthly Self-Reported Out-of-Pocket Premiums for Survey Respondents, by Firm Size.....	80
Table 10	Attributes and Levels for the Choice Task.....	101
Table 11	Respondent Demographic and Socioeconomic Status Characteristics .....	102
Table 12	The Preferences for Health Insurance Plan Attributes.....	103
Table 13	Plan Source Predicted Probabilities .....	104

## List of Figures

Figure 1 The Unregulated Equilibrium .....	30
Figure 2 The Regulated Market .....	31
Figure 3 The Illegal/Legal market (After Legislation) .....	32
Figure 4 The Legal Adult Market with Exogenous Changes .....	33
Figure 5 The Illegal Adolescent Market with Exogenous Changes.....	34
Figure 6 MMLs Group treatment Ever Used Marijuana .....	41
Figure 7 MMLs Group treatment Use in Past 30 days .....	42
Figure 8 Decriminalization and RMLs Group treatment Ever Used Marijuana.....	43
Figure 9 Decriminalization and RMLs Group treatment Use in Past 30 days .....	44
Figure 10 Event study ever used marijuana.....	48
Figure 11 Event study marijuana use in the past 30 days.....	49
Figure 12 Annual Out-of-Pocket Premiums, Annual Healthcare Expenditures, and Medical Visits by Firm Size.....	81
Figure 13 Choice Pair Example.....	100

## Abstract

In the first chapter, we investigate the changing landscape of America's marijuana legislation. We first build a theoretical model to determine the impact of these changing laws on adolescents and take a closer look at the intricacies within the market. Then we provide an empirical analysis to test our hypotheses and improve upon econometric models used in previous research. We use data from the Youth Risk Behavior Survey (YRBS) administered from 2009 to 2017 in the United States. Our identification strategy included a non-linear generalized difference-in-differences approach and a group-time treatment effect. We find there is a consistent decrease in usage of marijuana by 1.4% to 1.7% in states with MMLs.

The second chapter includes a literature review and theoretical model of the demand for health insurance and insurance pooling. This chapter provides a framework for chapters 3 and 4.

The third chapter examines the association between firm size and the premiums paid by single employees for their employer-based health insurance coverage. We use survey data on single employees, ages 26-64, in 2017, and a secondary analysis using Medical Expenditure Panel Survey data. We estimated interval regression models of monthly health insurance premiums by maximum likelihood to determine differences by firm size and plan type. Employees in smaller firms (less than 50 people) pay more in premiums and individuals with HMO plans pay about \$20 less than those in PPO plans. The current structure of the U.S. health insurance



marketplaces an undue burden on single employees in small firms. These findings may help guide future U.S. policies that promote fairness in the U.S. health insurance marketplace.

The fourth chapter examines the values that single adults with employer-based coverage place on health insurance plan attributes using a discrete choice experiment (DCE). As part of an online survey, each respondent completed 28 paired comparisons trading-off four attributes: source of coverage, plan type, monthly out-of-pocket premium, and quality of coverage. Based on our results (N=2,207), single employees slightly preferred their employer over the Marketplace as a source of coverage (0.726 odds ratio; p-value<0.01). Single employees would be willing to switch to the Marketplace for a \$25 reduction in monthly premiums. Preferred Provider Organization (PPO) plans were overwhelmingly preferred over all other plan types, especially compared to Fee-for-Service (FFS) plans (4.230 odds ratio; p-value<0.01). The predicted probability that a health insurance plan from the Marketplace would be chosen ranged from 42% to 43.7%.

## Chapter One: Marijuana Legislation and the Effect on Adolescents

### 1. Introduction

Legislation, in the United States, is rapidly evolving regarding the purchase and use of marijuana. How will this change affect the utilization for marijuana in legal and illegal markets? As of 2019, 33 states and Washington D.C. have passed such Medical Marijuana Laws (MMLs), with eleven of these states going even further passing laws that legalize the recreational use of marijuana (National Conference of State Legislatures 2019). There is still a disconnect regarding State and Federal legislation, marijuana is federally recognized as a Schedule I drug, and according to the United States Drug Enforcement Agency these drugs have no medical benefits and are highly addictive (Controlled Substances Act 2016). It is unclear how differences in state and federal law will influence the market for marijuana. We will focus on changes in state legislation and the differences within state, and how this affects the recreational and illegal market for marijuana.

There is a worry that the creation of a legal market for recreational use of marijuana would cause children to increase their usage of marijuana, either through a change in perception of marijuana risk or greater availability of the drug. There is cause for concern as there are negative health consequences for adolescents that use marijuana. There is also debate on whether marijuana is a gateway drug that could lead to the use of other drugs or high-risk behaviors (Pacek, Martins, and Crum 2013, Wen, Hockenberry, and Cummings 2015, Morral,

McCaffrey, and Paddock 2002, Bachhuber et al. 2014). This paper will use a graphical analysis to determine how a change in legislation will affect child usage of marijuana. We will also examine how the legal market and illegal market will be linked.

Previous literature on theoretical analyses of illegal markets helped guide this paper, and we built on these findings for a more complete understanding of the market. We also explore differences in how each state implements legislation. States differ in many ways regarding marijuana legislation including but not limited to taxes, fees, geographical restrictions, dispensary restrictions, and regulations. Through the creation of a theoretical model, we explore the impact of the legalization of marijuana on the supply and demand of marijuana in the market, and the effect on price and utilization of marijuana. If low cost suppliers of marijuana leave the underground market and enter the legal market, how will this affect the price of illegal marijuana? Creating a legal market for marijuana will change demand of marijuana by adults, but the influence on the usage of children is undetermined.

We also discuss some of the other issues of legalizing the use of marijuana throughout the paper. For example, changes in the law could save state and federal governments large amounts money through decreased enforcement costs. A decline in individuals jailed for marijuana related offenses would reduce the crowding in the prison system. States could increase punishments for individuals that are caught selling marijuana to children. Canada has passed legislation that would make it a criminal offense to give or sell marijuana to any person under the age of 18 punishable by up to 14 years in prison (Cannabis Act 2018). We also examine the role price elasticity of demand may play in adolescent usage, how the perception of marijuana may change, and possible spillover from the recreational market.

We maintain as our null hypothesis that, absent state restrictions to the recreational market, adolescent marijuana usage would decrease as recreational marijuana legislation is introduced. If this is true and adolescent usage is of paramount importance, then the best course of action would be for states to legalize recreational use of marijuana with very little restrictions and increase the enforcement and punishment of those individuals that sell or give marijuana to children. We provide an empirical analysis to test our hypotheses and improve upon econometric models used in previous research. We contribute to the field by being the first paper to provide a theoretical model to specifically analyze the impact of marijuana legislation on the legal and illegal markets and the role exogenous changes would play. This will allow us to not only make predictions on the usage of adolescents but analyze the differences within states as legislation is not uniformly implemented. We also improve on the empirical estimates of previous literature by using a non-linear generalized diff-in-diff specifications and group-time treatment effects, which have not been used before. We also utilize a unique data set in order to provide context of the impact of legislation on the perception of punishment and accessibility.

## **2. Literature Review**

### **2.1. Legislation and the Impact on Adolescent Usage**

There have been a range of findings concerning changes in marijuana legislation and the impact on adolescent usage. The consensus in the literature is there is a small impact on adolescent usage, but the results are not significant. Lynne-Landsman, Livingston, and Wagenaar (2013) found implementation of MMLs has not significantly affected adolescent marijuana usage, at

least not in the first few years since the legislative change. This paper focused on Montana, Rhode Island, Michigan, and Delaware in its difference-in-differences framework. Harper, Strumpf, and Kaufman (2012) also found little evidence of MMLs impact on adolescent usage of marijuana when controlling for unmeasured state characteristics, as the estimates were negative and insignificant. Anderson, Hansen, and Rees (2015) found a negative relationship between childhood usage and the legalization of medical marijuana, but these findings were also insignificant and small. (Anderson et al. 2019) updated their previous study with updated data and report negative and significant for MMLs and RMLs. Harper, Strumpf, and Kaufman (2012) and Anderson, Hansen, and Rees (2015) used a generalized difference-in-differences framework to exploit time and geographical variation. One preliminary study of medical marijuana determined that states that enacted MMLs had higher adolescent marijuana use than those that didn't, using a two sample t-test (Wall et al. 2011).

There are not many papers that have looked at the impact of Recreational Marijuana Laws (RMLs) on adolescent usage. There are still only a few states that have passed this legislation and very recently. Cerdá et al. (2017) looked at the association of RMLs and adolescent use and found use among eighth and 10<sup>th</sup> graders increased in Washington, but there was no discernable difference in Colorado. As more states continue to change legislation regarding marijuana it will be important to better understand and quantify the impact on children.

Studies performed in other countries regarding specifically decriminalization of marijuana have found the impact of adolescent usage appears to be negligible. Australian studies determined there was no significant difference in the use of marijuana by children, and in the Netherlands reductions in criminal penalties have limited effects on marijuana use (MacCoun and Reuter

1997, 2001, McGeorge and Aitken 1997, Donnelly, Hall, and Christie 1995, Williams 2004).

These countries have significant differences regarding not only culture, but also the implementation of marijuana legislation.

## **2.2. Legislation and the Impact on Adult Usage**

The consensus is that legalizing marijuana for medical or recreational use will increase marijuana usage by adults, but more could be done to determine the difference in usage rates in those states that have passed legislation for medical purposes versus those that have passed legislation for recreational purposes. We surmised that after the passage of MMLs and RMLs that there would be an increase in adult marijuana usage because of increased availability, decriminalization, and change in social acceptance. Wen, Hockenberry, and Cummings (2015) found that among adults aged 21 or older MMLs lead to an increase in marijuana use and binge drinking. Another study focusing on legalization of recreational marijuana determined that usage among college student in Colorado where much higher than the national average (Jones, Nicole Jones, and Peil 2018). This study is limited by the fact that data was only collected from October 2013 to March 2015. Han et al. (2017) also found increases in adult usage from 2006 to 2013, especially in those individuals aged 50 and above. Johnston, O'Malley, and Bachman (1981) assessed how decriminalization affected high school seniors and young adults, and found no effect on not only marijuana use, but also attitudes towards marijuana.

## **2.3. Punishment and Taxation**

Pacula et al. (2010) examined how user sanctions affect marijuana markets and the price of marijuana. The focus of the paper is the evaluation of changes in demand side policies on the

equilibrium price of marijuana in illegal markets. They theorized that as the legal risks for users decrease the prices users face increase, and drug dealers receive a higher profit. DeSimone and Farrelly (2003) found that increases in the probability of arrest decrease the probability of using marijuana. Other studies have concentrated on the positive and normative effects of punishments on the production and consumption of illegal drugs (Becker, Murphy, and Grossman 2004). This study asserted that placing a monetary tax and making the good legal would, in theory, cause a greater increase in price and decrease in output than an optimal level of enforcement. This argument speaks to the question whether it would be more effective to legalize and tax these substances than to prohibit their use through punishment. Chu (2014) found that states that pass MMLs increase marijuana arrests by about 15-20% among adult males and admission to substance-abuse treatment facilities by about 10-20%.

#### **2.4. Price Elasticity and Demand of Illegal Drugs**

A few studies estimate the price elasticity of demand for illegal drugs, but finding dependable data on prices for illegal drugs can be difficult. Van Ours (1995) paper used data from the opium market in the Dutch East Indies during 1923 to 1938 and found the short-term price elasticity for opium use is about -0.7. More recent studies have also found inelastic demand for heroin and methamphetamines (Olmstead et al. 2015, Cunningham and Finlay 2016). A paper that examined the demand for marijuana among UCLA students in 1972 estimated the price elasticity of marijuana ranged from -0.7 to -1.0 (Nisbet and Vakil 1972). A meta-analysis performed by Gallet (2014) determined the price elasticity for marijuana to be less than that of cocaine and heroin.

Ding (2003) found that children are more price sensitive regarding cigarettes than adults. An Australian study also determined that younger age groups are more sensitive to price in relation to marijuana participation (Williams 2004). It is also possible to affect price elasticity and demand through public service announcements. Becker and Murphy (1993) argued that advertising has greater impact on the level of demand rather than the elasticity of demand. Past literature regarding cigarettes found that public service announcements decreased demand, but a longer term study performed by Sloan, Smith, and Taylor (2002) determined that this is less important than previously believed.

## **2.5. Perception of Marijuana**

There is an argument that once marijuana is legalized, children might perceive the risk of using marijuana has diminished or because marijuana is used for medical purposes it is actually beneficial for one's health (Joffe and Yancy 2004). There are conflicting studies on this issue. Miron and Zwiebel (1991) examined the effect of prohibition and determined that public perception might cause people to drink more alcohol as the illegal good is now romanticized. The impact of public perception is unclear and could increase or decrease usage. Khatapouch and Hallfors (2004) found that while attitudes changed with the passage of MMLs, usage did not increase. Whereas, Johnston et al. (2018) and Bachman, Johnson, and O'malley (1998) concluded that perceived risk of harmfulness is an important factor and found an inverse relationship between daily use of marijuana and its perceived risk.



## 2.6. Spillover Effect

A major concern as marijuana legislation changes in the United States is the access children will have to marijuana. As more adults begin to use marijuana for medical and recreational purposes, will it be easier for adolescents to obtain marijuana. Two studies that examined adolescents in substance treatment programs found it was very common for these individuals to obtain medical marijuana from someone else (Salomonsen-Sautel et al. 2012, Thurstone, Lieberman, and Schmiede 2011). These studies were limited to a specific sub-group of individuals and a small sample size, but it does show that these individuals can very easily obtain medical marijuana from others. Hao and Cowan (2017) studied states that shared borders with states that passed RMLs and found that there is a dramatic impact on adult marijuana possession arrests, but there is no impact on juvenile marijuana possession arrest.

## 3. Theoretical Model

We start with an analysis of an unregulated market. In figure 1 we have total demand for the market,  $D_{Total}$ , which is made up of the sum of demand for adults,  $D_A$ , and the demand for adolescents,  $D_C$ . We assume adolescents are more price sensitive (higher elasticity) and therefore have a flatter demand curve relative to adults. We arrived at this conclusion by a review of previous literature. The market supply curve,  $S$ , is upward sloping. The interaction between  $S$  and  $D_{Total}$  leads to an equilibrium quantity,  $Q^*$ , and equilibrium price,  $P^*$ . Adult quantity demanded of marijuana is  $Q_A$  and adolescent quantity demanded of marijuana is  $Q_C$ . In the next section we will move to a more realistic version of the market for marijuana.

In figure 2 we provide a graphical analysis of the regulated market. We still have the same demand and supply curves used in figure 1. These demand and supply curves do not incorporate the cost of avoiding detection by suppliers and consumers,  $A$ , or the cost of government enforcement,  $E$ , on the decision to buy and sell marijuana. Instead we introduce  $A$  and  $E$  as a function that is added to the price paid by the consumer,  $P^* + p_d(A_d, E) + A_d$ , and subtracted from the price received by the supplier,  $P^* - p_s(A_s, E) - A_s$ , we can now see the “wedge” that is formed in this illegal market as a vertical line between  $D_{Total}$  and  $S$ . Consumers now pay a higher price,  $P_D$ , and suppliers receive less,  $P_S$ . The incident of the burden will depend on the elasticities of the supply and demand curves. The equilibrium quantity decreases from  $Q^*$  to  $Q_i$ , as such quantity demanded by adults and adolescents decreases to  $Q_A'$  and  $Q_C'$  respectively.

In the next step, figure 3, we will analyze the effect of marijuana legislation on this market. We will assume that demand will not change for either children or adults after legislation. This is clearly reasonable for the child market where they will still be functioning in a regulated market. Which is the focus of this paper. In figure 3, both the illegal and legal market for marijuana are represented. Once legislation passes for the recreational use of marijuana the demand that remains would only include those individuals that could not legally purchase marijuana (mostly adolescents). Those suppliers able to produce marijuana at a lower marginal cost would leave the illegal market and sell in the legal market where they would not face the cost to avoid detection and the probability of arrest. First, we examine the legal market. The equilibrium quantity traded between adults and legal suppliers would be  $Q_L$  which is greater than  $Q_A'$ . As low-cost suppliers are leaving the illegal market the supply curve for the legal

market will shift to the left becoming,  $S'$ . The magnitude of the number of suppliers leaving this market will depend on legal market. We will first examine the situation in which there are no restrictions in the legal marijuana market.

Next we analyze the illegal market for marijuana. We show the initial illegal equilibrium from the interaction of  $D_c$  and  $S'$ , before incorporating the costs of avoidance and enforcement, at  $P_i$  and  $Q_i$ . Once these costs are added the “wedge” is formed, the vertical line between  $D_c$  and  $S'$ . The price that adolescents face is now equal to  $P_i + p_d(A_d, E) + A_d$  and the price suppliers face is equal to  $P_i - p_s(A_s, E) - A_s$ . We demonstrate that adolescent quantity has decreased,  $Q_c'' < Q_c'$  and adolescent price has slightly increased,  $P_D' > P_D$ .

The “wedge” can shift to the left or the right depending on  $A$  and  $E$ . States can enact policies to increase expenditures on enforcement against individuals that sell or give marijuana to adolescents. It would be possible to eliminate the illegal adolescent market for marijuana by shifting the “wedge” to the left until quantity demanded by adolescents is zero. In the next two sections we will investigate how exogenous changes will impact the legal and illegal market for marijuana.

In figure 4, the “wedge” now incorporates all exogenous changes,  $X$  and  $Y$ , which would restrict quantity in an otherwise perfectly competitive market such as licensing fees, taxes, location restrictions, patient restrictions, and limits on the number of suppliers. This will be added to the price adults pay,  $P_L + p_d(A_d, E, X) + A_d$ , and subtracted from the price suppliers receive,  $P_L - p_s(A_s, E, Y) - A_s$ . In the legal market avoidance and enforcement expenditures will be equal to zero. Most of these restrictions would impact the suppliers of marijuana,  $Y$ . We show that because of

these restrictions, quantity has decrease by  $Q_L$  minus  $Q_Y$  which some might argue is a good thing, but we must fully understand the possible ramifications in the illegal market. Those suppliers now unable to sell their product in the legal market may decide to remain in the illegal market and continue to sell to children. This would directly affect the corresponding shift of the supply curve in the adolescent market, which would be smaller than before. This would lead to a higher quantity of marijuana consumed in the adolescent market.

Each state has their own set of laws on governing the creation of this market for recreation marijuana. States that don't heavily tax or restrict the sale of legalized marijuana would see a larger number of suppliers leaving the illegal market and entering the legal market.

By legalizing the recreational use of marijuana, there would be massive amounts of resources freed up. In figure 1, this amount would be equal to  $Q_A'$  multiplied by  $E$ . Several possibilities for these freed-up resources include increased level of enforcement in the adolescent illegal market, rehabilitation services for addiction, infrastructure projects, public schools, and public service announcements.

In figure 5, we show an enlarged version of the illegal market equilibrium to provide a clearer picture of exogenous changes in the illegal market,  $X$  and  $Y$ . This will be added to the price adolescents pay,  $P_I + p_d (A_d, E, X) + A_d$ , and subtracted from the price suppliers receive,  $P_I - p_s (A_s, E, Y) - A_s$ . We will focus on the exogenous changes that affect adolescents,  $X$ . This includes the potential for children to have greater access to marijuana since the quantity demanded of marijuana by adults could possibly increase. If parents aren't conscientious about their own

personal use of marijuana, and ensuring that it is safely stored, it could lead to more children being exposed or a spillover effect.

There also may be a change in attitude towards marijuana once legalized. Children may feel that the drug is safer because it is now legal and is being used for medical purposes. One way to address this possible change in perception is through public service announcements. This is a tactic currently being used to inform individuals of the dangers associated with smoking cigarettes.

These exogenous changes shift the “wedge” to the right. Which could possible obscure the previous effect seen in figure 3 which shows that legalizing marijuana decreases adolescent consumption to  $Q_c''$ , but now we see consumption is greater at  $Q_c'''$ . Which is one of the possible reasons why pervious research has had difficulty in finding significant results in this area.

#### **4. Data and Empirical Strategy**

##### **4.1. Data**

To explore the impact of marijuana laws on marijuana usage by adolescents, we use pooled cross-sectional data from the Youth Risk Behavior Survey (YRBS) administered from 2009 to 2017 in the United States. The YRBS has collected information on more than 3.8 million high school students in more than 1,700 separate surveys since 1991 (CDC). The surveys were administered every two years and are representative of 9th through 12th grade students in the United States. The purpose of the survey is to monitor health risk behaviors that contribute to different problems among adolescents and adults in the United States. We focus on individual

adolescent data on marijuana use. The variables of interest will be states that have passed marijuana legislation.

To determine which states have passed legislation, we used information from official legislative websites of each US state, Politico, and NORML. Indicators will be whether a state has enacted legislation addressing the following: laws that allow for the medicinal use of marijuana (MML); legalization of marijuana for adults over 21; decriminalization statutes. One issue is the differences between state laws dealing with marijuana. States may differ in restrictions for possession and cultivation limits, medicinal qualification conditions, and penalties. Some states may allow for the treatment of certain medical conditions, while other states may not. States that allow for home cultivation and recreational users could lead to greater accessibility for adolescent use and broaden social perception of marijuana use, and we will try to control for these differences (Pacula et al. 2015).

Certain demographic characteristics could play a role in determining a child's propensity toward using illicit drugs. To control for this age, race/ethnicity, and gender will all be included as variables. Additional state controls will include cigarette tax, beer tax, spirits tax, unemployment rate, and census population. A dummy variable will be created for a MML indicator and a legalization (recreational and decriminalization) indicator. The outcome variable will be adolescent marijuana use. Adolescent use will be evaluated from questions on whether a child responded yes or no to ever using marijuana and use during the past month.

We also perform sensitivity analyses using National Survey on Drug Use and Health data (NSDUH) from 2002 to 2017. This is an annual survey of adolescents 12 years and older which

contains information on marijuana use, but also has more detailed information regarding the difficulty to obtain marijuana and the penalties associated with using marijuana. We were unable to obtain state level information for this data set.

## 5. Analysis

This paper will examine whether states that have implemented legislation regarding marijuana experience a significant change in adolescent marijuana usage. As states vary in the implementation of legislation, we will first employ a nonlinear generalized difference-in-differences approach to exploit geographical and time variation (Strezhnev 2017, Bertrand, Duflo, and Mullainathan 2004). This allows us to bound the outcome with 0 and 1. This does lead to stronger assumption, but we will run a linear specification later. Standard errors are clustered at the state level and robust. The linear specification may be expressed as:

$$Y_{ist} = \beta_0 + \beta_1 L_{st} + \beta_2 X_{ist} + \beta_3 G_{st} + \gamma_s + w_t + \gamma_s t + \epsilon_{ist} \quad (1)$$

Where  $Y_{ist}$  represents the decision to use marijuana for individual  $i$  in state  $s$  by time  $t$ ;  $\gamma_s$  and  $w_t$  represent state and year fixed effects and we include a state-specific linear time trend,  $\gamma_s t$ .  $L_{st}$  is a dummy for whether the state  $s$  has enacted (not just passed) marijuana legislation at time  $t$ .  $X_{ist}$  is a vector of control variables at the individual level,  $G_{st}$  is a vector of state-level controls, and  $\epsilon_{ist}$  is the error term. Individual level controls include age, gender, grade level, and race) and state level controls include cigarette tax, spirits tax, beer tax, unemployment rate, population, and median income.

The non-linear specification is expressed as a logit model:

$$\Pr(Y_{ist} = 1 | \beta_0, L_{st}, X_{ist}, G_{st}, \gamma_s, w_t, \gamma_s t) = \Lambda(\beta_0 + \beta_1 L_{st} + \beta_2 X_{ist} + \beta_3 G_{st} + \gamma_s + w_t + \gamma_s t) \quad (2)$$

Let  $x_{ist} = (L_{st}, X_{ist}, G_{st}, \gamma_s, w_t, \gamma_{st})$ , where  $\Lambda(\beta_0 + x_{ist} \beta_n)$  equals the logistic cumulative distribution function and  $\epsilon_{ist}$  is assumed to take the logistic form. Also,  $\Lambda(\beta_0 + x_{ist} \beta_n) = \left( \frac{e^{\Lambda(\beta_0 + x_{ist} \beta)}}{1 + e^{\Lambda(\beta_0 + x_{ist} \beta)}} \right)$

As the cross difference in this equation is not equal to the treatment effect, we estimate the marginal effect or the cross difference of the conditional expectation of the observed outcome minus the cross difference of the conditional expectation of the potential outcome without treatment (Puhani 2012). One issue that arises from this approach is we must use a stronger parallel trends assumption. Following from Strezhnev (2017), the Generalized Parallel Trends assumes that “the first-differences between all time periods in the potential outcomes under the control history are mean-independent of assignment to any of the treatment histories”. This assumption allows us to use those states that haven’t received treatment yet to estimate the counterfactual for those states that already have received treatment. Another problem is the estimates are weighted averages of all the possible two group/two period estimates. In order to address this, we run additional specifications including: linear group-time average treatment effects and we will look more closely at specific states (Callaway and Sant’Anna 2019).

## 6. Results

### 6.1. Respondent Characteristics

There were over 447,810 observations in the sample after removing those that had missing information for age, sex, grade level, race/ethnicity, and dependent variables. Over half of the individuals were female (52.2%), fell between the ages of 15 to 17 (75.7%), and a majority were white (50.9%). Each grade level was represented by at least 20% of the observations. States



with MMLs comprised 30.1% of the data compared only 3.5% for RMLs which is a small sample size. Regarding use of marijuana, 19.5% of the respondents answered that they have used marijuana in the past 30 days, while 35.2% answered that they have used marijuana at some point in their lives.

When we split the sample based off whether a state has passed some form of marijuana legislation some characteristics differ slightly. Adolescents in the states that have passed legislation are slightly younger, and more respondents identify as being Hispanic or an “other race.”

## **6.2. Marijuana Usage**

In this section we present the estimates from the models described in the analysis. There are separate estimates for states with MMLs and states that have passed other forms of marijuana legislation (legalization or decriminalization).

Using the nonlinear generalized diff-in-diff specification we find that legalizing marijuana for medical use has a negative effect on the usage of marijuana by adolescents. These treatment effect estimates in Table 3 range from -0.008 to -0.014. The only estimate that was not significant was the specification that did not control for covariates and the dependent variable was whether the adolescent had ever used marijuana. This may be because some states have recently passed marijuana and this variable may not be as sensitive to recent changes like the question regarding use in the past month. The size of the effect was also consistently bigger for use in the past month.

When focusing on other types of legislation (recreational and decriminalization) we find a consistent positive effect from legislation on adolescent usage of marijuana (0.009 to 0.014). As we incorporate a state-specific linear time trend we find that the estimates become insignificant. This differs from our theoretical model and the estimates from states that have passed MMLs, but there is possible spillover effects and differences in the creation of these markets that must be accounted for.

Recent literature on generalized difference-in-difference coefficients turn out to be weighted averages of all the possible two group/two period estimates (Goodman-Bacon 2018). The weights could be positive or negative and are determined by sample size and treatment variation. This is an issue that we address by estimating group-time average treatment effects and performing a synthetic control method on certain states.

### **6.3. Group-time Average Treatment Effect**

In this analysis we address the issue of having multiple time periods and variation in treatment timing. We follow the approach taken by Callaway and Sant'Anna (2019), and group states together by year of treatment implementation and calculate average treatment effects using the “did” package in RStudio. This allows us to focus on the causal parameter of interest. We are also able to determine if marijuana legislation has a dynamic effect (over time) on marijuana usage.

We have three groups that introduced MMLs during 2010-2011, 2014-2015, and 2016-2017.

We also only use states that have observations in every year that the survey was given, and we exclude states that passed MMLs before 2009, causing the number of observations to decrease

to 173,599. The simple average treatment effect for all groups is decrease of 1.7 percentage points for ever using marijuana and a decrease of 1.4 percentage points for using marijuana in the past 30 days each is significant at the 95% level. Figures 6 and 7 show each of these treatment groups and their estimates with 95% confidence intervals. We also determine how the effects differ dynamically. When accounting for the effect overtime the estimates are slightly more negative (-1.9 and -1.5 percentage points) which indicates some small lasting effect of the MMLs.

When looking at states that have passed legislation other than MMLs we also have three groups: 2010-2011, 2012-2013, and 2016-2017. We restrict the data as we did in the previous analysis and have 245,850 observations. The simple average treatment effect for all groups is 1.4 percentage points for ever using marijuana and 1.8 percentage points for using marijuana in the past 30 days each is significant at the 95% level. The dynamic estimates are smaller (0.6 and 1.5) and insignificant for ever used marijuana. There don't seem to be any lasting effects from RMLs or decriminalization.

#### **6.4. Sensitivity Analysis**

We used data from the National Survey on Drug Use and Health (NSDUH) to further explore the impact of MMLs. This dataset is unique in that it contains survey questions on the difficulty of obtaining marijuana and the possible penalties associated with getting caught using marijuana. We use a generalized ordered logit model, but one without the restrictive assumption of parallel lines or proportional odds. This is done by using `gologit2` in Stata 15 and allows for the  $\beta$ s to differ by the dependent variable's categories (Williams 2006, Williams 2016). Table 5 and

6 illustrate the issues that could possibly arise with marijuana legislation if we don't consider the dynamics between the legal and illegal markets. We see very consistent significant results, that in states with MMLs adolescents find it easier to obtain marijuana and reduced penalties associated with getting caught using marijuana. The positive coefficients of MML states in column 1 indicate that respondents are more likely to be in higher categories of the dependent variable (easier to obtain marijuana as category levels increase). The negative coefficients of MMLs states in column 2 indicate respondents are more likely to be in the current or lower categories of the dependent variable (harsher penalties as category levels increase).

We also focused our analysis on specific subgroups within the state and tried to find states that were similar in size and political leanings. The nature of this data set made this difficult as there are only a few states that have observations in every year. When the analysis was focused on Arkansas as the treatment group with Kentucky and Oklahoma as controls. We still find consistently negative impact on marijuana usage, but it is insignificant, and the number of observations is greatly reduced.

Figures 10 and 11 illustrate an event study to show the impact of MMLs relative to when they were enacted. There is no significant pre-trend prior to implementation of the MMLs. We do not find that adolescents are decreasing their usage of marijuana in response to an upcoming legislation change. Yearly survey data would have allowed for greater accuracy when completing the event study. We do find an impact on usage up to 4 years after legislation is introduced. This is in line with our dynamic group-treatment estimates.

## 7. Discussion

It is not fully understood how changes in the legislation of marijuana will affect adolescent usage. We begin by building a theoretical model that allows us to better analyze the impact of MMLs, RMLs, and decriminalization on the legal and illegal market. We combine this with an empirical research to test these hypotheses. Our paper utilizes the same YRBS data as Anderson, Hansen, and Rees (2015), but with a new wave of 2017 surveys. This is what is updated in Anderson et al. (2019), but we also use a second data set (NSDUH) to provide a comprehensive sensitivity analysis. We also code the legislation by the date of implemented. We improve upon the empirical strategy by using not only a nonlinear generalized difference-in-difference specification which estimates the true treatment effect according to Puhani (2012), but also a group-time treatment effect specification. We explore the impact of legislation changes over time and find there is a consistent decrease in usage of marijuana in states with MMLs.

When focused on adolescent usage in the past 30 days we find consistent significant decreases in the probability of usage regardless of model specification. We also found a significant dynamic impact from the change in legislation on adolescent usage over time. We combine states that have implemented decriminalization and RMLs and find an increase in the probability usage of marijuana by adolescents. This is largely driven by decriminalization as the number of observations for states that have passed RMLs is small. Our sensitivity analysis sheds light on the possible issues in researching this market. Adolescents reported that maximum penalties for marijuana possession in states that have passed MMLs is lower than states that haven't. Adolescents also found it easier to obtain marijuana which contradicts our theoretical

model and would lead us to believe there would be more marijuana usage. This might allude to the fact that as adult usage increases there is greater access within the home rather than through an illegal supplier.

These findings illustrate that making marijuana legal to purchase, for medical purposes, it would reduce the amount of marijuana usage by adolescents. This could provide a better way of trying to prevent children from consuming marijuana until they are over the age of 21.

In our literature review we mention studies by (Anderson, Hansen, and Rees 2015, Lynne-Landsman, Livingston, and Wagenaar 2013) also find similar results, but many studies vary and there is no current consensus within the literature (Harper, Strumpf, and Kaufman 2012). This paper also shows consistent and significant negative estimates on not only use within the past 30 days but if an adolescent has ever use marijuana. We find differ from Anderson et al. (2019) in our findings regarding RMLs. Our model finds an increase in adolescent usage when RMLs are introduced. They may be due to including states that have enacted legislation to decriminalize marijuana usage.

Another possible explanation could be that it isn't the supply of illegal marijuana that is being affected, but it is that perception is changing towards marijuana. Decriminalization appears to increase both adolescent and adult usage of marijuana. States implementing marijuana legislation might want to consider accompanying these changes with laws that included more severe punishments for suppliers of adolescents.

## **7.1. Limitations**

One problem that arises in this analysis is the assumption of conditional parallel trends before treatment does not hold in certain groups, and we can see this in figures 6 and 7. There is also not enough data currently available to run a robust model on just states that have passed legislation regarding recreational use. As time passes and more information is collected, we will be able to focus on these states. It can be hard to disentangle the impact of specific legislation changes as many states introduce multiple legislation changes over time. Also, MMLs vary in scope and implementation depending on the state.

## **7.2. Future Research**

Future research will include an extension to this paper using synthetic control approach to better match states according to pre-trends and further building upon improved statistical modeling in this area. We will also take an in depth look at the differences within states that have passed MMLs, this may include whether or not a state allows dispensaries, the fees associated with opening a dispensary, the number of marijuana plants allowed to be cultivated within the home, and medical marijuana patients.

## **8. Conclusion**

We show in detail how the markets for marijuana are inextricably linked to one another with our theoretical model and the role the government still must play even when states move to legalization. We also, establish significant findings that MMLs reduce the amount of marijuana adolescents are using. Previous research has issues with model specification that we have attempted to solve.

By delaying the age at which children start using marijuana we can shield them from most of the harmful health impacts associated with the drug. The introduction of a legal market for the trading of marijuana combined with new laws targeted at illegal production and public service announcements could significantly reduce the number of adolescents that are getting access to the drug and education them on the dangers of its use.

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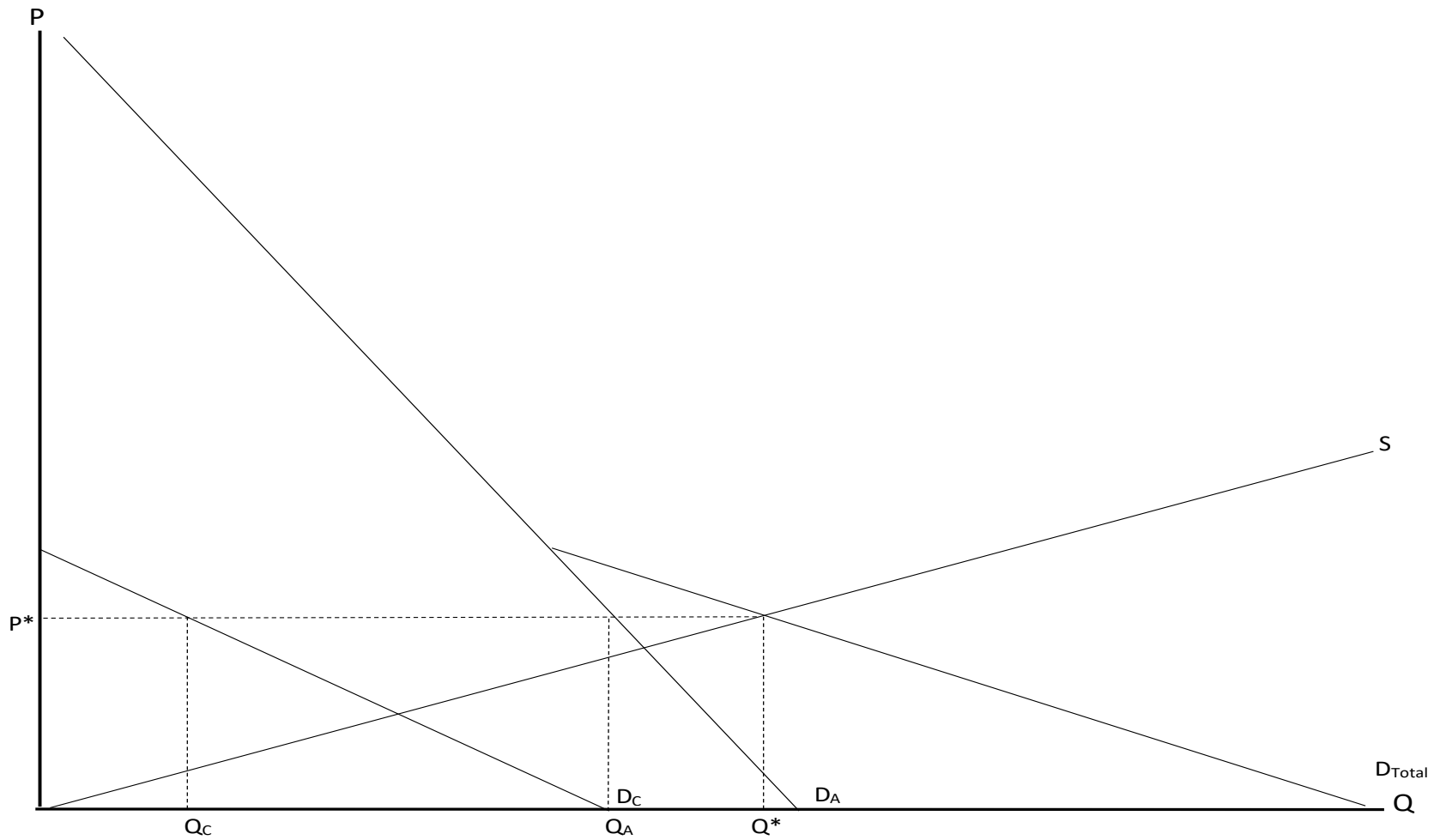


Figure 1 The Unregulated Equilibrium

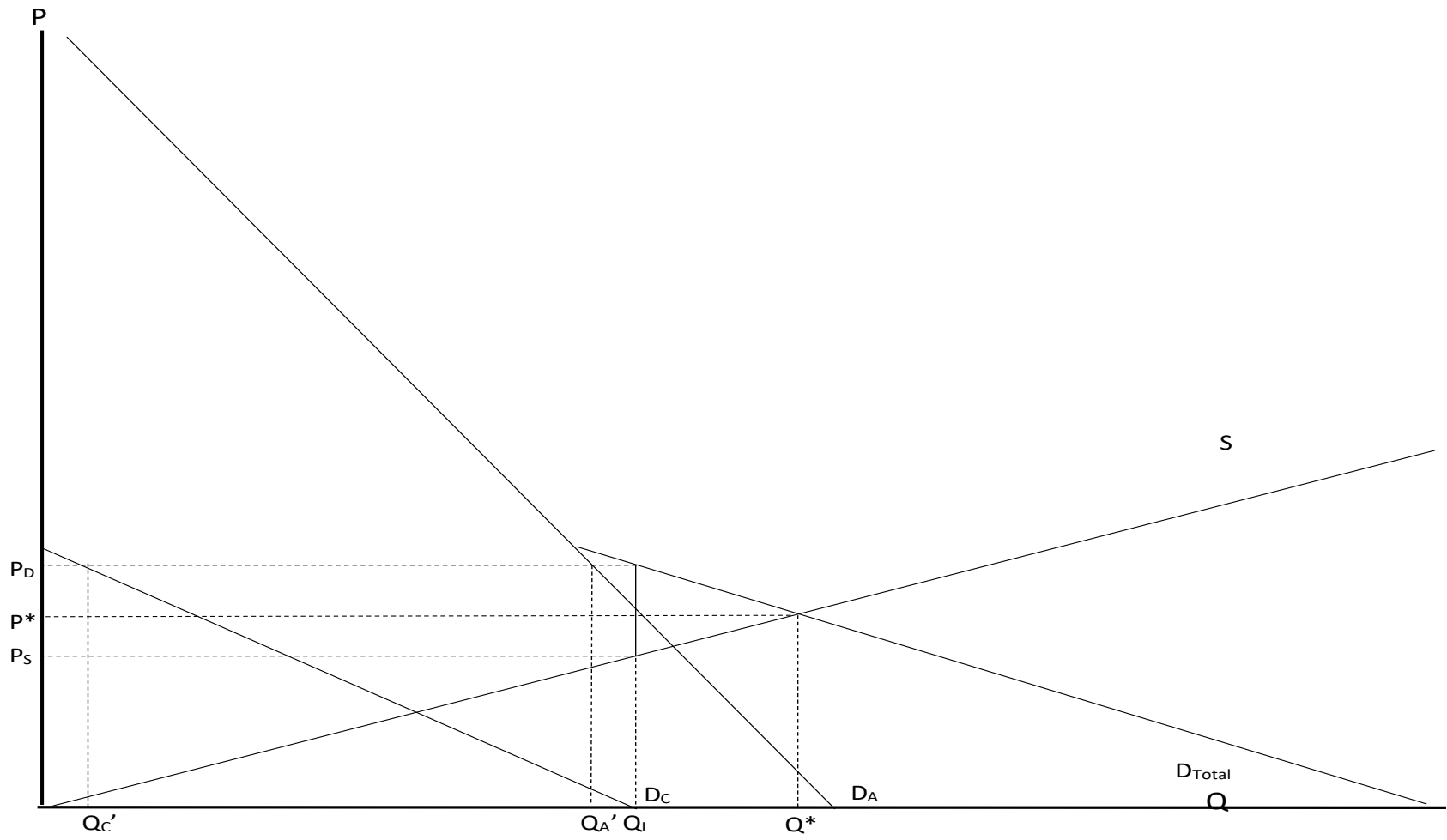


Figure 2 The Regulated Market



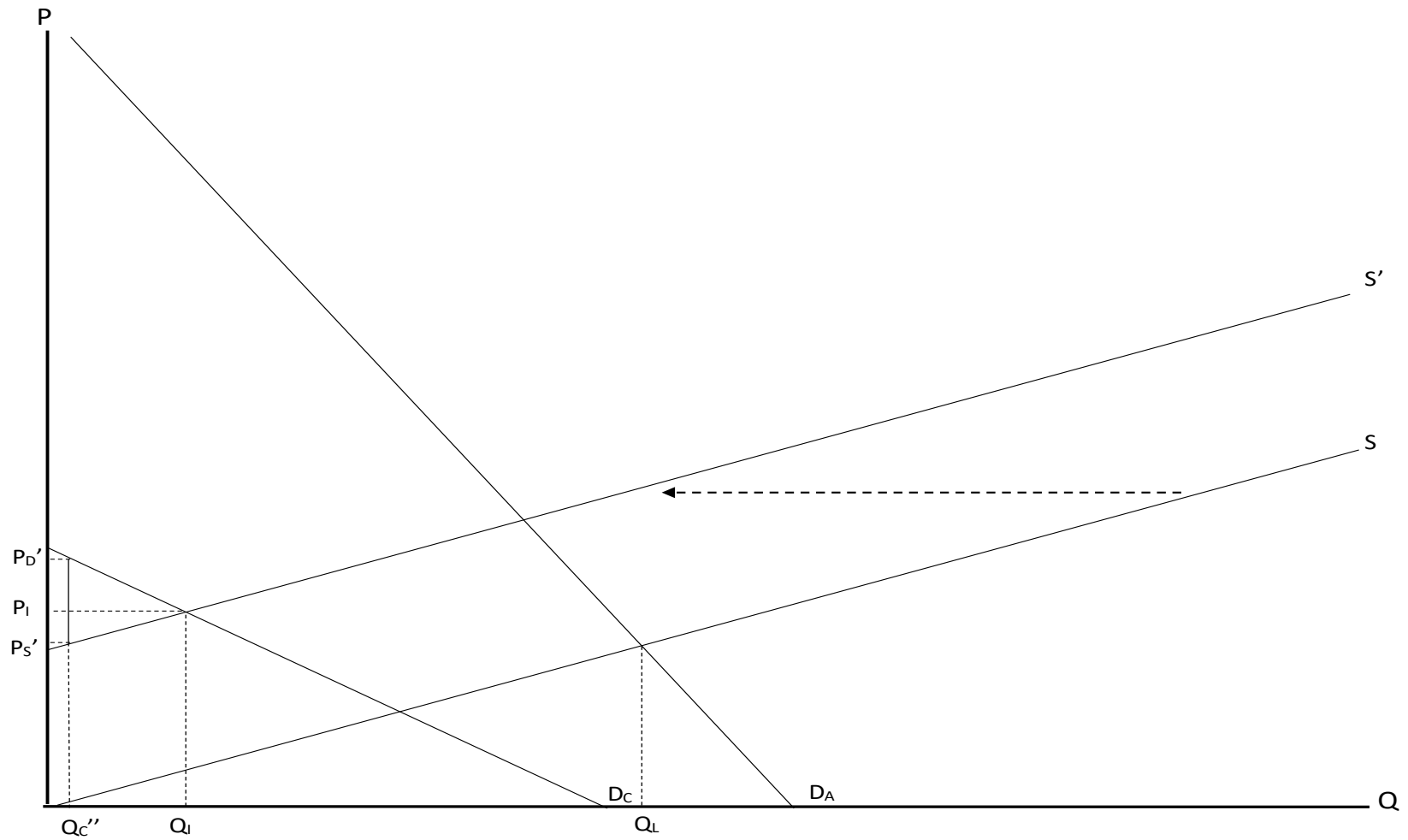


Figure 3 The Illegal/Legal market (After Legislation)

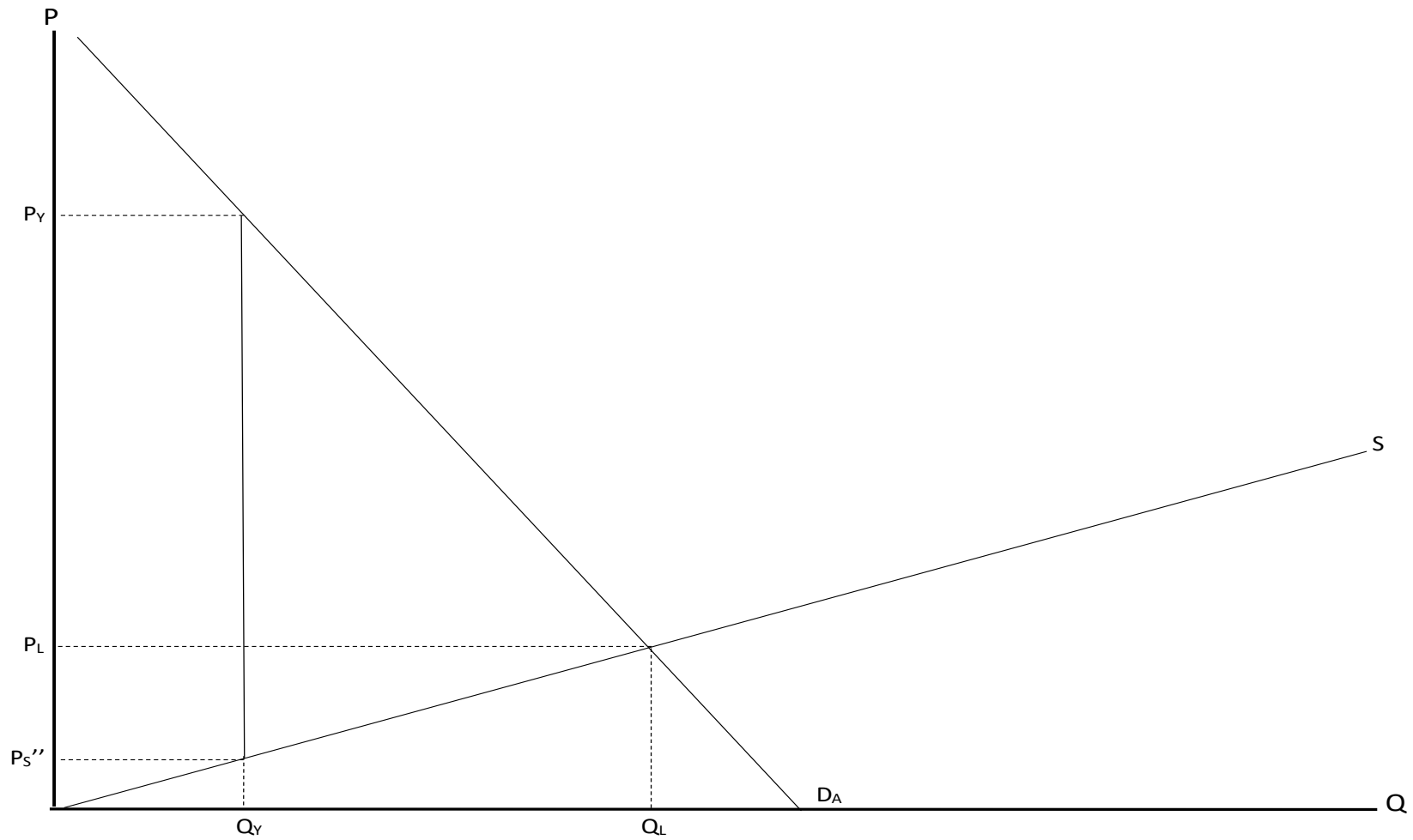


Figure 4 The Legal Adult Market with Exogenous Changes

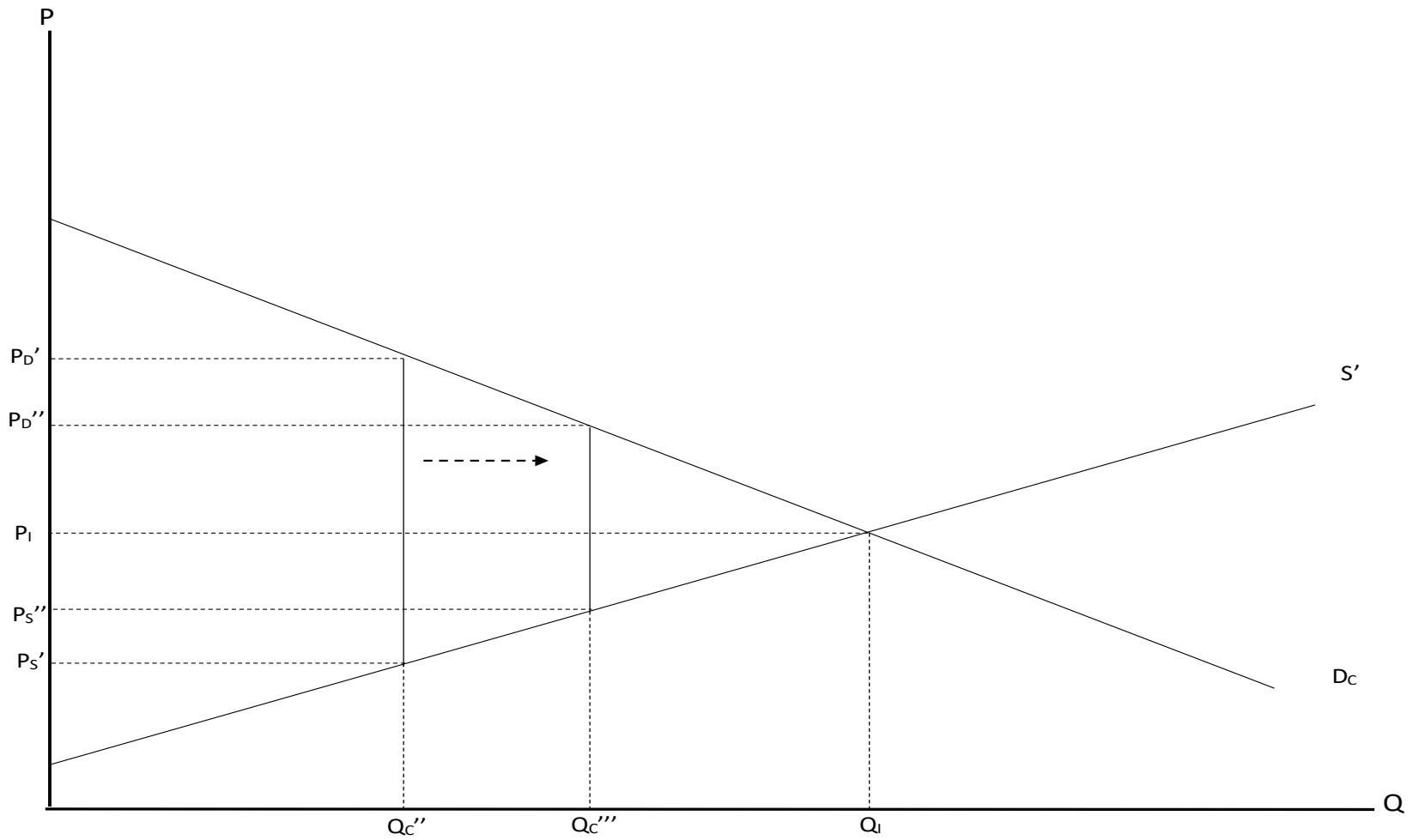


Figure 5 The Illegal Adolescent Market with Exogenous Changes

**Table 1 Descriptive Statistics**

	Overall		Legislation = 1		Legislation = 0	
	N= 447,810	%	N= 228,437	%	N= 219,373	%
<b>Age</b>						
14 or younger	56984	12.7%	31926	14.0%	25058	11.4%
15	116790	26.1%	59809	26.2%	56981	26.0%
16	119476	26.7%	60344	26.4%	59132	27.0%
17	102593	22.9%	51620	22.6%	50973	23.2%
18 or older	51967	11.6%	24738	10.8%	27229	12.4%
<b>Sex</b>						
Female	233702	52.2%	119571	52.3%	114131	52.0%
Male	214108	47.8%	108866	47.7%	105242	48.0%
<b>Race/Ethnicity</b>						
White	227787	50.9%	111161	48.7%	116626	53.2%
Black	70032	15.6%	33403	14.6%	36629	16.7%
Other Races	51044	11.4%	53240	23.3%	45707	20.8%
Hispanic or Latino	98947	22.1%	30633	13.4%	20411	9.3%
<b>Grade level</b>						
9th	125999	28.1%	63354	27.7%	62645	28.6%
10th	120810	27.0%	61414	26.9%	59396	27.1%
11th	111309	24.9%	57037	25.0%	54272	24.7%
12th	89692	20.0%	46632	20.4%	43060	19.6%
<b>Year</b>						
2009	123796	27.6%	68182	29.8%	55614	25.4%
2011	88728	19.8%	36785	16.1%	51943	23.7%
2013	81619	18.2%	29900	13.1%	51719	23.6%
2015	79930	17.8%	42312	18.5%	37618	17.1%
2017	73737	16.5%	51258	22.4%	22479	10.2%

**Table 1 (continued)**

		Overall		Legislation = 1		Legislation = 0	
Medical							
	No	281717	62.9%				
	Yes	166093	37.1%				
Recreational							
	No	432358	96.5%				
	Yes	15452	3.5%				
Decriminalization							
	No	313032	69.9%				
	Yes	134778	30.1%				
Marijuana Use (Past 30 Days)							
	No	360371	80.5%	182255	79.8%	178116	81.2%
	Yes	87439	19.5%	46182	20.2%	41257	18.8%
Marijuana Use (Ever)							
	No	290194	64.8%	146133	64.0%	144061	65.7%
	Yes	157616	35.2%	82304	36.0%	75312	34.3%

**Table 2 Observations by State and Year**

State	2009	2011	2013	2015	2017	Total
Alabama	1,362	1,291	1,444	1,419	0	5,516
Alaska	1,161	1,229	1,126	1,287	1,231	6,034
Arizona	2,369	2,613	1,456	2,352	0	8,790
Arkansas	1,528	1,262	1,370	2,474	1,428	8,062
California	2,772	2,716	2,596	4,042	3,885	16,011
Colorado	1,429	1,378	0	0	1,298	4,105
Delaware	2,154	2,113	2,463	2,490	2,708	11,928
Florida	12,144	13,764	13,907	11,103	10,274	61,192
Hawaii	1,353	0	0	0	0	1,353
Idaho	2,060	1,625	1,811	1,680	1,758	8,934
Illinois	3,927	4,878	4,417	2,929	6,031	22,182
Iowa	0	1,499	0	0	1,539	3,038
Kansas	1,963	1,760	1,851	0	2,244	7,818
Kentucky	1,627	1,583	1,530	2,343	1,866	8,949
Louisiana	933	1,044	988	0	1,035	4,000
Maine	7,772	8,387	0	8,593	8,544	33,296
Michigan	3,109	3,968	4,028	4,506	1,537	17,148
Mississippi	1,711	1,692	1,503	1,877	0	6,783
Missouri	1,563	0	0	0	0	1,563
Montana	1,731	3,900	4,644	4,199	4,464	18,938
Nebraska	0	2,583	1,698	1,567	1,349	7,197
Nevada	1,951	0	1,988	1,359	1,510	6,808
New Hampshire	1,424	1,336	1,573	0	0	4,333
New Jersey	1,660	1,581	1,611	0	0	4,852
New York	33,611	0	0	0	0	33,611
North Carolina	6,946	3,527	3,061	5,523	2,893	21,950

**Table 2 (continued)**

State	2009	2011	2013	2015	2017	Total
North Dakota	1,721	0	0	0	0	1,721
Oklahoma	1,369	1,123	1,449	1,541	1,519	7,001
Pennsylvania	1,993	0	0	2,677	3,434	8,104
Rhode Island	2,994	3,681	2,269	3,155	2,021	14,120
South Carolina	1,018	1,333	1,487	1,246	1,206	6,290
South Dakota	2,077	1,464	1,231	1,207	0	5,979
Tennessee	2,139	2,528	1,747	0	1,903	8,317
Texas	904	1,062	0	2,471	3,014	7,451
Utah	1,505	1,611	2,069	0	1,723	6,908
Virginia	0	1,359	6,344	4,182	0	11,885
Washington	1,642	0	1,582	0	0	3,224
West Virginia	1,525	2,061	1,728	1,495	1,384	8,193
Wisconsin	3,965	4,497	3,821	0	1,939	14,222
Wyoming	2,684	2,280	2,827	2,213	0	10,004

**Table 3 Non-linear Generalized Diff-in-Diff**

	Ever Used Marijuana			Use in Past 30 Days		
Medical	-0.034	-0.050**	-0.084***	-0.061***	-0.073***	-0.094***
	(0.025)	(0.023)	(0.034)	(0.021)	(0.023)	(0.025)
<i>Treatment effect</i>	-0.008	-0.011**	-0.018**	-0.009***	-0.011***	-0.014***
	(0.006)	(0.005)	(0.007)	(0.003)	(0.003)	(0.004)
Observations	447,810	447,810	447,810	447,810	447,810	447,810
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Covariates Individuals	No	Yes	Yes	No	Yes	Yes
Covariates State	No	Yes	Yes	No	Yes	Yes
State specific linear time trend	No	No	Yes	No	No	Yes
	Ever Used Marijuana			Use in Past 30 Days		
Legislation	0.052***	0.060***	0.053	0.060*	0.062*	0.087**
	(0.020)	(0.021)	(0.053)	(0.033)	(0.034)	(0.042)
<i>Treatment effect</i>	0.012***	0.013***	0.012	0.009*	0.010*	0.014**
	(0.005)	(0.005)	(0.012)	(0.005)	(0.005)	(0.007)
Observations	447,810	447,810	447,810	447,810	447,810	447,810
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Covariates Individuals	No	Yes	Yes	No	Yes	Yes
Covariates State	No	Yes	Yes	No	Yes	Yes
State specific linear time trend	No	No	Yes	No	No	Yes

Notes: \*p-value<0.10, \*\*p-value<0.05, \*\*\*p-value<0.01



**Table 4 Group Treatment Diff-in-Diff**

	Ever Used Marijuana	Use in Past 30 Days
Medical	-0.017*** (0.006)	-0.014*** (0.005)
Dynamic effect	-0.019** (0.008)	-0.015** (0.007)
Legislation	0.014** (0.006)	0.018*** (0.006)
Dynamic effect	0.005 (0.008)	0.014*** (0.005)

Notes: \**p*-value<0.10, \*\**p*-value<0.05, \*\*\**p*-value<0.01

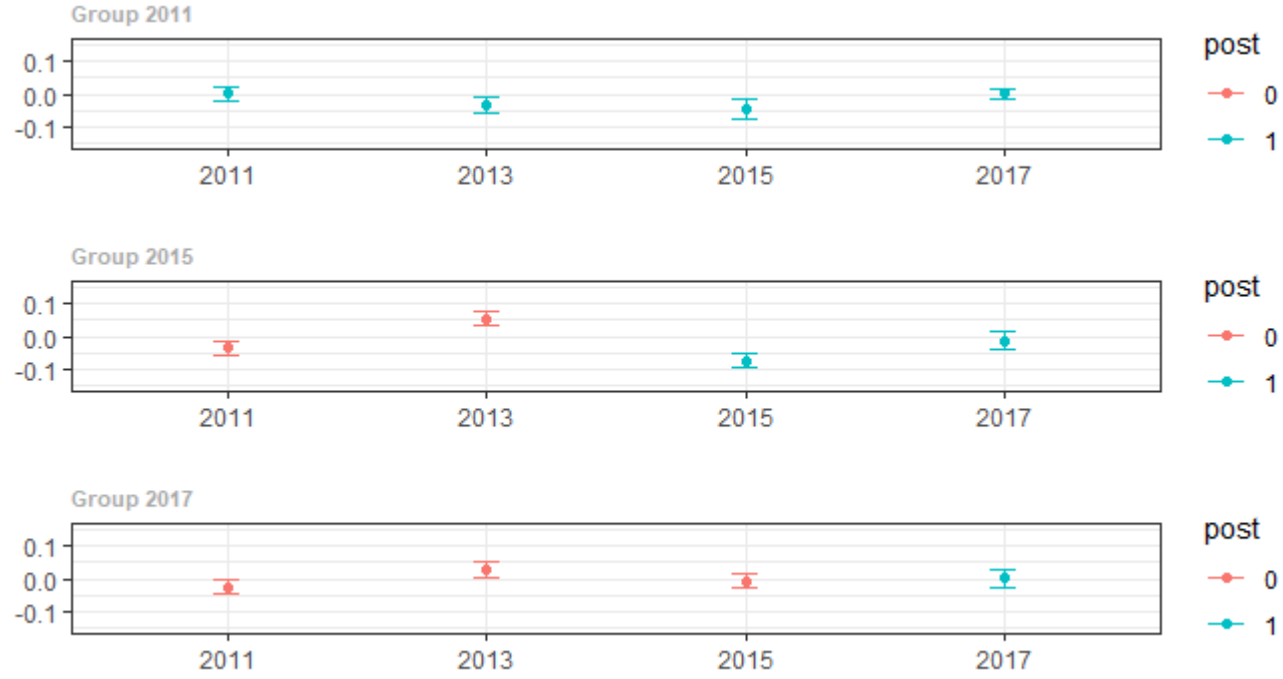


Figure 6 MMLs Group treatment Ever Used Marijuana

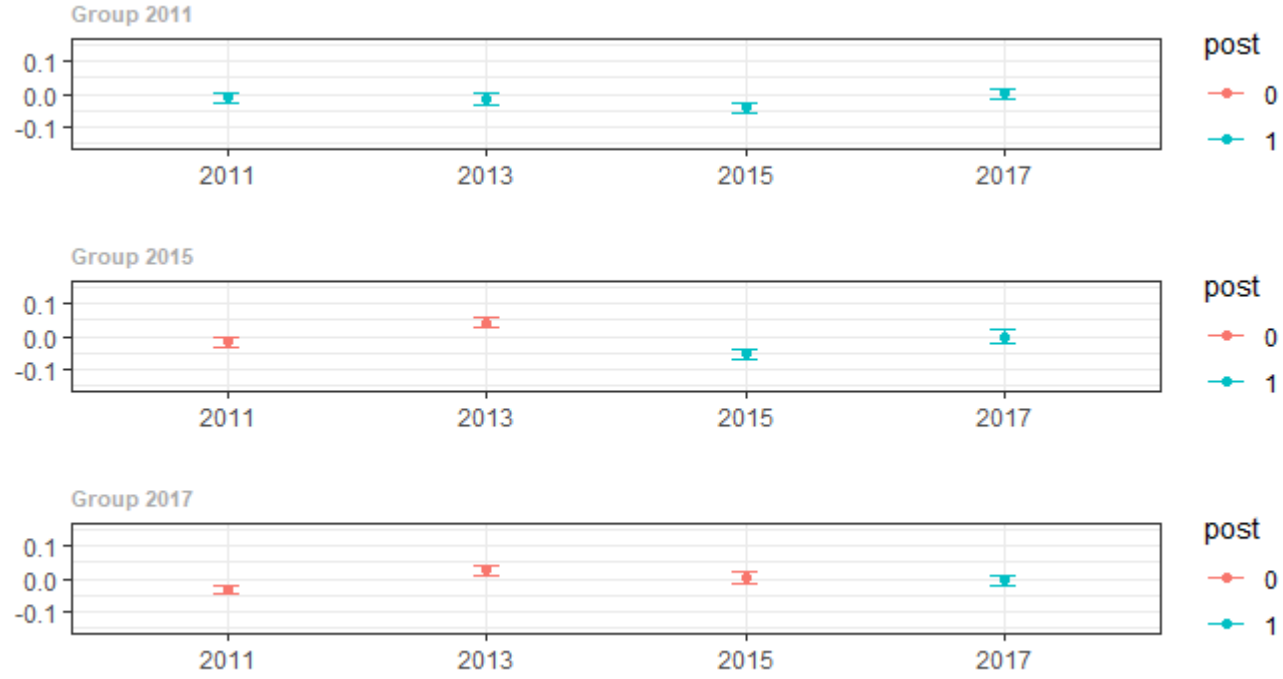


Figure 7 MMLs Group treatment Use in Past 30 days

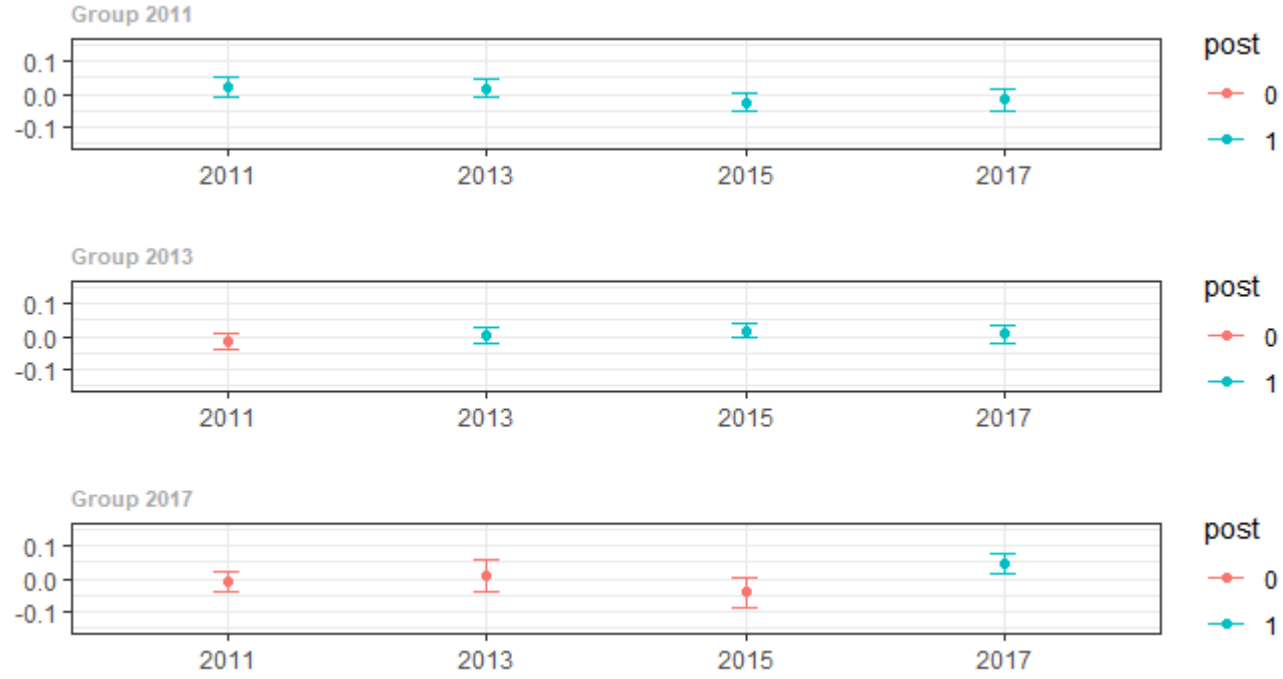


Figure 8 Decriminalization and RMLs Group treatment Ever Used Marijuana

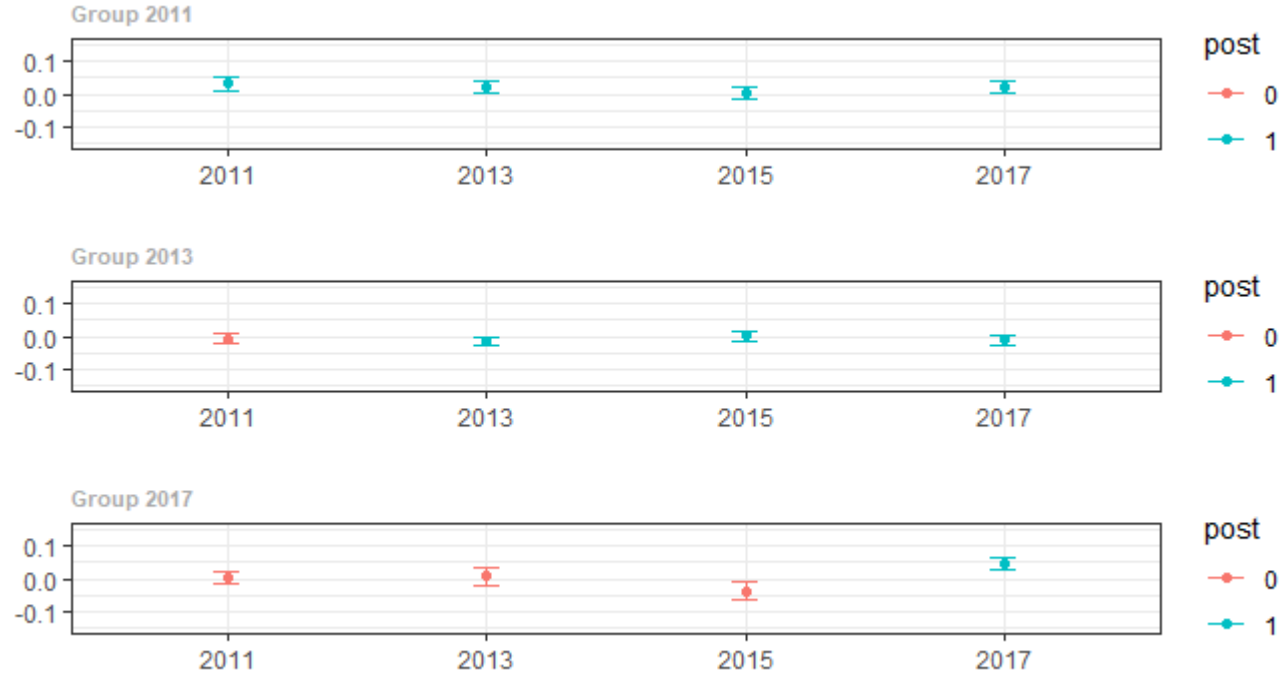


Figure 9 Decriminalization and RMLs Group treatment Use in Past 30 days

**Table 5 Sensitivity Analysis Difficulty Obtaining**

	Difficulty obtaining marijuana	Coefficient	Standard error	95% Confidence Interval	
1					
	MML state	0.254***	(0.025)	0.206	0.302
	Age	0.985***	(0.016)	0.953	1.017
	Sex	0.114***	(0.024)	0.067	0.162
	Race/ethnicity	-0.033***	(0.005)	-0.042	-0.024
	Constant	-0.921***	(0.051)	-1.020	-0.821
2					
	MML state	0.290***	(0.022)	0.246	0.333
	Age	1.069***	(0.014)	1.041	1.097
	Sex	0.164***	(0.022)	0.121	0.207
	Race/ethnicity	-0.017***	(0.004)	-0.026	-0.009
	Constant	-1.954***	(0.047)	-2.046	-1.862
3					
	MML state	0.260***	(0.022)	0.217	0.302
	Age	1.127***	(0.014)	1.099	1.155
	Sex	0.205***	(0.021)	0.163	0.247
	Race/ethnicity	-0.012***	(0.004)	-0.021	-0.004
	Constant	-2.888***	(0.048)	-2.982	-2.793
4					
	MML state	0.205***	(0.026)	0.155	0.256
	Age	1.074***	(0.018)	1.039	1.108
	Sex	0.149***	(0.025)	0.100	0.199
	Race/ethnicity	-0.002	(0.005)	-0.011	0.008
	Constant	-4.013***	(0.063)	-4.136	-3.890

Notes: 1 = Probably impossible, 2 = Very difficult, 3 = Fairly difficult, 4 = Fairly easy, 5 = Very easy; \*p-value<0.10, \*\*p-value<0.05, \*\*\*p-value<0.01

**Table 6 Sensitivity Analysis Maximum Penalty**

	Maximum penalty	Coefficient	Standard error	95% Confidence Interval	
0					
	MML state	-0.510***	(0.037)	-0.583	-0.437
	Age	0.181***	(0.023)	0.136	0.226
	Sex	-0.025	(0.036)	-0.096	0.046
	Race/ethnicity	-0.033***	(0.007)	-0.047	-0.020
	Constant	2.792***	(0.077)	2.641	2.944
1					
	MML state	-0.390***	(0.020)	-0.430	-0.351
	Age	-0.212***	(0.013)	-0.237	-0.187
	Sex	0.023	(0.020)	-0.016	0.061
	Race/ethnicity	0.001	(0.004)	-0.007	0.009
	Constant	1.644***	(0.044)	1.558	1.730
2					
	MML state	-0.222***	(0.018)	-0.257	-0.188
	Age	-0.306***	(0.011)	-0.328	-0.284
	Sex	-0.074***	(0.017)	-0.109	-0.040
	Race/ethnicity	-0.014***	(0.003)	-0.021	-0.007
	Constant	0.953***	(0.038)	0.879	1.027
3					
	MML state	-0.275***	(0.018)	-0.310	-0.240
	Age	-0.317***	(0.011)	-0.339	-0.294
	Sex	-0.132***	(0.018)	-0.167	-0.097
	Race/ethnicity	-0.024***	(0.004)	-0.031	-0.017
	Constant	0.651***	(0.038)	0.577	0.726
4					

**Table 6 (continued)**

	Maximum penalty	Coefficient	Standard error	95% Confidence Interval	
	MML state	-0.315***	(0.030)	-0.373	-0.256
	Age	-0.476***	(0.018)	-0.512	-0.439
	Sex	-0.150***	(0.029)	-0.207	-0.092
	Race/ethnicity	-0.009	(0.006)	-0.020	0.003
	Constant	-0.895***	(0.059)	-1.011	-0.779

Notes: 0= No penalty, 1 = A fine, 2 = Probation, 3 = Community service, 4 = Possible prison sentence, 5 = Mandatory prison sentence;

\*p-value<0.10, \*\*p-value<0.05, \*\*\*p-value<0.0



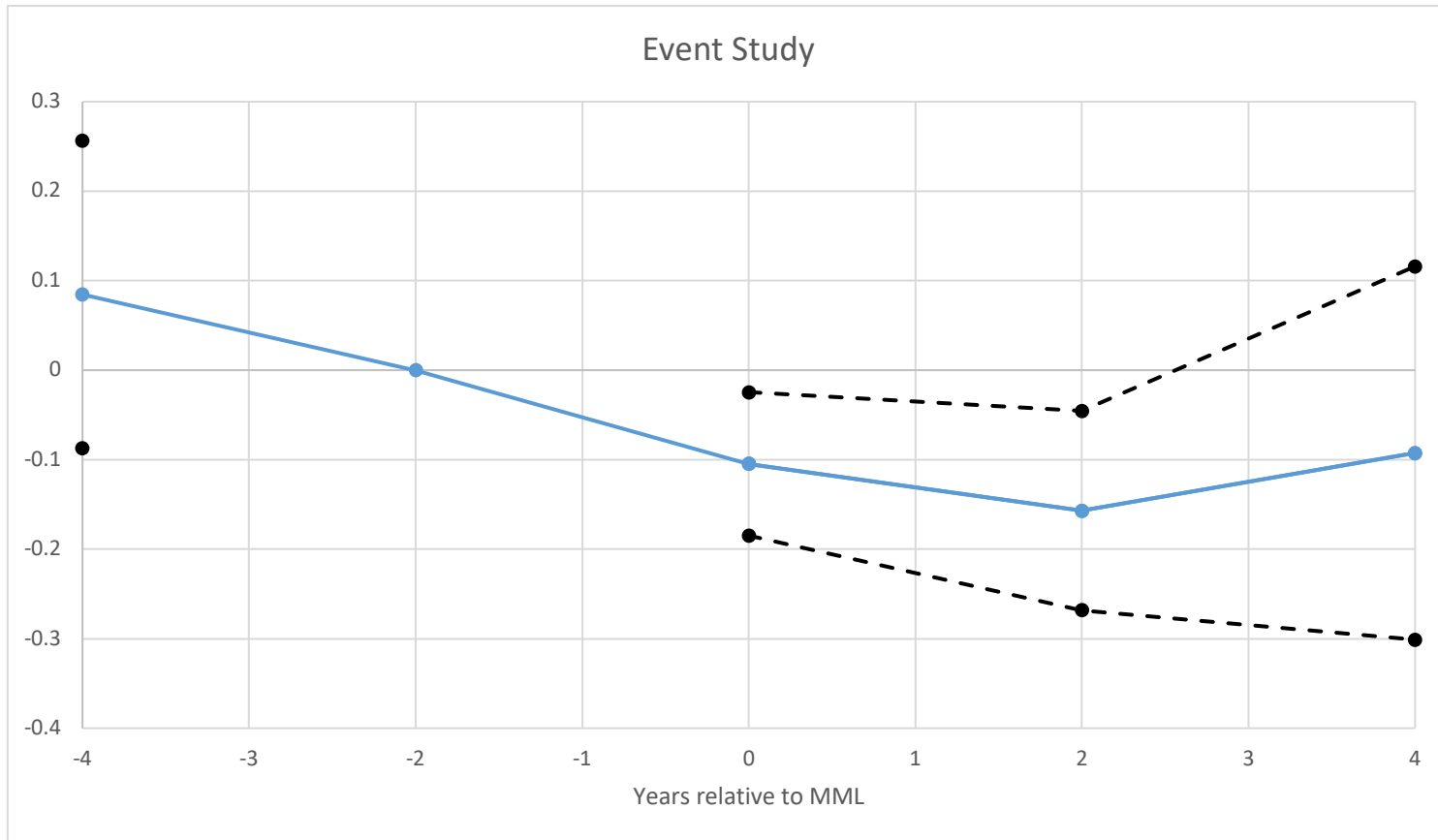


Figure 10 Event study ever used marijuana

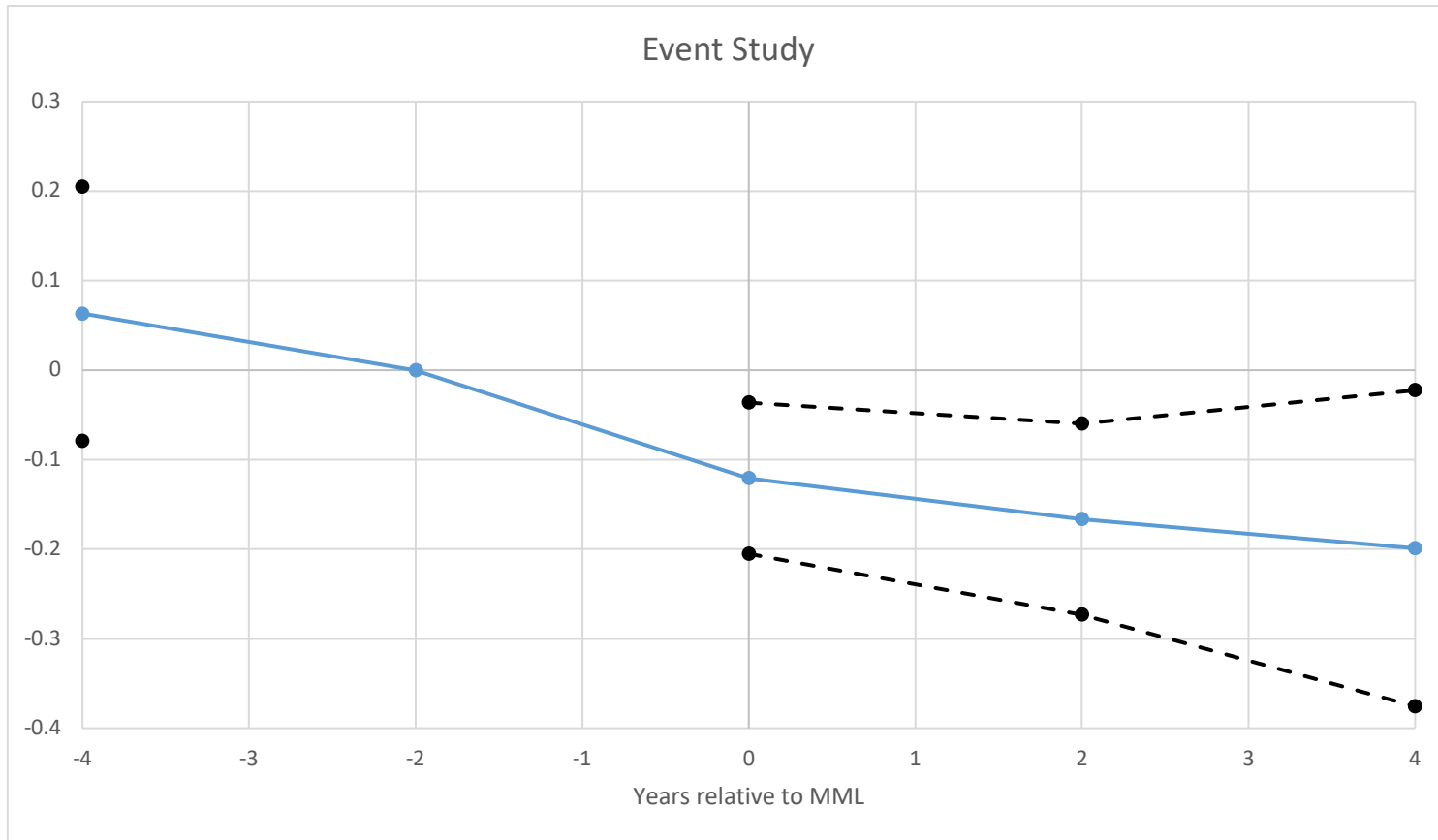


Figure 11 Event study marijuana use in the past 30 days

## Chapter Two: Background and Theoretical Model of Health Insurance Demand and Pooling

### 1. Introduction

What is the best method of providing quality medical care in the U.S.? This has been fiercely debated over the decades with cost containment and expansion of coverage being at the heart of the issue. The current system of using employer sponsored health insurance has inefficiencies that need to be addressed. While the introduction of the Patient Protection and Affordable Care Act (ACA) was seen to help individuals that don't currently have access to health insurance. It has struggled to meet past enrollment projections and premiums are rising because of this. Many Americans believe that the collapse of the Marketplace is inevitable. By focusing on consumer preferences and addressing current market inefficiencies, the Marketplace may thrive and help individuals attain higher quality health insurance coverage.

We first studied the role that firm size and health insurance plan type have on the cost of insurance. We found that individuals working in smaller firms pay higher out-of-pocket monthly premiums than those at larger firms. We attribute this to the pooling opportunities, administration costs, and negotiating power of larger firms. We next studied the preference of individuals regarding health insurance attributes: source, out-of-pocket monthly premium, plan type, and quality of coverage. We found that while people prefer employers as their source of coverage, the preference isn't very strong. Individuals also strongly prefer PPO plans over all over health insurance plan types.

By nudging individuals from small firms to choose coverage from the Marketplace we could provide higher quality coverage at a lower cost and stabilize premiums by drawing from a healthier group of individuals. This would not only solve the problems that arise when small firms offer health insurance, but the outlook of the Marketplace. We will build theoretical models on the demand for health insurance and insurance pooling that will guide the analysis in chapters three and four.

## **2. Literature Review**

### **2.1. Health Insurance Premiums and Insurance Selection**

Emerging research is providing evidence on the impact of the ACA on insurance premiums and the impact of earlier state-level health insurance reforms. Heim et al. (2015) studied the effects of the ACA on self-employed individuals and found that premiums are higher on average among the entire cohort, but, after taking taxes and subsidies into consideration, premiums are 42.3 percent lower for Silver category plans. Studies done on different state-level insurance reforms have reported contradictory results. Liu and Jin (2015) explore the impact of employer premium contribution schemes on premiums and find that two market incentives contribute to premium growth. The impact that market concentration has on premiums has also been an area of focus. Trish and Herring (2015) look at the relationship between insurer market power and hospital market power and how this affects employer-sponsored health insurance premiums. They find that there are offsetting effects of increases in insurer concentration, but higher levels of concentration are associated with higher premiums.

There have been many studies using administrative data focused on the selection of health insurance by consumers. Studies show that consumers do not always make the optimal decision when choosing their health plan. A study using University of Michigan employment records shows that one-third of workers were enrolled in a plan that was inferior for them compared to another plan that they could have chosen (Sinaiko and Hirth 2011). Heiss et al. (2013) also found that consumers pay about \$300 per year in excess spending as a result of suboptimal health insurance choices. The trade-off between price and wait time has also been explored. Pizer and Prentice (2011) found that a 10% increase in VA wait times increased the demand for Medigap coverage by 5%.

## **2.2. Health Insurance Preferences**

Other studies have used survey data to determine what information is most important to individuals. In Massachusetts, data from state employees show that information on specific health insurance plan benefits, quality, average out-of-pocket costs, and premium prices are the most important factors when determining which health plan to pick, while information about quality of mental health care and the amount of individuals satisfied with their plan are not considered useful (Tumlinson et al. 1997). This study also found that among respondents that have switched plans in the past three years, other than the plan being canceled, the top two reasons were high premiums and high out-of-pocket costs. A study in the Netherlands found that 64% of Dutch consumers switched health insurers because of the price of insurance (Duijmelinck, Mosca, and van de Ven 2015). Many consumers also rely on information from their employers when deciding on a health insurance plan (Feldman, Christianson, and Schultz

2000). Studies have also shown that employers are responsive to employee preferences when choosing what health plans to offer as fringe benefits (Bundorf 2002).

### **2.3. DCE: Health Insurance**

There has been considerable research in the emerging area of DCE regarding health insurance plans and preferences of consumers, especially in Europe. Not as many studies have been done in the U.S., concerning the ACA and the choices of consumers concerning different health insurance plans.

Discrete choice experiments have been increasingly used in the field of health economics. The characteristics that are most widely studied are: (i) monthly premiums, (ii) source of insurance, (iii) choice of physician and network, (iv) benefits offered by provider, and (v) insurance coverage. A study done in the Netherlands found that choice of provider was most important for those people over the age of 45, with some kind of chronic condition, and higher income; while monthly premium was the most important characteristic for the young, healthy, and lower income individuals (Determann et al. 2016). This is consistent with other studies that determined younger consumers tend to be more price sensitive, whereas older individuals are more concerned about the quality of their insurance (Brabers, Reitsma-van Rooigen, and de Jong 2012). Chakraborty, Ettenson, and Gaeth (1994) found that the most important attributes were hospitalization coverage, followed by choice of doctor, premium, dental coverage, and choice of hospital and there were notable differences in subgroups of the population. Kerssens and Groenewegen (2005) discovered that the most significant characteristic to be dental benefits, followed by deductible, and choice of hospitals. Other studies have focused on

different types of individuals and how they respond to different options. Van de Berg et al. (2008) found that high and low risk individuals are willing to pay more for insurance products that can be shown to offer better outcomes, this could be an argument for better health plan performance indicators to reduce adverse selection. Other studies have found that consumers most value family coverage and health insurance benefits (Trujillo et al. 2012). A U.S. study using choice-based conjoint analysis demonstrated how providers could design health insurance options that would be optimal for the consumer (Gates, McDaniel, and Braunsberger 2000).

### **3. Theoretical Framework**

#### **3.1. Demand for Health Insurance**

Early theories of health insurance surmised that obtaining health insurance lowers the price of health care, and therefore moral hazard is induced (Newhouse 1993). Pauly (1968) was the first to present the case, that any additional health care that is consumed as a result of simply being insured is a welfare loss, as the value of the care is less than the value of the cost. While, Friedman and Savage (1948) proposed that individuals purchase insurance because of uncertainty.

We used the model proposed by Nyman (2003) which rejects both of these models, and determines the decision to purchase insurance comes down to a pure income transfer from the healthy to the sick. In other words, there would be a transfer of income from health individuals to those who become ill and this type of moral hazard would be welfare increasing. This theory would also reason that providing insurance for the uninsured and implementation of national

health insurance would be unequivocally good for society (Nyman 2003). Based on this theory, the ACA has been successful thus far in providing insurance for more Americans and trying to make the purchase of insurance easier through state exchanges. The following model will draw on the previous work of Nyman (2003).

A consumer without insurance, that becomes ill, will solve the following problem:

$$\max U^s (M, Y)$$

$$\text{s.t. } Y^0 = M + Y,$$

$U^s$  is the utility for the consumer when ill,  $M$  is health care,  $Y$  is income, and  $Y^0$  is the initial endowment.

The first order conditions are (price of  $M$  is normalized at 1):

$$U^s_M / U^s_Y = -1$$

$$Y^0 - M - Y = 0,$$

A consumer with insurance, that becomes ill, will solve the following problem:

$$\max U^s (M, Y)$$

$$\text{s.t. } Y^0 - R = cM + Y,$$

in this equation,  $R$  is the premium, and  $c$  is the coinsurance rate. The premium is assumed to be actuarially fair, and equals:

$$R = \pi(1-c)H_i,$$

The first order conditions are:



$$U^s_M / U^s_Y = -c$$

$$Y^o - R - cM - Y = 0,$$

This theoretical model shows that an additional increase in either the probability of getting sick or the coinsurance rate will reduce the demand for health care because the premium and coinsurance costs experienced by the insured will increase. Now a deeper look into what attributes of health insurance are most important to the consumer is needed.

Nyman (2003) breaks down the decision of the consumer to purchase insurance with a comparison of the expected utility without insurance to the expected utility with fair insurance:

Expected utility without insurance,

$$EU_u = \pi U^s(M^u, Y^o - M^u) + (1 - \pi) U^h(0, Y^o)$$

Expected utility with fair insurance,

$$EU_i = \pi U^s[M^i, Y^o - \pi(1 - c)M^i + (1 - c)M^i - M^i] + (1 - \pi) U^h[0, Y^o - \pi(1 - c)M^i]$$

Insurance will be voluntarily purchased when  $EU_i > EU_u$ .

### 3.2. Health Insurance Pooling and Administration Costs

Pauly and Herring (1999) investigated the differences between individual, small group, large group structures. We used their model to explain our findings and explored if individuals monthly out-of-pocket health insurance premiums vary by firm size.

Pauly and Herring (1999) found that pooling is greater in larger groups, but the difference might not be as great as originally thought as non-group insurance markets also try to effectively pool

individuals. Pooling is not complete for large groups and there is still a great deal of premium variation according to the individual's risk profile.

High administration costs, determined by group size and number of insurance options, caused much of the difference in premiums between the three groups (Pauly and Herring 1999). The process of "underwriting" in which applications are reviewed varies depending on the size of the group. In non-group insurance everyone is reviewed, and a premium is determined, whereas in group insurance the underwriter will take into consideration the characteristics of the group in its entirety. Individuals in the non-group market must pay higher premiums relative to the benefits they receive because of these higher loading costs (Pauly and Herring 1999).

Another question is, should employment-based health insurance receive a tax subsidy? Pauly and Herring (1999) found that this tax subsidy leads to problems with excess levels of health insurance coverage. By abolishing the tax subsidy, smaller employers could offer higher wages in lieu of insurance coverage. This could lead to an influx of a large and healthy population to potentially enroll in the Marketplace.

The Marketplace could be more efficient in pooling small and non-group individuals and offer lower administrative costs. These costs could also be impacted by investigating which health insurance options are preferred by individuals and limiting the number of options available to those that are most valued.

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## Chapter Three: Health Insurance Premiums of Single Employees at Small Firms: Are They Getting a Raw Deal?

### 1. Introduction

The Patient Protection and Affordable Care Act (ACA), known colloquially as “Obamacare,” was designed to transform nearly all aspects of the health care industry. Specifically, the ACA included provisions to expand health care coverage among the uninsured, lower health care costs, offer greater insurance choice, increase essential benefits coverage in health insurance plans, enhance quality of care, and protect patients from punitive or discriminatory actions by insurance companies (Patient Protection and Affordable Care Act 2010). Research and government statistics indicates that several of these provisions have achieved at least partial success to date in meeting targeted objectives. For example, the ACA has significantly expanded coverage rates, especially among those with pre-existing conditions and young adults under the age of 26 (Garrett and Gangopadhyaya 2016, The Henry J. Kaiser Family Foundation 2017b). The ACA also led to the implementation of state-specific Health Insurance Marketplaces, also known as “Marketplace” or “exchange” plans, which were created in order to give consumers who needed to purchase insurance on the individual (non-group/employer) market the ability to more easily compare and purchase different health insurance packages. States have responded in a multitude of different ways to the ACA legislation, most notably with 32 states and the District of Columbia expanding Medicaid and 18 not expanding it, and with certain

states refusing to start health insurance marketplaces and leaving the federal government to establish and operate the Health Insurance Marketplace within them.

Although poorly understood by most consumers, the Marketplace is most relevant for the minority of consumers who are not covered by an employer-provided or public health insurance program (Loewenstein et al. 2013, Newport 2013). Prior to the ACA, research had shown that information asymmetries and confusing terminology inhibited consumers' comparison shopping of insurance products (Blomqvist and Léger 2005, Mulligan 2017). To improve access and affordability for these consumers, premium subsidies for lower income families (<200% of the federal poverty level) and cost-sharing reductions for lower- and middle-income families (<400% of the federal poverty level) were established for exchange purchases. Finally, the Marketplace was intended to foster competition among insurance companies through greater transparency and to control rising health insurance premiums.

Contrary to the intended policy objective, large rate increases for health insurance premiums were experienced in 2017, but premiums have leveled off as of 2019 for consumers shopping for insurance through the Marketplace (Cox et al. 2016, Fehr et al. 2018). While uncertainty around federal policies may be a factor, two fundamental economic problems are adverse selection and market concentration (limited competition or monopoly insurers) (Terhune and Appleby 2017). First, despite the individual mandate for health insurance, there is data suggesting that the younger segment of the population (18-34) did not enroll in the state exchanges as much as projected, resulting in premium increases to offset insurers' higher costs (Centers for Medicare & Medicaid Services 2017). In some states, insurance companies have withdrawn from certain state Marketplaces or selected geographic areas, reportedly because of

losses that were suffered as a result of underestimating the premium costs. Initial exchange enrollment figures projected by CMS and the CBO were around 21-24.8 million people, but only 12.7 million people were enrolled in the state exchanges in 2016 (Cox et al. 2016, The Henry J. Kaiser Family Foundation 2016). Nonetheless, enormous variation in state experiences persists. The cost growth in exchange plans is due in part to “pent up” demand for health care among previously uninsured persons, who have utilized health services at a greater level than forecasted after obtaining insurance. Since insurance functions through risk pooling, one policy solution for lowering cost growth is to increase the number of healthy, low cost individuals who enroll in exchange plans. However, a substantial number of these individuals have shown through revealed preference that they do *not* wish to purchase current insurance products at current prices. In 2016, 45% of uninsured adults reported that they do not purchase coverage because of the high cost (Cox et al. 2016). To increase exchange enrollment, policymakers need greater information about the *preferences* of people who are choosing between different health insurance plans to enhance the offerings, subsidies, and other regulations that affect consumers’ out-of-pocket costs. What could drive consumers to start choosing to enroll in the Marketplace rather than having inferior coverage or being uninsured.

Related to this, 150 million non-elderly receive coverage through employer-sponsored health insurance programs in 2016 (The Henry J. Kaiser Family Foundation 2016). While these plans are relatively popular with employees, growth of health insurance premiums and cost-sharing has made even this traditional benefit less generous than in the past. Many health policy and economic studies have shown that employer-provided health insurance is a socially inefficient way of providing coverage (Chivers, Feng, and Villamil 2017, Fairlie, Kapur, and Gates 2011,



Fang and Gavazza 2011). This is particularly relevant given current problems with the ACA. If more people were to choose insurance plans from the Marketplace, or if employers were incentivized to send their employees to the Marketplace, this could be a viable way to insure the feasibility of the broader Marketplace. Doing so would increase the pool of healthier individuals in Marketplace plans, helping to drive down premiums and promote competition among insurers. This may also give employees greater labor flexibility and provide better coverage choice. Although single persons with employer-based health insurance coverage was not the target population for ACA, they may benefit by switching their source of coverage from their employer to the Marketplace and the Marketplace may also benefit from their participation.

To address the critical policy question of how more individuals could be induced to enroll in Marketplace (exchange) health insurance plans, the purpose of this study is to examine the premiums paid by single employees for their employer-based health insurance coverage and their association with firm size and respondent characteristics. What are the attributes that could drive healthier and lower-cost individuals to buy insurance through the Marketplace?

### **1.1. Health insurance premiums and insurance selection**

Emerging research is providing evidence on the impact of the ACA on insurance premiums and the impact of earlier state-level health insurance reforms. Heim et al. (2015) studied the effects of the ACA on self-employed individuals and found that premiums are higher on average among the entire cohort, but, after taking taxes and subsidies into consideration, premiums are 42.3 percent lower for Silver category plans. Studies done on different state-level insurance reforms

have reported contradictory results. Liu and Jin (2015) explore the impact of employer premium contribution schemes on premiums and find that two market incentives contribute to premium growth. The impact that market concentration has on premiums has also been an area of focus. Trish and Herring (2015) look at the relationship between insurer market power and hospital market power and how this affects employer-sponsored health insurance premiums. They find that there are offsetting effects of increases in insurer concentration, but higher levels of concentration are associated with higher premiums.

There have been many studies using administrative data focused on the selection of health insurance by consumers. Studies show that consumers do not always make the optimal decision when choosing their health plan. A study using University of Michigan employment records shows that one-third of workers were enrolled in a plan that was inferior for them compared to another plan that they could have chosen (Sinaiko and Hirth 2011). Heiss et al. (2013) also found that consumers pay about \$300 per year in excess spending as a result of suboptimal health insurance choices. The trade-off between price and wait time has also been explored. Pizer and Prentice (2011) found that a 10% increase in VA wait times increased the demand for Medigap coverage by 5%.

Other studies have used survey data to determine what information is most important to individuals. In Massachusetts, data from state employees show that information on specific health insurance plan benefits, quality, average out-of-pocket costs, and premium prices are the most important factors when determining which health plan to pick, while information about quality of mental health care and the amount of individuals satisfied with their plan are not considered useful (Tumlinson et al. 1997). This study also found that among respondents

that have switched plans in the past three years, other than the plan being canceled, the top two reasons were high premiums and high out-of-pocket costs. A study in the Netherlands found that 64% of Dutch consumers switched health insurers because of the price of insurance (Duijmelinck, Mosca, and van de Ven 2015). Many consumers also rely on information from their employers when deciding on a health insurance plan (Feldman, Christianson, and Schultz 2000). Studies have also shown that employers are responsive to employee preferences when choosing what health plans to offer as fringe benefits (Bundorf 2002).

## **2. Methods**

### **2.1. National Survey of Single Adults with Employer-based Insurance Coverage**

The data was collected through an online cross-sectional survey targeting single individuals, 26 to 64 years of age, with no dependents and who currently have health insurance coverage through their employers. This sample was chosen to focus the analysis on insurance plan choice. Families and dependents add complexity since multiple people are covered under the plan, requiring a household level decision model. Also, individuals with public health insurance were excluded because these individuals face little or no monthly premium and have a different choice set and reservation options available for health insurance. The age range was designed to avoid dependent coverage under parental plans through age 25 and typical Medicare enrollment at age 65. There were definitions of important health insurance terms included throughout the survey in order to aid the respondent.

Fielding was conducted by a market research firm which invited participants to take part in our online survey. Quota sampling of employed single individuals aged 26-64 with employer-based

health insurance was based on age brackets (26-34, 35-54, and 55-64), gender (male and female), and race (Non-Hispanic, White or Caucasian, Non-Hispanic, African American or Black, Non-Hispanic, Other, and Hispanic) interactions. These frequencies were determined by a supplemental analysis of Medical Expenditure Panel Survey (MEPS) questionnaire data from 2001-2014 to ensure a big enough sample size. The analysis done in this paper is infeasible using the MEPS- Insurance Component supplementary data, because information on individual monthly health insurance premiums and firm size are not consistently measured across years and the amount of missing data is substantial. The online survey did not involve any intervention or interactions with an individual and the information obtained was not recorded in such a manner that the respondents or any other living person can be identified, directly or through identifiers (i.e., no identifiable private information (45 CFR 46.102(f)).

## **2.2. Analysis of Monthly Out-of-pocket Premiums**

In this model, self-reported monthly health insurance premium was the dependent variable of interest, and the independent variables were firm size (eight categories), age by three dummy groups (26-34, 35 to 54, 55 to 64), female, four race dummies (Non-Hispanic, White or Caucasian, Non-Hispanic, African American or Black, Non-Hispanic, Other, and Hispanic), three educational attainment dummies (Less than Bachelor's, Bachelor's Degree, and Greater than Bachelor's), three income dummies (Less than \$50,000, \$50,000 to \$75,000, and \$75,000 or greater), four region dummies (Northeast, Midwest, South, and West), and four health insurance plan types (FFS, PPO, POS, and HMO). Apart from response frequencies, we assess the correlation between firm size and income using a chi-squared test.

The data on premiums were reported using intervals and are right-censored with the upper bound considered to be infinity, so we estimate interval regressions (linear and exponential) by maximum likelihood (StataCorp 2013, Wooldridge 2012).

### 3. Results

The first two columns in Table 7 show that, among the 6,120 individuals who responded to the survey invitation, 885 (14.46%) dropped out during the screener, 1,865 (30.47%) failed the screener requirements (e.g., older than 64 years in age, married, no employer-based health insurance coverage), and 367 (6.00%) were excluded because sampling quotas were filled.

The 2,207 individuals who completed the survey were younger than those who dropped out, more likely to be male, less likely to be Hispanic, and from the Northeast and Midwest regions. Also, this online survey was conducted in 2017 and included more respondents with higher educational attainment and household incomes compared the MEPS household interviews, which were conducted between 2001 and 2014.

Table 8 provides an overview of respondents' firm size, health coverage, health, and medical care utilization. Firm size was not associated with household income ( $p$ -value=0.74). The predominant plan type that individuals report is Preferred Provider Organizations (70.14%). We also found that over half of the respondents report paying \$100 or less per month for their health insurance (51.75%), and less than 5% answer that they are in fair or poor health. About half of the respondents reported \$250 or less in yearly out-of-pocket health care costs (44.59%) and two or fewer medical visits (41.32%).

### 3.1. Analysis of Monthly Out-of-pocket Premiums

We estimated two linear interval regressions examining the association between monthly out-of-pocket premium and firm size (with and without plan type) controlling for respondent characteristics. Our results show that firm size is negatively related to premiums (p-value<0.01; Figure 12) and that firms with less than 50 workers pay out-of-pocket about \$20 more for premiums than larger firms, on average (Table 9). The annual difference in premium costs for employees at smaller firms (less than 50 workers) would equate to about \$200 to \$400 per year.

Although single employees in small firms pay more for their employer-based health insurance coverage than single employees in larger firms, they have similar health care expenditures (p-value=0.16). Employees at firms with 25 people or less were less likely to have any medical visits (p-value<0.05) than employees in larger firms.

Looking at the respondent characteristics (Table 9), premiums were not associated with gender, educational attainment and household income, but increased with age (p-value < 0.01).

Respondents in the 55 to 64 age group pay about \$41.62 more than 26 to 34-year-old respondents. We also found statistically significant regional differences, as respondents in the South and especially in the West pay less in monthly premiums than those in the Northeast.

Indicator variables for plan type were added to the second linear regression model to explore the influence of plan type on premiums. Although plan type is associated with premium (p-value<0.01), HMO plans were the only plans that differed significantly from PPOs (p-value<0.01). Specifically, respondents with HMO plans payed about \$20.04 less than those with PPOs.

We examined whether the respondent's industry (8 indicator variables) was related to premiums but did not find an association ( $p$ -value=0.39).

Finally, we performed a sensitivity analyses. We tested whether the results were sensitive to functional form and re-examined the associations using two different models: an exponential model and a linear model on log intervals. While model selection is challenging to quantify, these adjustments did not influence the findings of this study.

#### **4. Discussion**

We expected to find that older individuals and sicker individuals would pay more in monthly premiums. This study gives a more precise value to the differences among these groups. We did not find any differences among income or gender. Wealthier individuals are paying the same in monthly health insurance premiums as poorer individuals. The reason for there being no significant difference between males and females may be due to the specific group that is being observed (non-married). We also identified that employees in firms with less than 50 workers are paying significantly more in monthly out-of-pocket premiums than those in larger firms. There is also a disparity in the amount of annual medical visits undertaken by those at small firms. Smaller firms do not have the negotiating power or pooling opportunities to be able to obtain cheaper rates for their employees.

It is socially inefficient, and arguably inequitable, for the quality and cost of health insurance to vary by the size of a firm that a person works at. At the very least, this variation may inhibit labor flexibility or induce job lock (Gruber and Madrian 2002). These problems could be reduced if policy solutions pooled employees from small firms into a much larger group pool—

such as the Marketplace. One major attempt by ACA to address this issue is the Small Business Health Options Program (SHOP), which allows businesses with fifty or fewer full-time employees to purchase health insurance coverage through online marketplaces. SHOP had lower than anticipated participation and faced multiple issues including: technical problems with its electronic marketplace, brokers unwilling to buy-in, and small businesses being unaware of its existence (Blumberg and Rifkin 2014, Government Accountability Office 2014). By learning more about individuals' health insurance, it is possible to help guide them in the process of choosing health insurance plans and try to correct market inefficiencies. The Marketplace is a potential solution to this problem. Employees at small firms could get access to more affordable health insurance. This influx of new beneficiaries would also have an impact on premiums in the Marketplace.

A limitation of this study may be that individuals generally do not know how much their employers are contributing to their health insurance. It is possible that the individuals that are facing the highest monthly premiums at these smaller firms might not be in our sample because they choose not to have health insurance and pay the individual mandate. We could also explore different populations than the one studied here. Another possible limitation to the study is that, when comparing the sample of individuals from this study to the MEPS data, there are differences since MEPS oversampled African Americans and Hispanics. There are also differences due to how the data was collected (administered via online survey).

There will need to be continued research on the impact of the Marketplace on health insurance premiums and insurer concentration. Should there be legislation that targets concentration among hospitals to avoid a disparity in the negotiating power that hospitals have when dealing



with insurers? Is there a way to get more transparency for the prices that are charged for different medical services? We could also explore individuals that are uninsured or those with public insurance, regarding the type of health coverage they are receiving. There are current disparities in the health insurance market that need to be addressed, and the objective of future legislation should be to eliminate these inequalities.

## **5. Conclusions**

Health insurance premiums have been increasing progressively over the past decade in the United States. ACA was thought of as a solution to control health care costs and increase health insurance availability. It was hoped that the creation of Health Insurance Marketplaces would foster competition among insurers and reduce premiums. Many individuals obtain insurance through their employers and opt not to join the Marketplace, however. Getting these healthy individuals to choose to purchase insurance through the Marketplace could help manage the cost of insurance. Individuals would also gain the benefit of not having their health insurance tied to their job. This may lead to greater labor mobility, as individuals do not have to worry about being uninsured while looking for new employment. We see that larger firms have an advantage over smaller firms because of pooling opportunities. Larger firms can offer employees much lower monthly premiums than those with less than 100 employees. Should the government motivate small businesses to send their employees to the Marketplace, and would this lead to better health insurance coverage for these individuals? If that happened, what would their beneficiaries want? With a much greater number of people in the Marketplace, it would be interesting to analyze the impact on health care coverage and cost. It may also be beneficial for firms to not have to offer health insurance. Employers could save

time and effort by allowing individuals to choose their own coverage. The purpose of this study is to gain a better understanding of the health insurance coverage of the population and ways that we could possibly change the structure of the insurance model to deliver more affordable and sustainable health care.

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**Table 7 Respondent Demographic and SES Characteristics**

	Dropout N=272 % (#)	Completed N=2207 % (#)	p-value	MEPS- IC N=3253 %
<i>Age in years</i>			0.010	
26 to 34	34.93% 95	41.34% 912		29.79%
35 to 54	47.44% 129	44.91% 991		53.80%
55 to 64	17.64% 47	13.78% 304		16.42%
<i>Sex</i>			0.044	
Male	38.60% 104	44.95% 992		42.42%
Female	61.40% 167	55.05% 1214		57.58%
<i>Race/Ethnicity</i>			0.861	
African American or Black	15.07% 40	11.92% 263		23.95%
Caucasian or White	73.53% 200	75.80% 1672		66.58%
Asian	6.99% 19	8.97% 197		5.16%
American Indian or Alaska Native Hawaiian or other Pacific	0.74% 2	0.63% 13		0.80%
Other	0.00% 0	0.14% 3		0.77%
	3.68% 10	2.54% 56		2.25%
<i>Hispanic ethnicity</i>			0.077	
Hispanic or Latino	18.01% 49	11.15% 245		16.19%
Not Hispanic or Latino	81.99% 222	88.85% 1961		83.81%
<i>Educational Attainment</i>			0.125	
Less than high school	0.00% 0	0.14% 3		8.27%
High school graduate	4.42% 12	4.76% 105		27.45%
Some college, no degree	15.07% 40	11.51% 254		9.35%
Associate's degree	10.29% 27	8.25% 182		16.57%
Bachelor's degree	40.44% 109	43.18% 952		26.50%
Graduate or professional degree	29.78% 81	32.17% 709		11.87%
<i>Household income</i>			0.908	
\$14,999 or less	2.57% 6	0.18% 3		4.00%
\$15,000 to 24,999	1.84% 5	1.99% 43		14.88%
\$25,000 to 34,999	4.78% 13	6.66% 146		19.74%
\$35,000 to 44,999	10.29% 27	10.51% 231		16.75%
\$45,000 to 49,999	10.66% 28	6.07% 133		6.55%
\$50,000 to 74,999	24.63% 66	29.63% 653		22.96%
\$75,000 to \$99,999	17.28% 47	18.08% 399		8.24%
\$100,000 to \$149,999	13.60% 36	14.09% 310		5.07%
\$150,000 or more	6.62% 18	7.89% 174		1.81%
Refused/Don't know	7.72% 20	4.89% 107		-----
<i>Region</i>			0.028	
Northeast	20.59% 56	23.65% 522		17.15%
Midwest	18.01% 49	23.97% 529		21.95%
South	36.03% 97	30.09% 664		36.52%
West	25.37% 69	22.29% 492		24.38%

**Table 8 Respondent Firm and Health Characteristics**

	N=2207 % (#)
<i>Firm Size</i>	
Less than 10	4.94% 109
10 to 25	8.07% 178
26 to 49	6.21% 137
50 to 100	8.16% 180
101 to 500	19.30% 426
501 to 1,000	7.66% 169
1,001 to 5,000	11.87% 262
5,000 or more	33.80% 746
<i>Health Insurance Plan Type</i>	
Fee-for-Service (FFS)	4.76% 105
Preferred Provider Organization (PPO)	70.14% 1548
Point of Service (POS)	8.29% 183
Health Maintenance Organization (HMO)	16.81% 371
<i>Health insurance Premium (monthly)</i>	
\$1-\$25	16.86% 372
\$26-\$50	12.96% 286
\$51-\$75	9.38% 207
\$76-\$100	12.55% 277
\$101-\$125	9.20% 203
\$126-\$175	7.25% 160
\$176-\$250	8.11% 179
\$251 or more	10.83% 239
Don't know	12.87% 284
<i>Self-Rated Health</i>	
Fair/Poor	4.98% 110
Excellent/Very Good	95.02% 2097
<i>Out-of-pocket Health care costs (past year)</i>	
\$1-\$250	44.59% 984
\$251-\$750	22.56% 498
\$751-\$1,500	11.78% 260
\$1,501-\$2,500	8.56% 189
\$2,501 or more	7.97% 176
Don't know	4.53% 100
<i>Number of Medical Visits (past year)*</i>	
None	20.39% 450
1	20.93% 462
2	18.99% 419
3	13.37% 295
4	10.19% 225
5 to 9	11.33% 250
10 or more	4.80% 106

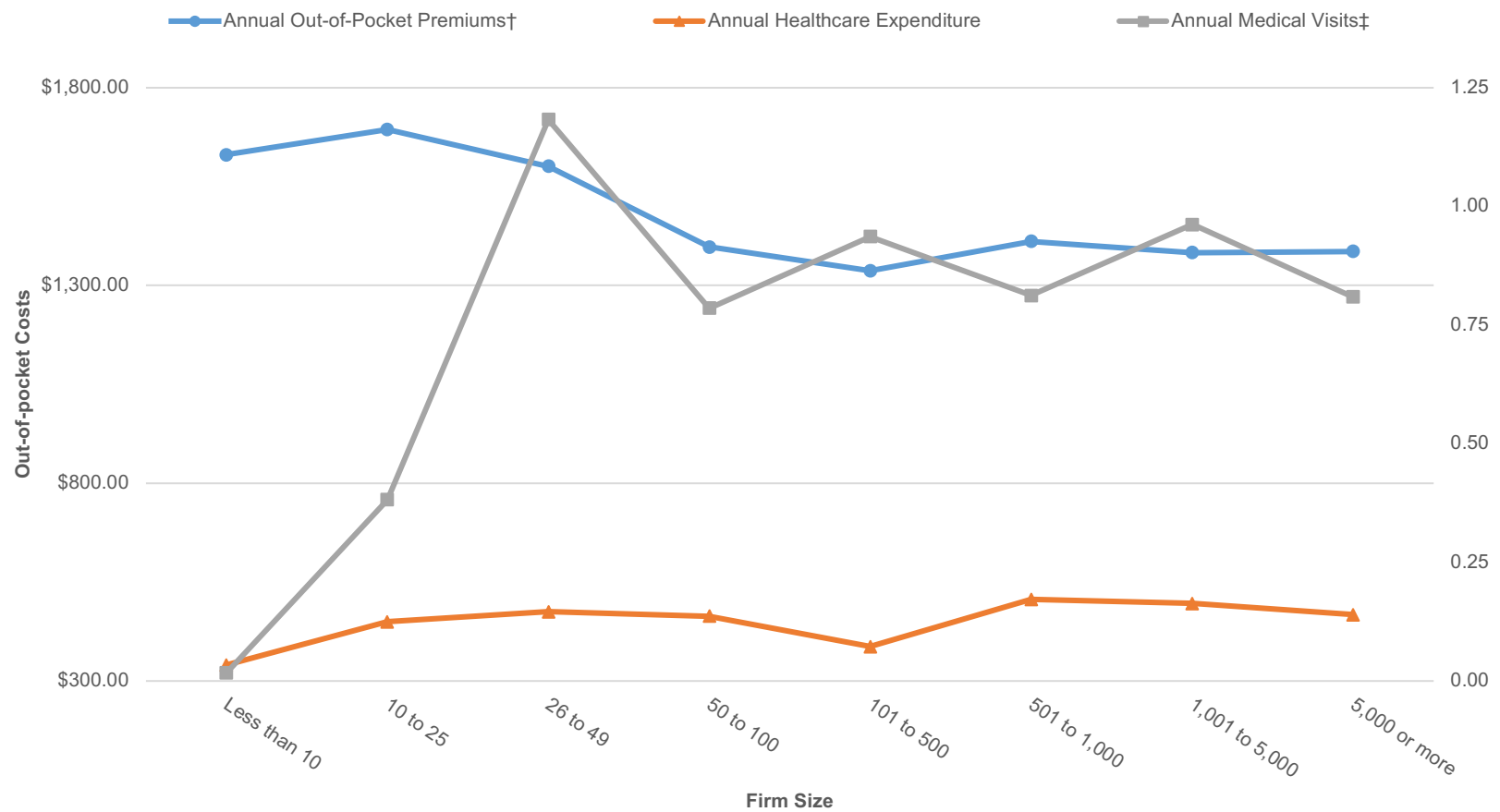
Notes: \*Doctor's office or clinic



**Table 9 Monthly Self-Reported Out-of-Pocket Premiums for Survey Respondents, by Firm Size**

	Coefficient	95% Confidence Interval		Coefficient	95% Confidence Interval	
<i>Firm size (number of employees)</i>						
Less than 10	135.64	71.21	200.07	135.86	71.58	200.14
10 to 25	141.04	78.58	203.51	141.20	78.89	203.51
26 to 49	132.72	69.87	195.56	133.45	70.74	196.16
50 to 100	115.75	53.36	178.13	116.44	54.18	178.69
101 to 500	111.28	49.57	172.99	111.44	49.89	172.99
501 to 1,000	116.85	53.86	179.84	117.62	54.79	180.45
1,001 to 5,000	115.33	52.97	177.69	115.30	53.09	177.50
5,000 or more	115.95	54.29	177.61	115.51	54.01	177.01
<i>Age in Years</i>						
<i>(26-34 to)</i>						
35 to 54	+13.65***	+4.61	+22.69	+13.54***	+4.51	+22.56
55 to 64	+41.62***	+28.68	+54.57	+42.33***	+29.42	+55.25
<i>Gender</i>						
<i>(Male to)</i>						
Female	-6.90	-15.41	+1.60	-7.47*	-15.95	+1.02
<i>Race/Ethnicity</i>						
<i>(Non-Hispanic, White/Caucasian to)</i>						
Non-Hispanic, African American or Black	-7.72	-20.88	+5.44	-6.90	-20.02	+6.22
Non-Hispanic, Other	+10.20	-50.79	+71.19	+10.45	-50.35	+71.24
Hispanic, All races	-8.52	-68.01	+50.97	-6.61	-65.89	+52.68
<i>Educational Attainment</i>						
<i>(Bachelor's Degree to)</i>						
Less than Bachelor's	-3.56	-14.10	+6.97	-4.01	-14.51	+6.48
Greater than Bachelor's	-0.56	-10.04	+8.93	-0.87	-10.33	+8.58
<i>Household Income</i>						
<i>(\$50,000 to \$75,000 to)</i>						
Less than \$50,000	-1.17	-11.76	+9.42	-0.57	-11.13	+9.98
\$75,000 or greater	+1.95	-7.92	+11.83	+2.48	-7.36	+12.32
<i>Region</i>						
<i>(Northeast to)</i>						
Midwest	-3.66	-15.46	+8.14	-3.96	-15.72	+7.80
South	-12.12**	-23.41	-0.83	-12.68**	-23.93	-1.42
West	-26.73***	-38.64	-14.81	-24.03***	-35.97	-12.09
<i>Plan type</i>						
<i>(PPO to)</i>						
FFS	-----	-----		+4.47	-14.40	+23.34
POS	-----	-----		+6.52	-8.01	+21.05
HMO	-----	-----		-20.04***	-31.03	-9.06

Notes: \*\*\*p<0.01, \*\*p<0.05, \*p<0.1. Estimates shown in 2017 US dollars. No reference group for firm size to obtain premium means.



Notes: †A significant negative linear trend ( $p < 0.01$ ). ‡A significant positive linear trend ( $p < 0.05$ ).

Figure 12 Annual Out-of-Pocket Premiums, Annual Healthcare Expenditures, and Medical Visits by Firm Size

## Chapter Four: The Value Employees Place on Health Insurance Plans: A Discrete Choice

### Experiment

#### 1. Introduction

The Patient Protection and Affordable Care Act (ACA) was introduced in 2010 as a way of delivering more affordable and better-quality health care. A major component of this health care legislation was the creation of an online marketplace where individuals could easily compare and purchase health insurance plans. The viability of the federally-facilitated Marketplace is currently in question, as initially the projected number of enrollees had fallen short and premiums were rising faster than expected (Cox et al. 2016, Centers for Medicare & Medicaid Services 2017). As of 2019, premiums for average benchmark plans are decreasing slightly, but there is a wide variation across the United States (Fehr et al. 2018). Much of the public believes that the collapse of these Marketplaces is inevitable, and the repeal of the individual mandate has added to this speculation as well as the possibility of ACA being declared unconstitutional (Kirzinger et al. 2018, Wamsley 2019). Getting healthier people to purchase their plans through the Marketplace could help reduce premiums and offer a higher quality of coverage.

To motivate healthier people to enroll in the Marketplace, it is important to understand their preferences for health insurance. Discrete choice experiments (DCEs) have been used increasingly in the field of health economics to examine respondents' preferences on health

and health-related goods and services (Clark et al. 2014, Drummond et al. 2015). By asking respondents to tradeoff between plan attributes, analysts can quantify the value of plan attributes and predict shifts in demand (McFadden 1974, Orme 2006). In this study, respondents were asked to choose between health insurance plans that differed in source of coverage, plan type, monthly out-of-pocket premium, and quality of coverage.

This study is the first to focus on the values of single employees and one of the first to examine health insurance preferences more generally. Not only is this a far less complex population than individuals with multiple-person plans or individuals with public insurance (Medicaid, Medicare, TRICARE, etc.), this population is rather healthy and may be motivated to switch from their employer-based plans to the Marketplace. Although the Consolidated Omnibus Budget Reconciliation Act (COBRA) mandates some continuity of employer-based plans post-employment there is still the possibility of reduced job mobility as the employer no longer contributes to the health insurance plan (Bailey and Chorniy 2016). Individuals with chronic illnesses may be disproportionately affected by having their health insurance tied to their employer (Stroupe, Kinney, and Kniesner 2001). A switch to the Marketplace would allow these employees to change employers without changing their current insurance coverage. Employees at smaller firms are also not able to take advantage of risk pooling opportunities and administrative cost savings that are provided by larger firms (Pauly and Herring 1999).

With the evidence from this study, policy makers will have a better understanding of consumer's health insurance preferences and be able to use this information to offer higher quality and sustainable health insurance coverage.

## 2. Method

As part of an online survey, each respondent completed 28 paired comparisons (Figure 13), choosing between plans that varied by their attributes (Table 10). This section breaks down the methods by attributes and levels, DCE design, survey instrument, sampling and data collection, and analysis (Bridges et al. 2012, Louviere and Lancsar 2009, Mühlbacher et al. 2016).

### 2.1. Attributes and levels

The attributes and levels (Table 10) were taken from the Marketplace and the Medical Expenditure Panel Survey (MEPS) as well as supplemented with a review of the literature.(Brabers, Reitsma-van Rooigen, and de Jong 2012, Chakraborty, Ettenson, and Gaeth 1994, Determann et al. 2016, Gates, McDaniel, and Braunsberger 2000, Kerssens and Groenewegen 2005, Trujillo et al. 2012, Van de Berg et al. 2008). For example, we considered monthly premiums greater than \$250, but this didn't seem to be a realistic option for the target population based on the MEPS data. The quality levels – also known as metal levels – and their definitions were taken directly from the Marketplace.

Understanding the intricacies of the health insurance attributes can be difficult, so the survey contained definitions throughout (see Appendix A). Plan type and quality of coverage attributes required providing more detailed information; therefore, we included tables with lay explanations of these terms. Apart from instructional tables, these definitions were easily accessible by hovering the cursor over the term, at which point a text box would appear with the definition.

## 2.2. DCE Design (Pair Selection, Task, Choice Sets)

To further enhance the respondents' cognition, the 28 paired comparisons were separated into two series. The first series included four comparisons where each alternative plan was a variation on respondent's current health insurance plan type (see Appendix A). In the second series (24 comparisons), each alternative plan was a new plan, which allowed plan type to vary. Generally, we applied the same approach to generate the pairs for each series.

We used a fractional factorial design. Given the descriptive system, after removing the dominant pairs (i.e., where one alternative was unambiguously better at each attribute compared to its counterpart), there were 756 possible pairs in the first series (2 alternatives and 3 attributes with levels ranging from 2-7) and 16800 possible pairs in the second series (2 alternatives and 4 attributes with levels ranging from 2-7). It was not possible to use Bayesian efficiency algorithm to select the subset of pairs, because there was no prior information to base expectations (Bliemer, Rose, and Hess 2008); therefore, we applied three rules to select the pairs:

- i. Within each choice set, the difference in the "premium" attribute had to be at least two or more levels;
- ii. For source, coverage, and premium attributes, the weighted difference in levels needed to be less than 1.67 where weighted difference =  $(A_{\text{source}} - B_{\text{source}})/2 + (A_{\text{coverage}} - B_{\text{coverage}})/3 + (A_{\text{premium}} - B_{\text{premium}})/4$ ; and
- iii. The total absolute difference in levels within the choice set needed to be less than 0.34 for the first series and less than or equal to 0.25 in the second series where total

absolute difference =  $\text{abs}(A_{\text{source}} - B_{\text{source}})/2 + \text{abs}(A_{\text{coverage}} - B_{\text{coverage}})/3 + \text{abs}(A_{\text{premium}} - B_{\text{premium}})/4$ .

This was done to gain better information on preferences and to strike a balance between statistical efficiency and response efficiency. The alternatives in the paired comparisons differed but not by a substantial amount to limit cognitive burden. There was some overlap in the design which increased response efficiency, but to account for possibly limiting trade off information we increased the number of paired comparisons in the second series (total absolute difference in levels is less than the first series). From this subset of 2758 pairs (402 in the first series and 2356 in the second series), we arbitrarily drop two pairs from the first series and add 44 pairs to the second series to achieve a design with 400 and 2400 pairs, respectively. The pairs were also assigned in respondent-specific blocks (to promote response efficiency), which randomized pair sequence (4 pairs and 24 pairs) and format (i.e., left-right) (Reed Johnson et al. 2013).

### **2.3. Survey Instrument/Questionnaire**

As part of the screener, the survey instrument began with questions regarding consent and respondents' demographic and socioeconomic status (see Appendix A). The screener also contained questions about employment, firm size, and their current health insurance plans. The screener questions were designed to verify qualification to participate and for use in the quota sampling. After the screener, the DCE component began with three paired comparisons as a warm-up activity followed by the two series of paired comparisons (one of which was a within-

set dominated pair). Afterwards, respondents were asked about their health and utilization of health care as well as any comments about the survey.

To obtain initial feedback on the survey instrument, undergraduate and graduate students at the University of South Florida, Department of Economics, were hired as beta testers. The main areas of interest were length of time to complete the survey, technical or syntax errors, ease of use, clarity in the definitions being presented, and general comments. Most testers completed the survey within 20 minutes and had little difficulty in understanding the health insurance attributes; however, some layout and text changes to the instructional material were made based on their comments.

#### **2.4. Sampling and Data Collection**

Participants were recruited via email from a nationally representative panel by Dynata which is a global marketing research firm. Each invitation included a link to the survey instrument (i.e. not via online banners, ads, or promotions). The sample selection criteria included: (1) 26 to 64 years of age; (2) single as marital status; and (3) was enrolled in an employer-provided private health insurance plan. Respondents younger than age 26 were excluded due to the potential for parental coverage and respondents 65 and older were excluded due to potential public insurance, largely Medicare.

Quota sampling was based off three age brackets (26-34, 35-54, and 55-64), gender (Male and Female) and race (Non-Hispanic, White/Caucasian or Other; Non-Hispanic African American or Black; and Hispanic, All races). These quotas were based on an analysis of MEPS and ensured a minimum amount of demographic diversity at the pair level.



## 2.5. Analysis

For each respondent  $i$ , utility ( $U$ ) of a health insurance plan,  $s$ , in choice set,  $j$ , is composed of an explainable component,  $V_{isj}$ , and an unexplainable random component,  $\eta_{isj}$  (i.e.,  $U_{isj} = V_{isj} + \eta_{isj}$ ). Under the assumption that  $\eta_{isj}$  is extreme-value type-I distributed, the probability of alternative  $n$  being chosen from the complete set of alternatives  $s$  ( $s = 1, \dots, S$ ) in choice set  $j$  is:

$$P_{inj} = \frac{e^{V_{inj}}}{\sum_{s=1}^S e^{V_{isj}}} \quad j = 1, \dots, S$$

We incorporated the four attributes of the health insurance plan into  $V_{isj}$  using a linear regression of binary variables indicating the attribute levels:

$$V_{isj} = \beta_1 Sour_{isj} + \beta_2 Plan_{isj} + \beta_3 Prem_{isj} + \beta_4 Cov_{isj}$$

The coefficients of the regression were estimated using the conditional logit command in the STATA 13 software. Due to multiple responses per respondent, the standard errors for the coefficients were adjusted to account for clustering at the individual level. We also performed a sensitivity analysis using a more flexible mixed logit, but we found no substantial differences in the odds ratios (i.e. 95% confidence intervals overlapped). We then estimated 95% confidence intervals for predicted probabilities that a respondent would choose the Marketplace given its attribute levels using percentile bootstrap methods (Lancsar, Louviere, and Flynn 2007).

As implied by the design and power calculation, we hypothesized that employer-based coverage, Fee-for-Service (FFS) plans because of the freedom in which it allows consumers to choose providers of care, lower premiums and greater coverage are preferred over their counterparts. To aid interpretation, the coefficients are shown as odds ratios. Odds ratios that

are less than 1 represent that the null level is preferred over the attribute level. The null level for source was health insurance plan through employer, and the null level for plan type was FFS. For each level of premiums and coverage, the null is the next lower level (e.g., \$50 premiums were compared to \$25 premiums; \$75 premiums were compared to \$50). In statistical terms, we hypothesized that all odds ratios were significantly less than one at a 0.05 significance level.

### **3. Results**

#### **3.1. Respondent Characteristics**

Between May and July 2017, 2,479 respondents were successfully recruited and screened; 2,207 (89.02%) finished the entire survey, which took 23 minutes on average; and 272 (10.97%) respondents dropped out at some point during the survey. Participants that dropped out were older, more likely female, and more likely to be from the Southern or Western regions of the U.S compared to those who completed the survey (Table 11).

Over half of the respondents were female (55.05%), and a majority had attained a bachelor's degree or higher in education (75.35%). Most of the respondents (95.02%) self-rated their health as excellent or very good. Only 4.61% of the respondents chose the dominated option (Bronze, HMO, \$250 vs Platinum, FFS, \$25) on the warm-up task. Respondents generally made the same amount of left and right choice, 49.83% to 50.17% respectively, and less than 1% of individuals made only the right (left) choice for all 28 pairs.

### 3.2. Preferences Between Health Insurance Plans

Table 12 reports the odds ratios, standard errors, and 95% confidence intervals for the health insurance attribute levels. In the first four comparisons, the plan type was the respondent's current health insurance plan type for both alternatives, whereas plan type varied in the second series of 24 comparisons. Table 12 shows the results by series and combined. All odds ratios were significant ( $p$ -value  $< 0.01$ ).

As hypothesized, the first series regarding respondent's current health insurance plan type showed that lower premiums and greater coverage were preferred. We find very small odds ratios at the higher end of the premium scale' \$175 to \$250 (0.085 and 0.035) and the biggest difference in coverage comes from the jump between silver or bronze (0.523 and 0.232, respectively). The results demonstrate a slight preference for employer-based over Marketplace as the source of coverage (0.726; 95% CI: 0.646-0.815); however, this is the second largest odds ratio, which implies that a \$25 reduction in premiums or an increase in coverage from Bronze to Silver or from Silver to Gold would nudge the majority of respondents to switch to the Marketplace, assuming that they could keep their current health insurance plan type.

The second series compared two new plans, often with different plan types. Among the new plans, FFS plans were not preferred over all other plan types, which uniformly contradicts the original hypotheses. Instead, respondents strongly preferred all other plan types to FFS plans, especially PPO plans (4.230; 95% CI: 3.816-4.687). The results also showed that the difference in value between the HMO and POS plans was insignificant.

Comparing the first and second series, the largest odds ratio in the second series was between \$25 and \$50 premiums (0.804; 95% CI: 0.737-0.877); otherwise, the results are like the first series: PPO plans are preferred over FFS plans and a \$25 reduction in premiums or an increase in coverage could nudge the majority of respondents to switch to the Marketplace.

We merged the evidence from both series and found that the effect of moving from employer to Marketplace is similar for current and new plans types (0.798 and 0.752, respectively).

Similarly, respondents had a slight preference between \$25 and \$50 premiums and between Platinum and Gold coverage (0.770 and 0.774, respectively). Overall, source, premiums and coverage at the upper end of the range did not have a substantial effect on preferences (i.e., odds ratio greater than 0.7). On the contrary, the choice between plans largely depended on whether the plan was a FFS, the premium (ranging from \$50 to \$250) and coverage between Gold and Bronze (i.e., odds ratio less than 0.7).

Table 13 shows the predicted probabilities of choosing the Marketplace controlling for the other attributes. The probability of choosing the Marketplace was 42.0% (CI: 39.5-44.9) in the first series and 43.7% (41.8%-45.8%) in the second series.

#### **4. Discussion**

Although the focus of this study is narrow (single employees with employer-based health insurance coverage), it is one of the first to examine preferences on health insurance plans in the United States. It found that a \$25 subsidy in premiums is enough for many single employees to seek coverage through the Marketplace. Alternatively, a slight increase in coverage, say between Bronze and Silver or between Silver and Gold, would be a similarly

influential. It also predicted that single employees would pick the Marketplace about 43% of the time when holding other attributes constant. It was not seen as big of a hurdle as previously thought.

Contrary to our hypotheses, single employees preferred PPO plans over FFS plans. This suggests that they valued some freedom in provider choice but wanted the structure of a health insurance network. Overall, they seemed most interested in a PPO plan with Bronze to Gold coverage for \$50 to \$125 monthly premiums. PPO plans are the most frequently utilized health insurance plan type of workers in the U.S., with about 48 percent enrolled (The Henry J. Kaiser Family Foundation 2017a). Also, of the 11.8 million consumers enrolled in the Marketplace in 2018, 29 percent chose bronze plans, 63 percent chose silver plans, and 7 percent chose gold plans (Centers for Medicare & Medicaid Services 2018).

These findings show that offering a slightly cheaper or greater coverage (for example: Silver rather than Bronze) would be enough to entice single employees to choose insurance through the Marketplace. Instead of lowering premiums or increasing coverage, insurance companies offering insurance through the Marketplace may increase the number of PPO plans and offer a wider range of similar options to attract single employees.

Further research could explore those individuals with more complex plans (e.g., family plans) and determine if their preferences align with those of single employees. Exploring an opt-out option or a dual response (force and unforced choice model) design regarding the DCE choice task is a possibility, as the penalty for not having insurance has now been repealed. Future

research will need to be done on different health insurance attributes and subgroups within this population.

#### **4.1. Limitations**

Our study focused on a narrow sample of individuals, which may reduce the generalizability of our results. Additionally, people with family plans or public health insurance may differ in terms of the value they place on health insurance plan attributes. Also, most of the sample self-reported as healthy, more educated, and wealthier than the sample of individuals from MEPS.

Second, the presentation of the choice pairs is meant to closely mimic real-world situations that individuals might face, particularly the definitions. However, the Marketplace online interface differs from our set up, which could affect the analysis. Respondents only chose between two different options in our choice tasks, whereas they face several different options in the Marketplace. The next version of this survey will incorporate an opt-out option as this would more closely resemble a situation that respondents would be faced with and considering the repeal of the individual mandate. There is a trade off between efficiency and complexity when including an opt-out. Also studies have shown that respondents learn when being forced to answer choice tasks, and researchers would also need to investigate why respondents are choosing to opt-out (Veldwijk et al. 2014). At the time of the survey completion not having an opt out or status quo option was deemed to more closely represent the real world. To some, the range of our out-of-pocket premium cost was unrealistic, limited to just \$25 to \$250. For the population being studied and considering previous analyses, we felt that this was a

reasonable limit to place on the premiums of individuals; however, some may face no premiums or higher premiums (e.g., premier plans).

Understanding the value employees place on health insurance plan is particularly challenging due to the complexity of the health insurance market and its reliance on employer-based coverage. Prior to the survey, some respondents may not have had a clear understanding of the terminology related to health insurance and possibly relied on their employers or others to choose for them. To address this, we included many hover definitions and glossary tables throughout the questionnaire and choice tasks to inform respondents. The end-of-survey comments revealed that most individuals did not complain about the terminology. A few respondents indicated that they would have liked to have definitions within each choice pair description so that they did not need to jump back to the glossary tables to refresh their memories on definitions and attribute levels. This issue will be addressed in future designs.

Our results are also conditional on the fact that search costs are not included in the model. There could be large differences in how much time individuals would have to spend choosing between many different health insurance options through the Marketplace versus two to three options that their employer selects. Our hope is that this paper could help guide insurance companies, within the Marketplace, to offer a smaller selection of plans that individuals prefer. This would help narrow the differences between the two sources of coverage.

## **5. Conclusion**

These findings can help guide employers and insurance companies to further develop options that best encapsulate health insurance preferences of single employees. They also show how

legislation may be passed to entice single employees to purchase their health insurance plan through the Marketplace. By changing a few key attributes, the Marketplace could attract a healthier population, while enrollees could benefit by obtaining better coverage that isn't tied to employment. While individuals do place some value on having their health insurance provided by their employers, it isn't particularly strong. Giving them greater information on the benefits of the Marketplace or offering them modest subsidies could nudge this population into the Marketplace, which is a step toward improvements in the U.S. health insurance and labor markets.

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Which do you prefer?

Starting today, 12 months with a new  
**health maintenance organization** plan  
from your **current employer**  
with **bronze** coverage and  
a monthly premium of **\$50**  
(your out-of-pocket cost)

Starting today, 12 months with a new  
**point of service** plan  
from your **current employer**  
with **silver** coverage and  
a monthly premium of **\$125**  
(your out-of-pocket cost)

Figure 13 Choice Pair Example

**Table 10 Attributes and Levels for the Choice Task**

Attributes	Attribute Descriptions	Level Descriptions
Plan Source	A service that helps people shop for and enroll in health insurance. The federal government operates the Marketplace, available at HealthCare.gov, for most states. Some states run their own Marketplaces.	Current plan type from your current employer Current plan type from a state exchange New plan type from your current employer New plan type from a state exchange
Plan Type	An insurance contract that provides hospital and/or physician coverage to an individual for an agreed-upon fee for a defined benefit period, usually a year.	Fee-for-Service (FFS) Preferred Provider Organization (PPO) Point of Service (POS) Health Maintenance Organization (HMO)
Monthly Premium	Agreed upon fees paid by beneficiary for coverage for a defined benefit period.	\$25 \$50 \$75 \$100 \$125 \$175 \$250
Plan Coverage	Details the amount of costs and services provided by different metal categories.	Platinum Gold Silver Bronze

**Table 11 Respondent Demographic and Socioeconomic Status Characteristics**

	Dropout N=272 % (#)	Completed N=2207 % (#)	p-value	MEPS* N=3253 %
<i>Age in years</i>			0.010	
26 to 34	34.93% 95	41.34% 912		29.79%
35 to 54	47.44% 129	44.91% 991		53.80%
55 to 64	17.64% 47	13.78% 304		16.42%
<i>Sex</i>			0.044	
Male	38.60% 104	44.95% 992		42.42%
Female	61.40% 167	55.05% 1214		57.58%
<i>Race</i>			0.861	
African American or Black *	15.07% 40	11.92% 263		23.95%
Caucasian or White	73.53% 200	75.80% 1672		66.58%
Asian	6.99% 19	8.97% 197		5.16%
American Indian or Alaska	0.74% 2	0.63% 13		0.80%
Native Hawaiian or other Pacific	0.00% 0	0.14% 3		0.77%
Other	3.68% 10	2.54% 56		2.25%
<i>Hispanic ethnicity</i>			0.077	
Hispanic or Latino *	18.01% 49	11.15% 245		16.19%
Not Hispanic or Latino	81.99% 222	88.85% 1961		83.81%
<i>Educational Attainment</i>			0.125	
Less than high school	0.00% 0	0.14% 3		8.27%
High school graduate	4.42% 12	4.76% 105		27.45%
Some college, no degree	15.07% 40	11.51% 254		9.35%
Associate's degree	10.29% 27	8.25% 182		16.57%
Bachelor's degree	40.44% 109	43.18% 952		26.50%
Graduate or professional degree	29.78% 81	32.17% 709		11.87%
<i>Household income</i>			0.908	
\$14,999 or less	2.57% 6	0.18% 3		4.00%
\$15,000 to 24,999	1.84% 5	1.99% 43		14.88%
\$25,000 to 34,999	4.78% 13	6.66% 146		19.74%
\$35,000 to 44,999	10.29% 27	10.51% 231		16.75%
\$45,000 to 49,999	10.66% 28	6.07% 133		6.55%
\$50,000 to 74,999	24.63% 66	29.63% 653		22.96%
\$75,000 to \$99,999	17.28% 47	18.08% 399		8.24%
\$100,000 to \$149,999	13.60% 36	14.09% 310		5.07%
\$150,000 or more	6.62% 18	7.89% 174		1.81%
Refused/Don't know	7.72% 20	4.89% 107		-----
<i>Region</i>			0.028	
Northeast	20.59% 56	23.65% 522		17.15%
Midwest	18.01% 49	23.97% 529		21.95%
South	36.03% 97	30.09% 664		36.52%
West	25.37% 69	22.29% 492		24.38%

\* Medical Expenditure Panel Survey (unweighted) 2001 to 2014 oversampled African American and Hispanic respondents.

**Table 12 The Preferences for Health Insurance Plan Attributes**

Attributes	Levels	First Series (4 Pairs)				Second Series (24 Pairs)				Both Series (All Pairs)			
		Odds ratio	Standard Error	95% Confidence Interval		Odds ratio	Standard Error	95% Confidence Interval		Odds ratio	Standard Error	95% Confidence Interval	
Plan Source													
Plan Type*	(Employer to) Current plan type: the Marketplace	0.726	0.043	0.646	0.815					0.798	0.035	0.732	0.870
	New plan type: the Marketplace					0.777	0.034	0.714	0.847	0.752	0.030	0.696	0.813
Plan Type*	(FFS to)												
	PPO					4.230	0.222	3.816	4.687	4.111	0.211	3.718	4.546
	POS					3.080	0.231	2.659	3.567	2.905	0.203	2.532	3.332
	HMO					2.949	0.319	2.385	3.647	2.698	0.268	2.220	3.278
Monthly Premium													
	(\$25 to)												
	\$50	0.663	0.056	0.562	0.782	0.804	0.036	0.737	0.877	0.770	0.032	0.710	0.834
	\$75	0.431	0.033	0.371	0.501	0.524	0.024	0.479	0.574	0.500	0.021	0.461	0.543
	\$100	0.292	0.029	0.240	0.355	0.364	0.021	0.325	0.409	0.345	0.018	0.311	0.383
	\$125	0.183	0.022	0.145	0.231	0.261	0.020	0.225	0.304	0.240	0.016	0.210	0.274
	\$175	0.085	0.013	0.064	0.114	0.128	0.012	0.106	0.154	0.116	0.010	0.098	0.137
	\$250	0.035	0.006	0.025	0.049	0.057	0.007	0.045	0.071	0.050	0.005	0.041	0.062
Plan Coverage													
	(Platinum to)												
	Gold	0.793	0.046	0.709	0.888	0.777	0.026	0.727	0.830	0.774	0.024	0.729	0.822
	Silver	0.523	0.044	0.443	0.617	0.579	0.028	0.526	0.637	0.563	0.025	0.516	0.615
	Bronze	0.232	0.029	0.182	0.297	0.288	0.022	0.248	0.335	0.273	0.019	0.238	0.312

\* The plan types, Fee-for-service (FFS), Preferred Provider Organization (PPO), Point-of-service (POS), and Health Maintenance Organization (HMO), were described in concordance with the information provided by the Health Insurance Marketplace.



**Table 13 Plan Source Predicted Probabilities**

Levels	First Series (4 Pairs)		Second Series (24 Pairs)	
	Predicted Probability	95% Confidence Interval*	Predicted Probability	95% Confidence Interval*
Current plan type: the Marketplace	0.420	0.395 .449		
New plan type: the Marketplace			0.437	0.418 0.458

\* Percentile bootstrap methods 1,000 simulations (dropped 25 highest/lowest)

## Appendix A: Discrete Choice Experiment Information

### Screenshots of Metal Category and Plan Type Definitions

You likely preferred the platinum plan with a \$25 premium over the bronze plan with a \$250 premium.

The next example is more challenging than this one, because it requires that you understand the differences between the amounts of coverage provided by each health insurance plan.

	<u>Platinum Coverage</u>	<u>Gold Coverage</u>	<u>Silver Coverage</u>	<u>Bronze Coverage</u>
<u>Out-of-pocket cost</u>	Lowest costs when you get care	Low costs when you need care	Moderate costs when you need care	Highest costs when you need care
<u>Deductible</u>	No deductible	Less than \$500 per year	About \$2,000 per year	About \$7,000 per year
<u>Co-insurance rate</u>	10%	20%	30%	40%
<u>Recommended under specific conditions</u>	Persons who want nearly all costs to be covered	Persons who use a lot of care	Persons who use routine care and want to protect themselves from the worst-case scenarios	Persons who want to protect themselves from the worst-case scenarios

Thank you for your responses!

You will now read a final series of **24 paired comparisons**. Each describes a choice between two new **health insurance plans**. Type of **health insurance plan** is commonly described by the presence of a **provider network** and a **gatekeeper**.

	<b>Fee-for-Service (FFS) Plan</b>	<b>Preferred Provider Organization (PPO) Plan</b>	<b>Point of Service (POS) Plan</b>	<b>Health Maintenance Organization (HMO) Plan</b>
<b>Provider Network</b>	No restrictions on provider choice.	You pay less if you use providers in the plan's network.	You pay less if you use providers in the plan's network.	Will not cover out-of-network care except in an emergency.
<b>Gatekeeper</b>	No gatekeeper.	No gatekeeper.	You are required to get a referral from your primary care doctor in order to see a specialist.	You are required to get a referral from your primary care doctor in order to see a specialist.

Example of First Series (Respondent's current plan)

Which do you prefer?

Starting today, 12 months with your <b>current health insurance</b> plan from a <b>state exchange</b> with <b>platinum</b> coverage and a monthly premium of <b>\$100</b> (your out-of-pocket cost)	Starting today, 12 months with your <b>current health insurance</b> plan from your <b>current employer</b> with <b>gold</b> coverage and a monthly premium of <b>\$100</b> (your out-of-pocket cost)
---	--

## Screenshots Consent and Respondents' Demographic and Socioeconomic Status

### Informed Consent and Research Authorization for an Adult

The following information is being presented to help you decide whether or not you want to take part in a minimal risk research study, Health Preference Research, funded by Procliv LLC.

#### Purpose

The purpose of this study is to examine the values people place on health. Specifically, the answers provided by you and about 50,000 other participants will help us understand health-related choices of people like you, adults age 18 or older. In the following survey, you will be asked to complete 4 sections. The first section asks you basic demographic questions. The second section asks you about your health. The third section asks you to complete a series of choices between health-related experiences. The fourth section asks you follow-up questions about you and your experience taking this survey.

#### Potential Risks

There are no physical risks posed by this study. There may be risk of psychological distress resulting from questions that ask you to evaluate alternative health scenarios. This study does not collect any personal identifying information, except dates and postal code. Your privacy and research records will be kept confidential to the full extent of the law. Authorized research personnel, Liberty IRB, Inc. and its staff, and any other individuals acting on behalf of Procliv LLC, may inspect the records from this research project.

### Voluntary Participation and Confidentiality

Your participation in this study will take about 15-30 minutes and is entirely voluntary. If you agree to participate, you may withdraw from the study at any time by simply closing your Internet browser. Upon completion, you will be compensated as agreed upon with your panel company. For more information about the study, call Benjamin Craig, Principal Investigator, at +1 855-776-2548. For information about your rights as a research participant, call Liberty IRB (a committee that has reviewed this research study to help ensure that your rights and welfare as a research participant are protected and that the research study is carried out in an ethical manner) at +1 386-279-4318.

Please read the following statements. Click "I Understand" if you understand the purpose, potential risks, voluntary participation, and confidentiality of the study. Click "I Do Not Understand" if you do not understand or do not wish to participate in the study. By clicking "I Do Not Understand" you will not be able to continue to the survey.

I understand that:

- My participation in this study is completely voluntary.
- I can withdraw from the study at any time.
- I will not be personally identified by any of my responses.

I understand

I do not understand

To be eligible for this survey, please complete the following questions:

Please select your current state:

Please select one ... ▾

Please enter your current 5-digit ZIP code:

What is your sex?

- Male
- Female

What is your age?

Please select one ... ▾

Are you of Hispanic, Latino, or Spanish origin?

- No, not of Hispanic, Latino, or Spanish origin
- Yes, Mexican, Mexican American, or Chicano
- Yes, Puerto Rican
- Yes, Cuban
- Yes, another Hispanic, Latino, or Spanish origin

What is your race? If necessary, select more than one category.

- |  |                                       |
|--|---------------------------------------|
| <input type="checkbox"/> White                             | <input type="checkbox"/> Asian Indian |
| <input type="checkbox"/> Black or African-American         | <input type="checkbox"/> Chinese      |
| <input type="checkbox"/> American Indian or Alaskan Native | <input type="checkbox"/> Filipino     |
| <input type="checkbox"/> Native Hawaiian                   | <input type="checkbox"/> Japanese     |
| <input type="checkbox"/> Guamanian or Chamorro             | <input type="checkbox"/> Korean       |
| <input type="checkbox"/> Samoan                            | <input type="checkbox"/> Vietnamese   |
| <input type="checkbox"/> Other Pacific Islander            | <input type="checkbox"/> Other Asian  |

Which of the following best describes your race?

- African American/Black
- Asian/Asian American
- Caucasian/White
- Native American/Inuit/Aleut
- Native Hawaiian/Pacific Islander
- Other

What is the highest level of school you have completed or the highest degree you have received?

Please select one ... ▾

What is your best estimate of your total income plus the total income of all family members from all sources, before taxes, in 2016?

Please select one ... ▾

Which of the following were you doing last week?

- Working for pay at a job or business
- With a job or business, but not at work
- Looking for work
- Working, but not for pay, at a family-owned job or business
- Not working at a job or business and not looking for work
- Retired
- Refuse to answer
- Don't know

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