Decriminalizing Indoor Prostitution:

Implications for Sexual Violence and Public Health*

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Abstract

Most governments in the world, including the United States, prohibit sex work. Given these types of laws rarely change and are fairly uniform across regions, our knowledge about the impact of decriminalizing sex work is largely conjectural. We exploit the fact that a Rhode Island District Court judge unexpectedly decriminalized indoor sex work to provide causal estimates of the impact of decriminalization on the composition of the sex market, reported rape offenses, and sexually transmitted infections. While decriminalization increases the size of the indoor sex market, reported rape offenses fall by 30 percent and female gonorrhea incidence declines by over 40 percent.

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1 Introduction

In the last 15 years, the American prostitution market has shifted from a primarily outdoor (street-based) to indoor market (massage parlors, escort agencies, and much of the online market) (Cunningham and Kendall, 2011). The indoor market constitutes up to 85% of all sex work activity in the United States (US) (Urban Justice Center, 2005). Though prohibited, the world's oldest profession thrives and grows indoors. The prostitution trade is estimated to generate over $14 billion a year in the US (Havoscope, 2013). Different data sources suggest that anywhere between 16 to 30 percent of men have paid for sex in the US (General Social Surveys, 1992-2010; Langer, Arnedt and Sussman, 2004).

Most governments in the world, including the United States, prohibit prostitution. This is likely due to moral concerns, though disease transmission and victimization risks associated with sex markets are salient policy concerns (Posner and Silbaugh, 1996). For example, the 1992 National Health and Social Life Survey (NHSLS) shows that 23% of female sex workers report they have ever had gonorrhea compared to 4.7% for females who have never been paid to have sex. Given the average sex worker sees 200-300 clients per year, and men have a 20% risk of getting the infection from a single act of vaginal intercourse with an infected woman while women have a 60-80% risk of getting the infection from a single act of vaginal intercourse with an infected man (National Institutes of Health, 2001), the spread of disease is a significant public health concern. Sex market related violence is also common. The incidence of rape and homicide victimization is extremely high for women engaged in prostitution (Miller and Schwartz, 1995; Brewer et al., 2006).

The aim of this paper is to provide quasi-experimental estimates of the causal effect of decriminalizing indoor prostitution on the composition of the sex market (supply and price), population sexually transmitted infection (STI) outcomes, and reported female rape offenses by using an unanticipated legal interpretation of a longstanding statute. We focus on reported rape offenses and gonorrhea incidence due to the high association each has with prostitution (Ross et al., 2012).

The theoretical effect of decriminalization on sexual violence and STI transmission is

ambiguous. Decriminalization lowers the costs associated with supplying and purchasing sex services, so we would expect decriminalization to expand the market. An expansion in sex services may increase population STIs due to the increase in the size of the sexual network. More sex work, in other words, might lead to more STI transmission. But some research suggests that higher STI rates are not necessarily guaranteed if lower risk sex workers enter the network. More sex in the population, even among sex workers, may reduce an STI epidemic if the marginal sex worker has lower background risk or engages in safe behaviors that dilute the risk in the sexual network (Kremer, 1996; Kremer and Morcom, 1998).

The effect of decriminalization on rape is equally complex and unclear. Decriminalization will increase sexual violence if violence is an increasing function of the number of women employed in the market. Cho (2015) suggests that prostitution and sexual violence are complements under prohibition regimes since the two behaviors are positively correlated in cross-sectional data. But Bisschop, Kastoryano and van der Klaauw (forthcoming) show that the two are negatively correlated when law enforcement create legal zones for purchases. Decriminalization could result in safer work spaces since firms might be more willing to invest in security due to well-defined property rights post-decriminalization. Sex workers may also be more willing to cooperate with police as police can now extract fewer rents. Thus it is unclear what we should expect theoretically from decriminalization.

We estimate the causal impact of decriminalization by exploiting the fact that a Rhode Island (RI) District Court judge effectively decriminalized indoor prostitution in July 2003 (Arditi, 2009). Neither the event nor its consequences have been widely understood or studied by researchers. Indoor prostitution was ultimately re-criminalized in November 2009, but for approximately six years, Rhode Island was the only state in the US with unbridled, decriminalized indoor prostitution and prohibited street prostitution with the decision being made in such a significant and unanticipated way.

We first show that this judicial decision, which decriminalized the indoor sex market, had bite. Decriminalization decreased sex worker arrests, expanded the size of the indoor prostitution market, increased indoor prostitution advertising, and decreased transaction

prices. We then estimate the causal effect of decriminalization on reported rape offenses and female gonorrhea incidence and find robust evidence that decriminalization caused reported rape offenses to decrease by 30 percent and gonorrhea incidence to decrease by over 40 percent.

It is poorly understood whether laws and regulation can reduce the potential costs associated with prostitution. Some social scientists have proposed a system which involves decriminalization of indoor sex work (as opposed to uniform criminalization), but few governments have been willing to experiment with the policy (Weitzer, 2011). It has been argued that indoor prostitution typically involves less exploitation, less risk of violence, more control over working conditions, more job satisfaction, and higher self-esteem (Weitzer, 2005). Street prostitution has higher rates of gonorrhea (Willcox, 1962; Dunlop, Lamb and King, 1971; Potterat, Rothenberg and Bross, 1979), rape and sexual assault (Church et al., 2001). However, none of these studies provide causal estimates, and most are plagued by statistical problems due to reliance on small, non-representative samples based on convenience sampling. In addition, despite the greater prevalence of indoor sex work, the majority of research has focused on street work. Given prostitution laws rarely change and are fairly uniform across regions, knowledge about the impact of decriminalizing indoor sex work is largely conjectural.

This is the first paper to evaluate the decriminalization of prostitution in the United States using a natural experiment, which allows us to provide causal estimates on the impacts of decriminalization. Bisschop, Kastoryano and van der Klaauw (forthcoming) show that opening legal street prostitution zones in the Netherlands reduces sexual abuse and rape; Cameron, Muz and Shah (2016) show that unexpectedly criminalizing sex work in Indonesia increases STI rates and decreases condom use; Lee and Persson (2015, 2016) provide theoretical analysis of how decriminalization affects the market for sex work.

This study contributes to the economics of prostitution literature by extending analysis to policy changes, particularly the decriminalization of indoor sex work. The literature on sex work in economics primarily begins with the seminal paper by Edlund and Korn (2002) suggesting that if prostitutes compromise marriage market prospects, they must be compensated, thus explaining the financial premium to sex work. Arunachalam and

Shah (2008) argue the premium to sex work is not due to the marriage market but is compensation for risk. A related strand of this literature estimates the premium to risky, non-condom sex in the sex market (see Rao et al. (2003); Gertler, Shah and Bertozzi (2005); Robinson and Yeh (2012); Arunachalam and Shah (2013)). Only recently has the economics literature started investigating the relative merits of policies impacting the sex market (see for example, Gertler and Shah (2011); Immordino and Russo (2015); Lee and Persson (2015); Cameron, Muz and Shah (2016); Bisschop, Kastoryano and van der Klaauw (forthcoming)).

It is important to note that the outcomes of interest in this paper are not only prostitution related—we use population level STI outcomes and reported rape offenses. This allows us to say something about the impacts of decriminalization as they relate to the population at large, not just sex workers. We estimate that approximately 5 to 50 percent of the decline in gonorrhea is from sex workers with the rest coming from the general female population in Rhode Island. While we cannot quantify how much of the rape reduction is coming from sex workers, we believe some proportion of the decrease in rape offenses is coming from non-sex workers. If anything, sex workers are more likely to report rape offenses to police after decriminalization (WHO, 2005), so the fact that we are finding overall decreases suggests that non-sex workers are also part of this decrease.

Police agencies, lawmakers, and prosecutors all over the US have responded to the growth in the indoor sex market by reallocating large amounts of resources toward arresting indoor sex workers. This reallocation has been considerably costly for local police since the indoor market is more diffuse and hidden.[1] This research can influence change in policies related to police enforcement of laws against prostitution. Decriminalization of indoor prostitution has experienced the most political traction as an alternative to uniform criminalization. In fact, Amnesty International recently passed a resolution calling for the decriminalization of sex work across the globe (Amnesty International, 2015).

[1]In a 2009 suit, Illinois Cook County Sheriff, Tom Dart, sued Craigslist for its role in "facilitating prostitution" and requested $100,000 in compensation for police man-hours the county had incurred to pay police to investigate prostitution advertisements on the website. His suit claimed that "between January and November 2008 his department devoted 3,120 man-hours and approximately $105,081 to make 156 arrests" (Rigg, 2010).

2 Rhode Island's Decriminalization History

The great irony of Rhode Island's decriminalization of indoor prostitution is that it was unintentional. All evidence suggests that a 2003 District Court judge's decision, which caused the *de facto* decriminalization of indoor sex work, was due to the court's discovery that a May 1980 amendment to §11-34 of the General Laws of Rhode Island had created an inadvertent legal loophole decriminalizing indoor sex work (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1980, 1981; *State v. Robert J. DeMagistris*, 1998). Legislators attempting to strengthen the state's enforcement of street prostitution passed a May 1980 amendment deleting seemingly innocuous phrases describing prostitution sex acts.[2] The new 1980 law prohibited pandering (e.g., pimps), brothels, and loitering for the purpose of prostitution (e.g., street solicitation) but in rewriting the statute, the amendment removed certain key phrases that addressed the commission of the act of prostitution itself. The new law's careful wording explicitly forbade street prostitution and street solicitation, but by failing to identify non-street prostitution (e.g., massage parlor prostitution), the new law had created a legal technicality in which indoor sex work was legalized (Breton, 2005; Arditi, 2009).

Despite the radical implications of the 1980 law change, there is no evidence that this interpretation was well understood. Direct and indirect evidence suggests that legal scholars, law enforcement and the public at large were unaware of indoor prostitution's new legal status.[3] Surviving members of the 1980 legislature have said their intention was

[2] At the time, residents of the Providence neighborhood West End were "up in arms" about the amount of street prostitution occurring in the neighborhood and complained to their representative Matthew Smith, Speaker of the House. Smith was advised by then-District Court Chief Judge Henry Laliberte that "to get prostitutes off the streets, [the state should] make prostitution a misdemeanor crime instead of a felony [so as] to speed prosecution in the courts" because he believed similar legislation in Oregon and New York had proven successful at reducing prostitution (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1981; Arditi, 2009). The main purpose of the May 1980 amendments was the creation of new statutes devoted exclusively to street prostitution workers (§11-34-8) and street prostitute clients (§11-34-8.1), as well as downgrading the penalty from a felony to a misdemeanor (*State v. Robert J. DeMagistris*, 1998).

[3] For example, a newspaper search shows that the first time newspapers acknowledge the decriminalization of indoor prostitution is March 2005 (Breton, 2005), twenty-five years after the May 1980 amendment itself. Widespread knowledge of the 1980 amendment's significance is also difficult to reconcile with the fact that Rhode Island police arrested massage parlor employees for violating §11-34-8 and §11-34-8.1 from the mid-1990s until 2003. A more reasonable interpretation is that the May 1980 amendment accidentally deleted key language from §11-34-5 that decriminalized indoor prostitution, and both because it was inadvertent, and because of the extensive bans on more common firm structures

to reduce the time between arrest and penalties for street prostitutes, not decriminalize indoor prostitution (Arditi 2009).[4]

The *de facto* decriminalization of indoor prostitution became effective policy in late 2003 when District Court Judge Bucci dismissed charges against a group of massage parlor employees arrested and charged with "loitering for the purposes of street prostitution" arguing that current law did not apply to indoor prostitution in *Rhode Island ex rel. City of Providence v. Choe*, No. 61-2003-03314 (6th Div. Dist. Ct. 2003) (Arditi, 2009). Breton (2005) states that police became powerless to arrest prostitutes or their customers inside massage parlors.

3 Data

Our study uses six unique datasets: crime arrests and reported rape offenses from the Uniform Crime Reports (UCR); gonorrhea cases from the Centers for Disease Control's Gonorrhea Surveillance Program; data on sex worker and transaction characteristics from a popular website called The Erotic Review (TER); weekly classified advertisements from the "adult services" section and restaurant advertisements from *The Providence Phoenix*; sexual behavior outcomes from the 1992 National Health and Social Life Survey (NHSLS); and state level covariates from the Current Population Survey (CPS).

Prostitution arrest data and arrest data for other crimes (rape, murder, larceny, burglary, car theft, robber, and assault) is obtained from the Summary Uniform Crime Reports Part II offenses database for every state from 1999-2009. These are arrests per 100,000 population, and rates are aggregated from the jurisdiction level to the state level. This data allows us to investigate whether decriminalization did in fact constrain police efforts.

We also collect information on reported female forcible rape offenses from the Part I Summary UCR database for every state from 1999 to 2009. This data is downloaded as

(e.g., pimping, streetwalking), no one thought to press the issue until the law was re-interpreted in 2003.

[4]Senator John F. McBurney III, the only member of the 1980 General Assembly still serving, claims the May 1980 amendment accidentally decriminalized indoor prostitution by saying that the legislators "didn't know what they were voting for". John Revens, Jr., who served in the 1980 General Assembly, said that "[the 1980 General Assembly] would never sponsor a bill decriminalizing prostitution if they knew what it was. No way. Not in a million years." (Arditi, 2009).

rape offenses per 100,000 population at the state level.[5] UCR defines a forcible rape offense as an offense satisfying the following definition: "carnal knowledge of a female forcibly and against her will." Attempts or assaults to commit rape by force or threat of force are also included.[6] We note that reported rapes are likely to be an underestimate of actual rape offenses.[7]

Our measure of sexually transmitted infection is the natural log of female gonorrhea incidence per 100,000 female population and the natural log of male gonorrhea incidence per 100,000 male population. Data was requested from the Centers for Disease Control (CDC) Gonorrhea Surveillance program, and we use state-level data from 1999 to 2009. Gonorrhea is chosen as opposed to syphilis or chlamydia because the demographics of gonorrhea make it more suitable for a study of this kind given its movements suggest a heterosexual vector, compared to syphilis which is today almost exclusively concentrated among men having sex with men (CDC, 2010).[8]

In Table 7 in the Appendix, we show that prostitution is significantly correlated with gonorrhea and not chlamydia for both men and women.

We also harvest data from an online review site called The Erotic Review. TER, a reputation website similar to Yelp.com, is one of the largest sex websites in the country

[5]The arrest data is retrieved from the National Archive of Criminal Justice Data (`https://www.icpsr.umich.edu/icpsrweb/NACJD/`) and the rape data is from `http://www.ucrdatatool.gov`.

[6]This definition goes all the way back to 1928. In December 2011, the definition was revised to "penetration, no matter how slight, of the vagina or anus with any body part or object, or oral penetration by a sex organ of another person, without the consent of the victim." This was motivated by the belief that the previous definition was outdated (Rivera, 2012). However, this does not affect our decriminalization analysis which ends in 2009.

[7]One concern is whether decriminalization changes the rate at which women report rapes. While we cannot think of a reason that non-sex workers would be more/less likely to report rape offenses after decriminalization, sex workers if anything, will be more likely to report rape after decriminalization as they are no longer engaging in illegal activities (WHO, 2005). Since we find a decrease in reported rape offenses, this implies we might be estimating a lower bound.

[8]Epidemiological differences between gonorrhea and chlamydia may explain why gonorrhea is statistically more common among high risk individuals in the heterosexual sexual network. Gonorrhea is relatively symptomatic compared to other STIs such as chlamydia, which is almost entirely asymptomatic. Given how observable the gonorrhea symptoms are, most people except for highly active individuals stop having sex once infected. This is not necessarily the case for less symptomatic STIs like chlamydia where individuals continue to be sexually active while infectious. In addition, unlike other STIs, gonorrhea has a short incubation period making it a better approximation of contemporaneous sexual behavior. For instance, HIV symptoms appear only in advanced stage HIV, which may be years from the date of infection, whereas gonorrhea symptoms materialize within days of infection (National Institutes of Health, 2001).

and only covers indoor sex workers. Customers use it primarily to provide feedback on transactions with sex workers in a particular area. We collect approximately 90,000 records from The Erotic Review database from 1999 to 2007 from all over the country. We identify Rhode Island based sex workers by using phone number area codes. We primarily use the data to focus on the types of services provided, transaction prices, and provider race.

The Providence Phoenix is a local weekly arts and adult entertainment publication. The "adult entertainment" section was used by the massage parlor establishments in Providence, the most populous city in Rhode Island, and surrounding areas for advertising. Shapiro (2009) notes that *The Providence Phoenix* was the main newspaper coordinating buyers and sellers in RI's indoor sex markets. As a comparison group, we also collect weekly data on restaurant advertisements from *The Providence Phoenix*. We collect information on every advertisement by week from the first week of January 2000 until the last week of December 2008. Together the TER and *The Providence Phoenix* data provide a nice snapshot of the sex market.

The 1992 National Health and Social Life Survey is one of the most comprehensive representative surveys to date on sexual behavior in the United States general population. These data contain over 1,600 variables from a national probability sample of 3,432 American males and females between ages 18 and 59.

Finally, we use state-level covariates from the Current Population Survey (1999-2009) on demographics and economic factors. These variables serve as control variables in the regression analysis.

Summary statistics for all of the important variables from these various datasets are presented in Table 1.

4 Did Decriminalization Increase the Indoor Sex Market?

Decriminalization should expand the size of the indoor sex market by reducing the costs of entry both for sex workers and firms (i.e massage parlors, brothels). Once the activity is decriminalized, sex workers are less likely to be arrested and/or harassed by police, and

firms can choose to invest since they now have secure property rights. As the indoor sex market increases, we also expect the stigma-related costs of entry to decrease (Guista, Tommaso and Strom, 2009). Therefore, we predict an unambiguous increase in the size of the indoor sex market post-decriminalization, and if indoor and outdoor sex workers are imperfect substitutes,[9] a net increase in the number of women employed overall in the sex market. In fact, Lee and Persson (2015) provide a theoretical analysis of the impact of decriminalization of prostitution and show that it leads to an expansion of the size of the market, a decrease in prices, and a compositional change of the workers serving in the market.

We empirically investigate whether prostitution arrests, supply of indoor prostitution, and transaction prices change post-decriminalization. We formalize this relationship with the following regression model:

$$y_{st} = \alpha_s + \gamma_t + \beta \cdot \mathbf{I}\{s = RI\} \cdot \mathbf{I}\{t \geq 2004\} + \psi X_{st} + \epsilon_{st} \tag{1}$$

The variable y_{st} represents an outcome for state s and year t such as prostitution arrests (later rape offenses and the natural log of gonorrhea incidence). The model includes state fixed effects (α), year fixed effects (γ), and an error term (ϵ). In some specifications we also include time varying state level controls (X). The coefficient of interest is β which is the difference-in-difference (DD) estimate of the effect of decriminalization on prostitution arrests in Rhode Island.

Inference from this DD approach relies on asymptomatic approximations associated with the assumption that the number of individuals within a state and/or the number of states grows large. However, this assumption does not apply in our setting since

[9]Unfortunately we do not have data on the US street sex market so we cannot test whether decriminalization of indoor sex market affects the street market. However, empirical evidence suggests the street market has declined substantially since the early 1990s both in Rhode Island and the US while the internet/indoor market has grown (Cunningham and Kendall, 2011). There is also evidence suggesting that the labor market for street and indoor workers is quite separate. For example, Cameron, Muz and Shah (2016) show that criminalizing indoor sex work in Indonesia does not increase the size of the informal street sector. Therefore, it is unlikely that street workers are transitioning into the indoor market since street and indoor workers are not substitutes. In terms of client demand, there is some evidence that street and indoor prostitution may be substitutes for clients on lower segments of the demand curve (i.e. men who do not wish to pay too much) (Holt, Blevins and Kuhns, 2014).

treatment occurred in only one state. We implement a variant of Fisher's permutation or randomization test (Fisher, 1935) to address this inference problem. To implement the procedure, we estimate equation (1) an additional 50 times replacing RI with an indicator for one of the other 49 states or the District of Columbia. Then we compare the RI estimate to the 50 placebo estimates obtained. With 50 placebo estimates, achieving 10 percent significance from a two-tailed test requires that Rhode Island be ranked second from the top or bottom of the placebo distribution, while 5 percent significance requires that Rhode Island be ranked at the top or the bottom. In Figure 1, we provide graphical illustrations (histograms) from the placebo based inference results for each outcome of interest. The vertical dashed bars present the 5th and 95th percent confidence intervals (excluding Rhode Island) and the solid line represents the DD estimate for Rhode Island. This is a very demanding statistical test to achieve statistical significance at conventional levels (Buchmueller, DiNardo and Valletta, 2011).

The key identifying assumption of equation (1) is that the outcome in Rhode Island would not have evolved differently to other states in the US in the absence of decriminalization. We estimate equation (2) to explore this assumption.

$$y_{st} = \alpha_s + \gamma_t + \beta_t \cdot \mathbf{I}\{s = RI\} \cdot \mathbf{I}\{t = 2000, 2001, 2002, \ldots, 2012\} + \epsilon_{st} \tag{2}$$

All variables are as defined above in equation (1) but β_t is a vector which takes on a unique value for each year from 1999–2012.[10] The base year is 1999. The solid vertical line in each figure denotes decriminalization. Figure 2 plots the coefficients (β_t) on Rhode Island-specific year effects for each outcome (prostitution arrests, rape, gonorrhea) generated from equation (2). The dashed vertical lines are the sampling distributions for the placebo estimates from the 5th-95th percentile for each year.

Table 2 reports the results from estimating equation (1). We list the 5th and 95th percentiles of the distribution of the placebo estimates as well as the corresponding p-value from a two-tailed test of the Rhode Island estimate. All models include state and year fixed effects and the even columns also include time variant controls from the CPS such

[10] We show an additional three years of data (2010-2012) because later in the paper we investigate what happens to the main outcome variables when Rhode Island re-criminalizes indoor sex work in late 2009.

as female population, male population, unemployment rate, share of population below poverty line, share of population in military, share of white population, share of black population, share of population that is male and single, share of population that is female and single, share of population that is male and married, and share of population that is female and married.

We report the results from estimating equation (1) for the dependent variable prostiution arrests per 100,000 in columns 1-2 of Table 2. The results indicate there is a 26 (column 2) to 40 percent (column 1) decrease in prostitution arrests from 2004–2009. Once we include control variables in column 2, the coefficient decreases in magnitude and loses statistical significance. In the top Panel of Figure 2, we plot β_t from equation (2) for prostitution arrests. Figure 2 shows that Rhode Island is not significantly different from the rest of the US pre-decriminalization, but there is a decrease in arrests post-decriminalization relative to the rest of the United States.

We also examine the effect of decriminalization on massage provision as well as transaction prices using data from one of the largest online sex websites in the country, The Erotic Review. We expect an increase in the provision of massages since anecdotal evidence suggests the Providence massage parlor sex industry grew post-decriminalization. We estimate equation (1) but the dependent variable is now massage provided (0/1) and log price. TER data is downloaded with geographic identifiers, which tend to be defined at the city level (a few minor exceptions include the Hawaiian islands, the Carolinas, New Mexico and New Jersey), so we estimate 43 placebo estimates using the TER geographic categories (where α_s from equation (1) is now the TER geographic categories as opposed to state fixed effects). Columns 3–6 include year and geographic fixed effects and columns 4 and 6 additionally control for whether the provider is an independent contractor.

In columns 3–6 of Table 2, we present evidence that massage provision increases and prices decrease post-decriminalization. Massage provision by RI sex workers increases by over 200% after decriminalization. Transaction prices decrease 33% between 2004–2009, which is what economic theory would predict given the increase in supply. Both results are statistically significant at conventional levels.

Since the internet market is only one snapshot of the market for sex, we also collect

data from *The Providence Phoenix* newspaper. In Figure 3, we present an index showing weekly advertisements in the "adult services" (top panel) section and local restaurants (bottom panel) of *The Providence Phoenix* newspaper. For each type advertisement, we present the number of advertisements (solid line) and the total amount of newspaper space advertisers purchased (dashed line) that week. The value of the index equals a given week's total counts divided by the starting value in week 1. An index value of 2 is equivalent to a doubling in that week relative to the first week. The decision to decriminalize corresponds immediately to an increase in the size of newspaper space advertisers like massage parlor owners purchased. About one year after decriminalization, the number of unique advertisers doubled, where each remains until 2007 before rising again. This massage parlor growth corresponds with the large increase in massage service provision shown in the TER results above.

In the bottom panel of Figure 3, we report comparable indices for local restaurant advertising in *The Providence Phoenix* as a placebo. There is no noticeable effect visible from the series, though restaurant advertising appears more volatile.[11]

Taken together, the results on arrests, massage provision, transaction prices, and massage parlor growth suggests that decriminalization did increase the size of the indoor sex market, and that this judicial decision was not simply some artifact without implications. We now turn to the main outcomes of interest: sexual violence and gonorrhea incidence.

5 Impact of Decriminalization on Sexual Violence

As shown above, decriminalization increased the size of the indoor sex market in Rhode Island. Decriminalization will increase sexual violence if violence is an increasing function of the number of women employed in the sex market. Some argue that prostitution comes with extremely high rates of physical and sexual violence, and increasing the size of the market, even the indoor market, will cause violence against women to increase (Farley, 2005).

[11]The results from these figures are robust to regression analysis. The size of adult services advertisements increases immediately by over 100 percent. The number of unique weekly advertisers also increases by over 100 percent during this period from 2004–2008 (results available upon request).

However, most of the recent empirical evidence lends itself to hypotheses suggesting decreases in violence. Bisschop, Kastoryano and van der Klaauw (forthcoming) evaluate the opening of legal street prostitution zones in 25 cities in the Netherlands on registered sexual abuse and rape and find that legal street prostitution zones are associated with a 30-40% decrease in sexual abuse and rape. Nguyen (2016) finds reducing costs to opening massage parlors leads to as much as a 28% decrease in rape offenses in California.

Decriminalization increases the return on capital by providing well-defined property rights to owners. Firms can use additional revenue to invest in locks, security cameras and security personnel to reduce the opportunity of premeditated client violence (Brents and Hausbeck, 2005). Decriminalization may also reduce violence by increasing sex worker willingness to cooperate with police and reducing opportunities for police corruption. Church et al. (2001) find that only 34% of prostitutes who are victims of violence by clients report it to the police. Levitt and Venkatesh (2007) find that a high prevalence of police officers demand sex from prostitutes as part of an implicit exchange to avoid arrest. If decriminalization increases the likelihood of victims reporting crimes to the police, then it lowers the expected return to a potentially violent client in addition to the aforementioned deterrent effects of security (Ehrlich, 1973).[12] It also implies that police can extract fewer rents from these women.

Decriminalization might also benefit populations other than sex workers. For example, decriminalization of indoor prostitution could allow police resources to be reallocated away from indoor arrests toward other crimes. The freeing up of police personnel and equipment to other areas could ultimately cause other crime rates like rape to decrease (Draca, Machin and Witt, 2011; Adda, McConnell and Rasul, 2014). A final mechanism by which decriminalization could reduce male violence is if prostitution is a substitute for violence against women (Posner, 1992). This theoretical possibility dates back to Catholic

[12]Philip Markoff, the so-called "Craigslist Killer", was charged with the armed robbery and murder of an alleged sex worker named Julissa Brisman whom he met via an advertisement in the adult services section of the Boston Craigslist website. Markoff's next victim, Corinne Stout, managed to avoid the same fate by screaming for help and alerting the man she used for security located in the next room of the attack in time. Markoff fled, and Stout contacted the police who caught Markoff within days. This attack occurred at a Holiday Inn Express in Warwick, Rhode Island in April 2009 when indoor prostitution was still decriminalized (Associated Press, 2009). While anecdotal, it supports the point that decriminalized sex work removes some of sex worker's unwillingness to cooperate with police.

theologian and moral philosopher, Thomas Aquinas (Dever, 1996). The proposed hypothesis is that men on the margin between rape and prostitution may choose prostitution since it becomes cheaper and more easily available post-decriminalization.

Given decriminalization of indoor prostitution has the potential to exacerbate or ameliorate sexual violence outcomes, we investigate these issues empirically in Table 2. We estimate equation (1) where the dependent variable is reported rape offenses per 100,000, and the results are displayed in columns 7-8. The results show that decriminalization reduces rape offenses, and the estimate is statistically significant in both columns. Decriminalization reduces rape offenses 31-34 percent from 2004-2009. From 1999-2003 reported rape offenses in the US are 34 per 100,000 and 40 per 100,000 in RI. From 2004-2009, rape rates decrease to 27.7 per 100,000 in RI while the US remains the same at 34.1 per 100,000. The middle panel in Figure 1 shows that the Rhode Island estimate ranks first compared to the rest of the placebo estimates, indicating this results is statistically significant at the 5% level. This is the strongest possible ranking from the permutation test.

In Figure 2 we show that the trends in Rhode Island relative to the rest of the United States are fairly similar pre-decriminalization. The middle panel of Figure 2 illustrates that the Rhode Island coefficient is not significantly different in rape offenses from the 50 placebo estimates pre-decriminalization, but this changes post-decriminalization.

5.1 Sexual Violence Pathways

We consider several potential pathways that relate decriminalization to the falling reported rape offenses we observe in the data.

First, it is possible that the ruling caused rapes to fall through extensive or intensive margin changes in police resources and/or effort. We check the extensive margin to investigate if there are any changes in overall police employment post–decriminalization. Our data comes from the FBI's Uniform Crime Report Law Enforcement Officers Killed or Assaulted (LEOKA) dataset which reports police employment annually. Figure 7 in the Appendix plots this data for Rhode Island and the rest of the US. We do not find any

changes in police employment post-decriminalization.[13]

On the intensive margin, since police stop arresting indoor sex workers, these police resources could be reallocated elsewhere in the agency including the policing of rape and other sex crimes. We investigate this hypothesis by testing whether decriminalization impacts arrests per offense for all crimes in the Uniform Crime Reports data (rape, murder, larceny, burglary, car theft, robbery and assault) using equation (1). Table 3 reports the results from this exercise. Decriminalization does not significantly impact rape arrests per offense, and importantly the coefficient is zero. It also appears that decriminalization does not significantly impact arrests per offense for any other crime (columns 2-8). However, we note that confidence intervals are wide and in some cases we cannot reject increases in arrests for a particular crime. We are somewhat reassured by the fact that the coefficients are small and not systematically positive. In column 1 of Table 3 we generate a measure which includes all arrests per offense. The coefficient of interest from this regression is close to zero and negative. Therefore it seems unlikely that a reallocation of resources is responsible for the observed decline in rape offenses. We also note that in Rhode Island, the Office of Narcotics and Organized Crime has been the principal agency responsible for arrests of massage parlor employees, and this is not the same office which pursues perpetrators of rape and other sexual crimes. Conversations with law enforcement officials in Rhode Island suggest that the reallocation hypothesis was unlikely in this particular case.

Second, we investigate whether changes in data collection or data definitions over this period could explain the findings, and fail to find evidence for this. The rape models are estimated using state by year data from the UCR. It could be the case that jurisdiction level attrition is causing the observed decrease in rape offenses. We re-estimate the models using data based on jurisdiction level files (see Chalfin and McCrary (forthcoming) for a description of these data). We re-estimate equation (1) with both a balanced and unbalanced panel of jurisdictions using forcible rape offenses as the dependent variable from this dataset. The results in Table 8 indicate that jurisdiction attrition cannot be

[13]We also estimate DD models of police employment and do not find any significant evidence that decriminalization impacts police employment in RI (results available upon request).

driving the rape result, as the results are robust to both the balanced and unbalanced panel of jurisdictions. In fact, 91.2 percent of all jurisdictions appear in the data consistently from 1999-2009.

We also spoke directly with the Providence police to understand whether any personnel or definitional changes were made that could explain the drop in rapes. We were assured by the Providence Police Department, the Rhode Island State Police and the FBI that the Uniform Crime Reports counts definitions did not change during our study period. We also inquired about personnel changes during this period that would have been relevant for the collection and distribution of the UCR records, but no such personnel changes were reported to have taken place. Another possible "definition" related explanation for the decline in reported rapes in the UCR data concerns the introduction of the National Incident Based Reporting System (NIBRS) in 2004. As NIBRS defines rapes more broadly than UCR Summary definitions, the introduction of a second crime data collection program may have impacted the reporting of UCR Summary data. However, while some smaller jurisdictions in Rhode Island may have adopted NIBRS in 2005, Providence does not start using NIBRS until 2007 (Rhode Island State Police, 2016), four years after decriminalization.

Third, decriminalization could reduce rapes among sex workers by improving the bargaining position of female sex workers relative to clients (Lee and Persson, 2016). Recent work in economics has shown that changes in female bargaining threat points has the potential to reduce violence against women (Stevenson and Wolfers, 2006; Aizer, 2010; Hidrobo and Fernald, 2013; Bobonis, Gonzlez-Brenes and Castro, 2013). Several studies note that indoor sex workers report considerably lower risks of victimization relative to outdoor street walkers, who themselves report extremely high rates of victimization (Church et al., 2001). While improvements in the safety of sex workers may be occurring, it is unlikely to explain the entirety of the rape results. Sex workers constitute a low share of total reported rape offenses given the illegal nature of their work (Bridgett and Robinson, 1999). Hence, even if decriminalization reduces actual rapes among sex workers, it would not reduce reported rapes by too much since pre-treatment reporting is likely to be lower than post–treatment reporting which would bias us against finding the

decrease.

The last hypothesis is related to the idea that some violent males think of rape and prostitution as substitutes (Posner, 1992; Dever, 1996). When the judicial decision caused supply to increase and prices to fall, violent males at lower segments of demand could have shifted towards purchasing sex indoors and away from violence toward women. In fact, Ciacci and Sviatschi (2016) find that indoor prostitution decreases sex crimes with no effect on other types of crime. They generate a daily panel from January 2004 to June 2012 with the exact location of police stops for sex crimes and the day of opening and location of indoor prostitution establishments in New York City. They argue that the reduction in sex crimes is driven by potential sex offenders that become customers of indoor prostitution establishments. In addition, while anecdotal, in the 2010 documentary *Happy Endings* which is about the efforts of Rhode Island to re-criminalize indoor sex work, there is a scene where a sex worker claims the men she services would likely rape other women had they not come to see her (Hurley, 2009). Therefore, this substitution could be driving the rape result.

6 Impact of Decriminalization on Public Health

Conceptually, decriminalization has an ambiguous effect on sexually transmitted infections. Assuming a net increase in the number of indoor sex transactions, decriminalization could increase the scale and growth rate of a gonorrhea epidemic. However if decriminalization shifts transactions indoors to lower STI risk sex workers and/or draws in lower risk sex workers, then decriminalization may reduce an epidemic.

Kremer and Morcom (1998) provide conditions whereby increasing the number of sexually active individuals in a sexual network would paradoxically cause HIV prevalence to decline. A decrease in STIs could occur if new entrants into the sex work network are lower risk thus diluting the propagation mechanisms fueling the epidemic. It may also cause street transactions to decrease by causing some clients of street prostitutes to shift indoors, thereby decreasing the size of the outdoor market which tends to be riskier. The finding that indoor sex work is less risky in terms of public health outcomes

is consistent across various countries (see Seib et al. (2009); Seib, Fischer and Najman (2009) for Australia, Jeal and Salisbury (2007) for the UK, Shannon et al. (2014) for Kenya and Canada).

Given decriminalization of indoor prostitution has the potential to exacerbate or ameliorate public health outcomes, we investigate this issue empirically. We estimate equation (1) and the dependent variable is log gonorrhea incidence per 100,000 females. In Table 2 (columns 9-10), we find that decriminalization decreases gonorrhea incidence 47 percent from 2004-2009. From 1999-2003 gonorrhea incidence in the US was 113.4 per 100,000 females compared to 81.4 per 100,000 females in Rhode Island. From 2004-2009, the rate in the US stays similar at 108.4 per 100,000 females but Rhode Island declines to 43.1 per 100,000 females.

This result, like rape, ranks first in the permutation test giving it a p-value of .04. The bottom panel in Figure 1 shows that the Rhode Island estimate ranks first compared to the rest of the placebo estimates indicating this results is statistically significant at the 5% level. This is the strongest possible ranking from the permutation test. In Figure 2 we show that Rhode Island is not significantly different in gonorrhea incidence from the rest of the United States pre-decriminalization but this changes post-decriminalization. In fact, the permutation results for Rhode Island from 2006 to 2011 show that the β estimated for Rhode Island is much lower than the β's estimated for the other 50 placebo states.

6.1 Public Health Pathways

In this section we provide evidence about why decriminalization may have decreased gonorrhea incidence. Decriminalization likely caused gonorrhea to decrease by diluting the "core group" through the selection of lower risk sex workers into the network (Hethcote and Yorke, 1984; Kremer and Morcom, 1998) and by reducing risky sex among indoor sex workers.

First, Section 4 suggest that the indoor sex industry grows post–decriminalization. This is likely changing the composition of the prostitution market, and might be diluting the core group by selecting lower risk sex workers into the network. Empirical evidence

suggests that indoor sex workers have lower rates of disease than street sex workers. For example, Loff, Gaze and Fairley (2000) estimate an 80-fold higher prevalence of bacterial STI among illegal street workers compared to legal sex workers. In Table 4 we show the change in indoor sex workers by racial category using TER data. The largest and only statistically significant change is coming from an increase in Asian providers (see columns 3-4) by 18 percentage points. The CDC Gonorrhea Surveillance data we use reports gonorrhea rates by race. Interestingly, the mean gonorrhea rate per 100,000 from 1999-2003 by race in Rhode Island is 26.1 for Asians, 48.6 for whites, 182.4 for Hispanics, and 596.2 for Blacks. Interestingly Asians have the lowest rates of gonorrhea incidence, so more Asian women entering the market should result in an overall lower risk pool, *ceteris paribus*.

If low risk individuals increase their activity by a larger proportion than high risk individuals, the composition of the pool of available partners will improve (Kremer and Morcom, 1998). This implies that male clients are now more likely to match with safer (i.e. gonorrhea free) sex workers, and we should observe an overall decrease in gonorrhea—which we do. Interestingly, Gertler and Shah (2011) find that increasing enforcement in the street prostitution market in Ecuador by one standard deviation per month is significantly associated with a 27 percent lower rate of sex workers being currently infected with syphilis, chlamydia, and/or gonorrhea. The mechanism at play here is similar: enforcement changes the composition of workers in the street market. This is closely related to the mechanism in Lee and Persson (2015) where decriminalization induces a compositional change of workers that raises the share of voluntary prostitutes in the sex market (relative to involuntary prostitutes).

Second, Table 4 (columns 9-16) shows the estimates from DD models using the Erotic Review data on four sex act outcomes associated with risk behaviors: fellatio with and without a condom, vaginal sex and anal sex.[14] The results suggest that sex acts become less risky after decriminalization as we observe decreases in anal sex, vaginal sex, and oral sex without condoms and increases in oral sex with a condom. The decreases in

[14]The Erotic Review does not provide the option to report whether vaginal or anal intercourse occurred with or without a condom.

anal sex and vaginal sex are statistically significant at conventional levels while the oral sex results are not statistically significant with the permutation tests. It is likely that increases are also occurring in manual stimulation. Unfortunately this is not an option in the TER data so we cannot measure it. However, Nguyen (2016) shows that quasi-legal prostitution firms like massage parlors most frequently offer manual stimulation, whereas illegal prostitution firms most frequently offer intercourse. In her data, 61.2 percent of massage transactions include manual stimulation. The results in Table 4 are consistent with other empirical evidence showing that sex workers who work indoors practice safer sex and are less likely to contract and transmit STIs (Seib et al., 2009; Seib, Fischer and Najman, 2009; Gertler and Shah, 2011).

The results suggest that decriminalization could have potentially large social benefits for the population at large—not just sex market participants. For the female gonorrhea estimates we calculate that approximately 5 to 50 percent of the decline in gonorrhea is from female sex workers. The rest is likely from female non-sex workers. We estimate the proportion of women who are sex workers in Rhode Island, though we note that the number of sex workers in the United States is not known, and estimates vary widely. Potterat et al. (1990) estimate that the annual prevalence of full-time-equivalent sex workers in the United States is 23 per 100,000 individuals, on the basis of a capture-recapture study of prostitutes found in police and STD clinic records in Colorado Springs between 1970 and 1988. This estimate is still widely used today (for example see Brewer et al. (2000); Delavande, Goldman and Sood (2010)). Based on this study, we generate the population of sex workers for each year in Rhode Island, multiply by 3.9 percent, the proportion of sex workers who have gonorrhea (El Paso County Department of Health and Environment, 1999), to estimate the number of sex workers with gonorrhea each year in Rhode Island. Our calculations suggest that even if every single sex worker with gonorrhea went from having gonorrhea to not having gonorrhea due to decriminalization, this could only account for approximately 50 fewer cases of gonorrhea from 2004-2009 or 5 percent of the decline due to decriminalization. Sex worker gonorrhea prevalence would have to be 95 percent to fully explain the decline due to decriminalization. If we take the unrealistically large estimate that 1 percent of women in the US are sex workers

(Alexander, 1987), this would still only account for 52 percent of the decline in gonorrhea cases due to decriminalization if prevalence is 3.9 percent. Under these assumptions, sex worker gonorrhea prevalence would have to be 7.5 percent to fully explain the decline due to decriminalization.

Lastly, we investigate male gonorrhea as an outcome of interest. If it is the case that decriminalization is resulting in less risky behavior and a change in the sexual network, we might expect a decrease in male gonorrhea incidence as well. We estimate equation (1) where the dependent variable is log male gonorrhea cases per 100,000 males. The results are presented in columns 11-12 of Table 2. Decriminalization decreases male gonorrhea incidence by 25-30 percent and this result is statistically significant in column 11 (p=0.08) but the p-value increases to 0.16 in column 12 once we add control variables. It appears likely that men are benefiting from decriminalization as well—though we note we cannot differentiate between male clients and non-client males.

7 Robustness: Synthetic Control Analysis

A complementary and alternative method for causal inference with aggregate data and one treatment unit is synthetic control analysis. As a robustness exercise, we implement the synthetic control approach which is a generalization of the DD framework (Abadie, Diamond and Hainmueller, 2010). However, unlike the DD models, the synthetic control model uses a subset of units for controls. This method selects control states that exhibit the same pre-treatment dynamics as RI. If there is any concern that the rest of the United States is not the right control group, then this model addresses that issue.

We follow Abadie, Diamond and Hainmueller (2010) and use an inferential technique based on several placebo exercises. We apply the treatment year to every state in our sample of 51 state units (50 states plus District of Columbia), placing Rhode Island back into the set of states in the donor pool. We select a set of optimal weights that minimizes the root mean squared prediction error (RMSPE) pre-treatment, and then apply those weights to the outcomes for our synthetic control ex–post. We generate a ratio of the post/pre-treatment RMSPE for each state. This ratio should be high for

Rhode Island, suggesting that the model fit the pre-treatment trends well (represented by a small RMSPE) but has failed to replicate the post–treatment series (represented by a large RMSPE). We rank the ratio of post/pre-treatment RMSPE for all 51 units in our sample from highest to lowest. The probability that chance could have produced the Rhode Island result is the rank order of Rhode Island in that distribution divided by the number of units (e.g., 51) which allows us to examine whether the effect of decriminalization is large relative to the distribution of the effects that we estimate for states not exposed to decriminalization.

7.1 Prostitution Arrests Synthetic Control Results

The synthetic control analysis for prostitution arrests uses the same UCR data from Table 2, but we extend the time series back to 1985 since Abadie, Diamond and Hainmueller (2010) show that if the number of pre-intervention periods in the data is large, then matching on the pre-treatment outcomes helps control for any heterogeneity of unobserved and observed factors on the outcome of interest.

The top panel in Figure 4 shows the synthetic Rhode Island trajectory before and after decriminalization compared to the actual outcome. The bottom panel of Figure 4 shows how well the model fits the data. The synthetic control model suggests that decriminalization resulted in 21.8 fewer prostitution arrests per 100,000 relative to the estimated counterfactual from 2004 to 2009, which is about a 53 percent decrease. This estimate is larger than the DD result presented above which suggests a 26-40 percent decrease. The large estimated decline in arrests is due in part to synthetic RI rising relative to actual RI. Insofar as our synthetic RI is valid, the model indicates that arrests would have been flat or risen slightly in absence of decriminalization. In the DD models above, the control group (ie the rest of the US) does not experience this uptick in arrests, which is likely why that estimate is smaller.

We present the actual and synthetic characteristics from our model in Table 9 in the Appendix. The states which make up synthetic Rhode Island are reported in Table 10 in the Appendix. Next we apply the synthetic control model to all 50 additional state-units for the placebo analysis. Rhode Island has the sixth highest ratio of post–RMSPE to

pre-RMSPE relative to any other state unit, implying a p-value of 0.118 (see top panel of Figure 9 in the Appendix for the distribution of RMSPE ratios).

7.2 Rape Synthetic Control Results

The rape analysis uses the same data from the DD models in Table 2 from the Uniform Crime Reports but again we extend the time series back to 1965. To minimize the volatility in the series we smooth the rape series using the moving average of the current and previous year's rapes. We present results from the synthetic control model in Figure 5 and map the gap in prediction error in the bottom panel. The synthetic control model suggests that rape offenses decreased by 14 per 100,000 or 32 percent. This result is qualitatively similar to the DD result of 30 percent above.

Table 10 shows that the synthetic control is a weighted average of Idaho (0.342), New Hampshire (0.162), North Dakota (0.140), and South Dakota (0.355). Figure 9 (middle panel) in the Appendix shows that Rhode Island has the third largest ratio of post/pre-treatment RMSPE, implying that if one were to assign decriminalization at random, the probability of obtaining a post/pre 2003 RMSPE ratio as large as Rhode Island's is 0.059 (or that the p-value=0.059).

7.3 Gonorrhea Synthetic Control Results

The synthetic control analysis of gonorrhea uses the same data from the DD models in Table 2 from the Center for Disease Control's Gonorrhea Surveillance Program for 1985 to 2009. We present results from the synthetic control model in Figure 6. Decriminalization resulted in 33 per 100,000 fewer cases of female gonorrhea relative to the estimated counterfactual from 2004 to 2009 which is about a 43 percent decrease. Again the synthetic control result is qualitatively similar to the DD result presented above.

We conduct the same placebo inference described above. The bottom panel of Figure 9 in the Appendix reports the results from this exercise. For female gonorrhea, Rhode Island has the highest ratio of post–RMSPE to pre-RMSPE relative to any other state unit, implying a p-value of 0.0196.

8 Re-criminalization of Indoor Prostitution

Rhode Island ultimately re-criminalized indoor sex work in November 2009 with the passage of bill HB5044A. If we believe this should result in the opposite response to decriminalization, then we should observe an increase in prostitution arrests, a decrease in the supply of sex work, and an increase in transaction prices. Gonorrhea incidence and rape offenses would likely increase. If we look at the simple Rhode Island yearly effects relative to the rest of the US, Figure 2 suggests there might be a slight increase in rape offenses and gonorrhea cases after prostitution is re-criminalized. We formalize these relationships by using equation (1), but add an additional term to capture the impact of re-criminalization. We use all of the same datasets as above, but extend all series to 2012. The estimating equation becomes:

$$y_{st} = \alpha_s + \gamma_t + \beta_1 \cdot \mathbf{I}\{s = RI\} \cdot \mathbf{I}\{t \geq 2004\} + \beta_2 \cdot \mathbf{I}\{s = RI\} \cdot \mathbf{I}\{t \geq 2010\} + \psi X_{st} + \epsilon_{st}, \quad (3)$$

where β_2 is the DD estimate of the effect of re-criminalization on the outcomes of interest. The re-criminalization term equals one for Rhode Island from 2010 to 2012. The coefficient β_1 is the DD estimate of the effect of decriminalization on sex worker outcomes in Rhode Island, where the decriminalization term equals one for Rhode Island from 2004-2012. All other variables are the same as before.

Table 5 reports the results for prostitution arrests, massage provision, transaction price, reported rape offenses, and the natural log of gonorrhea using equation (3). Panel A reports β_1 and panel B reports β_2. The results for β_1 are qualitatively similar as before so we focus on β_2. Table 5 shows that prostitution arrests do not change significantly due to re-criminalization, though massage provision decreases 11 percentage points and prices increase 25 percent. Interestingly, we do observe a decrease in the number of reviews in the TER data in Rhode Island immediately following re-criminalization (see Figure 8 in the Appendix). However, by 2012, the trend bounces back to the growth trend of the rest of the United States.

In terms of the main outcomes of interest, while rape offenses do appear to increase 3.9-4.0 cases per 100,000, the p-value is 0.2-0.3. Table 5 also indicates there is no statistically

significant impact of re-criminalization on gonorrhea incidence, at least in the first two years post re-criminalization. There is also no significant impact of re-criminalization on male gonorrhea which is as expected since we do not observe changes in female gonorrhea incidence.

In Table 6 we report results from estimating equation (3) using the TER data on services and race of the provider. Re-criminalization decreases the likelihood of an Asian provider and increases the probability of Hispanic providers suggesting that re-criminalization makes the pool of providers riskier. While there is no statistically significant change in the types of services provided, the positive signs on the anal and vaginal sex coefficients suggest a possible increase in risky behavior.

The re-criminalization analysis does not tell as clean a story as the decriminalization results. This is likely due to anticipatory effects and the short time period of data. Re-criminalization was anticipated, unlike the initial judicial decision that caused decriminalization; the push to re-criminalize started as early as 2006. Some claim that massage parlor owners and workers started leaving even before re-criminalization occurred, as they knew it was inevitable. Therefore empirical results could be biased due to anticipatory effects. Second, we have data until 2012 (at the time of writing), which is only two years post re-criminalization. Consequently we have a short post-treatment window and may be underpowered to detect effects. For example, Figure 2 shows that the decline in gonorrhea due to decriminalization lags at least a year, with the largest decline occurring in 2008, four years after decriminalization.

9 Discussion and Conclusion

This study provides causal estimates of the impact of decriminalization on the sex market as well as outcomes related to sexual violence and public health. The results from all empirical models (DD and synthetic control) are quite consistent, speaking to the strength of the results.

Decriminalization reduces sexual violence by 30 percent. Rape has high direct costs to society. McCollister, French and Fang (2010) using contingent valuation techniques

estimate that the cost per rape offense is $240,776 in 2008 dollars. This estimate includes both tangible cost such as criminal justice costs and intangible costs such as pain and suffering. Therefore, decriminalization has the potential to result in large savings in terms of rape offenses.

We show that decriminalization improves public health outcomes by decreasing female gonorrhea incidence by more than 40 percent. This has direct benefits for individuals but likely results in positive externalities as well. For example, the presence of comorbid STIs such as gonorrhea, can increase the likelihood of HIV transmission (Galvin and Cohen, 2004; Oster, 2005). Shannon et al. (2014) claims decriminalization of sex work would have the greatest effect on the course of HIV epidemics across all settings, averting 33-46 percent of HIV infections in the next decade. Therefore, finding a reduction in gonorrhea is likely understating the gains to public health.

The results suggest that decriminalization could have potentially large social benefits for the population at large—not just sex market participants. Almost 19 million new cases of STDs occur in the United States each year, and the annual direct medical costs of treating STIs (including HIV) is estimated at 11 to 17 US billion in 2003 dollars (Chesson, 2006). For the female gonorrhea estimates we calculate that approximately 5 to 50 percent of the decline in gonorrhea could be from female sex workers. The rest is likely from non-sex workers. While we cannot do the same calculation for rape offenses, we believe some proportion of the decrease in rape offenses is coming from non-sex workers. Sex workers are more likely to report rape after decriminalization, so the fact that we are finding overall decreases suggests that non-sex workers are likely part of this decrease.

Finally, while the findings in this paper point to positive impacts of decriminalization, we note that there are other outcomes impacted by decriminalization that have not been addressed here. Prostitution is morally repugnant for some individuals so decriminalizing the indoor market may impose moral costs that are difficult to quantify. In addition, others have argued that decriminalization may increase human trafficking (Cho, Dreher and Neumayer, 2013). However, good data on numbers trafficked is extremely difficult to uncover given the clandestine nature of this market.

References

Abadie, Alberto, Alexis Diamond and Jens Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association* 105(490):493–505.

Adda, Jerome, Brendon McConnell and Imran Rasul. 2014. "Crime and the Depenalization of Cannabis Possession: Evidence from a Policing Experiment." *Journal of Political Economy* 122(5).

Aizer, Anna. 2010. "The Gender Wage Gap and Domestic Violence." *American Economic Review* 100(4):1847–59.

Alexander, Priscilla. 1987. Prostitution: A Difficult Issue for Feminists. In *Sex Work: Writings by Women in the Sex Industry*, ed. Frederique Delacoste and Priscilla Alexander. Cleis Press.

Amnesty International. 2015. "Global Movement Votes to Adopt Policy to Protect Human Rights of Sex Workers." Press Release. `http://www.amnestyusa.org/news/press-releases/global-movement-votes-to-adopt-policy-to-protect-human-rights-of-sex-workers`.

Arditi, Lynn. 2009. "Behind Closed Doors: How R.I. Decriminalized Prostitution." *The Providence Journal* .

Arunachalam, Raj and Manisha Shah. 2008. "Prostitutes and Brides?" *American Economic Review Papers and Proceedings* 98(2):516–522.

Arunachalam, Raj and Manisha Shah. 2013. "Compensated for Life: Sex Work and Disease Risk." *Journal of Human Resources* 48(2):345–369.

Associated Press. 2009. "Boston 'Craigslist' Killing May Be Linked to Attempted Robbery in Rhode Island.". [Online; posted April 17, 2009].
URL: *http://www.foxnews.com/story/2009/04/17/boston-craigslist-killing-may-be-linked-to-attempted-robbery-in-rhode-island.html*

Bisschop, Paul, Stephen Kastoryano and Bas van der Klaauw. forthcoming. "Street Prostitution Zones and Crime." *American Economic Journal: Economic Policy*.

Bobonis, Gustavo J., Melissa Gonzlez-Brenes and Roberto Castro. 2013. "Public Transfers and Domestic Violence: The Roles of Private Information and Spousal Control." *American Economic Journal: Economic Policy* 5(1):179–205.

Brents, Barbara and Kathryn Hausbeck. 2005. "Violence and legalized brothel prostitution in nevada: examining safety, risk, and prostitution policy." *Journal of Interpersonal Violence* 20:270–295.

Breton, Tracy. 2005. "State Law Foils Efforts to Thwart Prostitution." *Providence Journal-Bulletin* .

Brewer, Devon D., John J. Potterat, Sharon B. Garrett, Stephen Q. Muth, Jr. John M. Roberts, Danuta Kasprzyk, Daniel E. Montano and William W. Darrow. 2000. "Prostitution and the sex discrepancy in reported number of sexual partners." *PNAS* 97(22):12385–12388.

Brewer, Devon D., Jonathan A. Dudek, John J. Potterat, Stephen Q. Muth, Jr. John M. Roberts and Donald E. Woodhouse. 2006. "Extent, Trends, and Perpetrators of Prostitution-Related Homicide in the United States." *Journal of Forensic Science* 51(5):1101–1108.

Bridgett, Madeleine and Julie Robinson. 1999. "Sex Workers and Sexual Asasult: The Hidden Crime." Unpublished Manuscript.

Buchmueller, Thomas C., John DiNardo and Robert G. Valletta. 2011. "The Effect of an Employer Health Insurance Mandate on Health Insurance Coverage and the Demand for Labor: Evidence from Hawaii." *American Economic Journal: Economic Policy* 3(4):25–51.

Cameron, Lisa, Jennifer Muz and Manisha Shah. 2016. "Crimes of Morality: Unintended Consequences of Criminalizing Sex Work." UCLA Working Paper.

CDC. 2010. *Syphilis and MSM - CDC fact sheet.* Atlanta, GA: CDC.

Chalfin, Aaron and Justin McCrary. forthcoming. "Are U.S. Cities Underpoliced?: Theory and Evidence." *The Review of Economics and Statistics.*

Chesson, Harrell W. 2006. "Estimated Effectiveness and Cost-Effectiveness of Federally Funded Prevention Efforts on Gonorrhea Rates in the United States, 1971-2003." *Sexually Transmitted Diseases* 33(10):S140–S144.

Cho, Seo-Young. 2015. "Does Prostitution Constrain Sex Crimes? Micro-Evidence from Korea." Philipps-University of Marburg Working Paper.

Cho, So-Young, Axel Dreher and Eric Neumayer. 2013. "Does Legalized Prostitution Increase Human Trafficking?" *World Development* 41:67–82.

Church, Stephanie, Marion Henderson, Marina Barnard and Graham Hart. 2001. "Violence by clients towards female prostitutes in different work settings: questionnaire survey." *British Medical Journal* 322:524–525.

Ciacci, Riccardo and Maria Micaela Sviatschi. 2016. "The Effect of Indoor Prostitution on Sex Crime: Evidence from New York City." Columbia University Working Paper.

COYOTE et al. v. Dennis J. Roberts, II et al. 1980. In *502 F. Supp. 1342.* United States District Court, District of Rhode Island.

COYOTE et al. v. Dennis J. Roberts, II et al. 1981. In *523 F. Suppl. 352.* United States District Court, District of Rhode Island.

Cunningham, Scott and Todd D. Kendall. 2011. "Prostitution 2.0: The Changing Face of Sex Work." *Journal of Urban Economics* 69:273–287.

Delavande, Adeline, Dana Goldman and Neeraj Sood. 2010. "Criminal Prosecution and Human Immunodeficiency Virus?Related Risky Behavior." *Journal of Law and Economics,* 53:741–782.

Dever, Vincent M. 1996. "Aquinas on the Practice of Prostitution." *Essays in Medieval Studies* 13:39–49.

Draca, Mirko, Stephen Machin and Robert Witt. 2011. "Panic on the Streets of London: Police, Crime, and the July 2005 Terror Attacks." *American Economic Review* 101(5):2157–81.

Dunlop, E.M.C., Amy M. Lamb and Dorothy M. King. 1971. "Improved tracing of contacts of heterosexual men with gonorrhea: relationship of altered female to male ratios." *British Journal of Venereal Disease* 47:192–195.

Edlund, Lena and Evelyn Korn. 2002. "A Theory of Prostitution." *Journal of Political Economy* 110(1):181–214.

Ehrlich, Isaac. 1973. "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation." *Journal of Political Economy* 81(3):521–565.

El Paso County Department of Health and Environment. 1999. "1999 STD/HIV Annual Report." Sexually Transmitted Diseases/HIV Programs.

Farley, Melissa. 2005. "Prostitution Harms Women Even if Indoors: A Reply to Weizer." *Violence Against Women* 11(7):950–964.

Fisher, R. A. 1935. *The Design of Experiments*. Edinburgh: Oliver and Boyd.

Galvin, Shannon R. and Myron S. Cohen. 2004. "The Role of Sexually Transmitted Diseases in HIV Transmission." *Nature Reviews Microbiology* 2(1):33–42.

General Social Surveys. 1992-2010. "National Opinion Research Center." dataset.

Gertler, Paul and Manisha Shah. 2011. "Sex Work and Infection: What's Law Enforcement Got to Do With It?" *Journal of Law and Economics* 54.

Gertler, Paul, Manisha Shah and Stefano M. Bertozzi. 2005. "Risky Business: The Market for Unprotected Commercial Sex." *Journal of Political Economy* 113(3):518–550.

Guista, Marina Della, Maria Laura Di Tommaso and Steinar Strom. 2009. "Who's Watching? The Market for Prostitution Services." *Journal of Population Economics* 22(2):501–516.

Havoscope. 2013. http://www.havocscope.com/prostitution-revenue-by-country/. Technical report.

Hethcote, Herbert and James Yorke. 1984. *Gonorrhea Transmission Dynamics and Control*. Vol. 56 Springer Berlin Heidelberg.

Hidrobo, Melissa and Lia Fernald. 2013. "Cash transfers and domestic violence." *Journal of Health Economics* 32(1):304 – 319.

Holt, Thomas J., Kristie R. Blevins and Joseph Kuhns. 2014. "Examining Diffusion and Arrest Avoidance Practices Among Johns." *Crime and Delinquency* 60.

Hurley, Tara. 2009. *Happy Endings*. It's Not Easy Productions.

Immordino, G. and F.F. Russo. 2015. "Regulating prostitution: A health risk approach." *Journal of Public Economics* 121:14 – 31.

Jeal, N. and C. Salisbury. 2007. "Health needs and service use of parlour-based prostitutes compared with street-based prostitutes: a cross-sectional survey." *An International Journal of Obstetrics and Gynaecology* 114(7):875–881.

Kremer, Michael. 1996. "Integrating Behavioral Choice into Epidemiological Models of AIDS." *Quarterly Journal of Economics* 111(2):549–573.

Kremer, Michael and Charles Morcom. 1998. "The effect of changing sexual activity on HIV prevalence." *Mathematical Biosciences* 151:99–122.

Langer, Gary, Cheryl Arnedt and Dalia Sussman. 2004. "Primetime Live Poll: American Sex Survey." http://abcnews.go.com/Primetime/News/story?id=156921page=1.

Lee, Samuel and Petra Persson. 2015. "Human Trafficking and Regulating Prostitution." Working Paper.

Lee, Samuel and Petra Persson. 2016. Violence and Entry in the Market for Sex. In *Handbook of the Economics of Prostitution*, ed. Scott Cunningham and Manisha Shah. Oxford University Press.

Levitt, Steven and Sudhir Alladi Venkatesh. 2007. "An Empirical Analysis of Street-Level Prostitution." University of Chicago Working Paper.

Loff, B., B. Gaze and C. Fairley. 2000. "Prostitution, public health, and human rights law." *Lancet* 356.

McCollister, Kathryn E., Michael T. French and Hai Fang. 2010. "The Cost of Crime to Society: New Crime-Specific Estimates for Policy and Program Evaluation." *Drug Alcohol Dependency* 108(1-2).

Miller, Jody and Martin D. Schwartz. 1995. "Rape myths and violence against street prostitutes." *Deviant Behavior* 16(1):1–23.

National Institutes of Health. 2001. Workshop Summary: Scientific Evidence on Condom Effectiveness for Sexually Transmitted Disease (STD) Prevention. Technical report Department of Health and Human Services.

Nguyen, Amanda. 2016. "Optimal regulation of illegal goods: The case of massage licensing and prostitution." UCLA Working Paper.

Oster, Emily. 2005. "Sexually Transmitted Infections, Sexual Behavior and the HIV/AIDS Epidemic." *Quarterly Journal of Economics* 120(2):467–515.

Posner, Richard A. 1992. *Sex and Reason*. 1st ed. Harvard University Press.

Posner, Richard A. and Katharine B. Silbaugh. 1996. *A Guide to America's Sex Laws*. 1st ed. University of Chicago Press.

Potterat, John J., Donald E. Woodhouse, John B. Muth and Stephen Q. Muth. 1990. "Estimating the Prevalance and Career Longevity of Prostitute Women." *The Journal of Sex Research* 27(2):233–243.

Potterat, John J., Richard B. Rothenberg and Donald C. Bross. 1979. "Gonorrhea in street prostitutes: epidemiologic and legal implications." *Sexually Transmitted Diseases* 6(2):58–63.

Rao, Vijayendra, Indrani Gupta, Michael Lokshin and Smarajit Jana. 2003. "Sex Workers and the Cost of Safe Sex: The Compensating Differential for Condom Use among Calcutta Prostitutes." *Journal of Development Economics* 71:583–603.

Rhode Island State Police. 2016. Uniform Crime Report: Crime in Rhode Island 2015. Technical report Rhode Island State Police.

Rigg, Robert. 2010. "The Not-so-Risky Business of High-End Escorts and the Internet in the 21st Century." *Richmond Journal of Law and Technology* XVII(1).

Rivera, Natalie. 2012. "FBI's Uniform Crime Reporting program changes definition of rape." *Daily Sundial* .

Robinson, Jonathan and Ethan Yeh. 2012. "Risk-Coping through Sexual Networks: Evidence from Client Transfers in Kenya." *Journal of Human Resources* 47(1):107–145.

Ross, Michael, Beth Crisp, Sven-Axel Mansson and Sarah Hawkes. 2012. "Occupational health and safety among commercial sex workers." *Scandanavian Journal of Work, Environment and Health* 38(2):105–119.

Seib, Charlotte, Jane Fischer and Jackob Najman. 2009. "The health of female sex workers from three industry sectors in Queensland, Australia." *Social Science and Medicine* 68(3):473–478.

Seib, Charlotte, Joseph Debattista, Jane Fischer, Michael Dunne and Jackob Najman. 2009. "Sexually transmitted infections among sex workers and their clients: variation in prevalence between sectors of the industry." *Sexual Health* 6(1):45–50.

Shannon, Kate, Steffanie Strathdee, Shira Goldenberg, Putu Duff, Peninah Mwangi, Maia Rusakova, Sushena Reza-Paul, Joseph Lau, Kathleen Deering, Michael Pickles and Marie-Claude Boily. 2014. "Global Epidemiology of HIV Among Female Sex Workers: Influence of Structural Determinants." *The Lancet* .

Shapiro, Melanie. 2009. Sex Trafficking and Decriminalized Prostitution in Rhode Island. Master's thesis University of Rhode Island. DigitalCommons@University of Rhode Island.

State v. Robert J. DeMagistris. 1998. In *No. 96-286-C.A.* Supreme Court of Rhode Island.

Stevenson, Betsey and Justin Wolfers. 2006. "Bargaining in the shadow of the law: Divorce laws and family distress." *The Quarterly Journal of Economics* 121(1):267–288.

Urban Justice Center. 2005. Behind Closed Doors: An Analysis of Indoor Sex Work in New York City. Technical report.

Weitzer, Ronald. 2005. "New Directions in Research on Prostitution." *Crime, Law & Social Change* 43:211–235.

Weitzer, Ronald. 2011. *Legalizing Prostitution: From Illicit Vice to Lawful Business*. NYU Press.

WHO. 2005. Violence Against Sex Workers and HIV Prevention. Technical report World Health Organization.

Willcox, R. R. 1962. "Prostitution and venereal disease: proportion of venereal disease acquired from prostitutes in Asia: a comparison with France, the United Kingdom, and the United States of America." *British Journal of Venereal Disease* 38:37–42.

Table 1 Summary Statistics

Dependent Variables	**Mean**	**Std. Deviation**	**Observations**
Reported rape offenses per 100,000	34.10	11.50	561
Ln female gonorrhea incidence per 100,000	4.33	1.00	561
Ln male gonorrhea incidence per 100,000	4.26	0.98	561
Prostitution arrests per 100,000	19.51	28.30	545
All crime arrests per offense	0.17	0.05	545
Rape arrests per offense	0.24	0.11	545
Murder arrests per offense	0.85	0.40	545
Larceny arrests per offense	0.16	0.06	545
Burglary arrests per offense	0.12	0.05	545
Vehicle theft arrests per offense	0.10	0.05	545
Robbery arrets per offense	0.27	0.10	545
Assault arrests per offense	0.43	0.17	545
Massage provision	0.14	0.34	83,135
Oral sex bare (no condom)	0.37	0.48	83,135
Oral sex (condom)	0.46	0.50	83,135
Vaginal sex	0.83	0.37	83,135
Anal sex	0.11	0.32	83,135
Ln transaction price	5.43	0.57	82,944
Asian provider	0.15	0.36	83,135
White provider	0.52	0.50	83,135
Hispanic provider	0.15	0.35	83,135
Black provider	0.10	0.30	83,135
Other Variables	**Mean**	**Std. Deviation**	**Observations**
Ln female population	14.38	1.04	561
Ln male population	14.35	1.03	561
State unemployment rate	5.44	1.70	561
Poverty rate	16.97	5.18	561
Military share of population	0.004	0.004	561
Share of population white	37.98	41.90	561
Share of population black	5.25	10.00	561
Share of population single male	21.20	23.11	561
Share of population single female	18.26	19.93	561
Share of population married male	19.66	21.26	561
Share of population married female	18.87	20.39	561
Number of weekly massage parlor advertisements	9.59	4.21	458
Number of weekly restaurant advertisements	18.71	6.71	469
Size of weekly massage parlor advertisements	1.16	0.65	458
Size of weekly restaurant advertisements	2.57	1.54	469

These are summary statistics from Uniform Crime Reports (1999-2009), CDC (1999-2009), The Erotic Review (1999-2007), and Current Population Survey (1999-2009) data.

Table 2 Effect of Decriminalization on Arrests, Massage Provision, Prices, Rape and Gonorrhea

Dependent variable:	**Prostitution Arrests**		**Massage Provision**		**Ln Price**		**Rape Offenses**		**Ln Female Gonorrhea**		**Ln Male Gonorrhea**	
RI decriminalization	-13.650*	-8.806	0.237**	0.231**	-0.426*	-0.414*	-12.607**	-13.712**	-0.762**	-0.633**	-0.364*	-0.281
Placebo tests (other states)												
5th percentile	-12.365	-14.832	-0.159	-0.157	-0.243	-0.258	-7.548	-7.027	-0.292	-0.276	-0.331	-0.292
95th percentile	12.052	12.255	0.138	0.139	0.242	0.239	11.584	10.595	0.482	0.335	0.482	0.362
Two-tailed test p-value	0.08	0.35	0.05	0.05	0.09	0.09	0.04	0.04	0.04	0.04	0.08	0.16
Observations	545	545	83135	83135	82944	82944	561	561	561	561	561	561
Baseline mean RI	34.05	34.05	0.11	0.11	5.39	5.39	40.4	40.4	4.39	4.39	4.18	4.18
Geographic and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

These are DD regressions (equation 1) where we present 5th and 95th percentile confidence intervals from permutation tests and p-values from a two-tailed test based on the distribution of placebo effects. Columns 1-2 and 7-8 use Uniform Crime Reports data (1999-2009); columns 3-6 use The Erotic Review data (1999-2007); and columns 9-12 use CDC data (1999-2009). Columns 1-2 and columns 7-12 include year and state fixed effects. Columns 3-6 include year and TER geographic fixed effects. Controls in columns 2, 8, 10, and 12 include female population, male population, unemployment rate, share of population below poverty line, share of population in military, share of white population, share of black population, share of population that is male and single, share of population that is female and single, share of population that is male and married, and share of population that is female and married. TER controls in columns 4 and 6 include whether the worker is an independent contractor. The baseline mean is the 1999-2003 RI mean. **Significant at the 5 percent level. * Significant at the 10 percent level.

Table 3 Effect of Decriminalization on Arrests per Offense

Dependent variable:	**All crime Arrests**	**Rape Arrests**	**Murder Arrests**	**Larceny Arrests**	**Burglary Arrests**	**Car Theft Arrests**	**Robbery Arrests**	**Assault Arrests**
RI decriminalization	-0.007	-0.002	0.139	-0.010	0.008	-0.030	0.008	-0.063
Placebo tests (other states)								
5th percentile	-0.038	-0.083	-0.708	-0.036	-0.038	-0.044	-0.096	-0.204
95th percentile	0.039	0.142	0.344	0.040	0.038	0.044	0.105	0.153
Two-tailed test p-value	0.63	0.98	0.67	0.55	0.86	0.27	0.90	0.39
Observations	545	545	545	545	545	545	545	545
Baseline mean RI	0.15	0.30	0.67	0.14	0.128	0.08	0.29	0.48
State and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

These are DD regressions (equation 1) using Uniform Crime Reports data (1999-2009). We present 5th and 95th percentile confidence intervals from permutations tests and p-values from a two-tailed test based on the distribution of placebo effects. Each dependent variable is arrests/per crime. All models include state and year fixed effects. Controls include female population, male population, unemployment rate, share of population below poverty line, share of population in military, share of white population, share of black population, share of population that is male and single, share of population that is female and single, share of population that is male and married, and share of population that is female and married. The baseline mean is the 1999-2003 RI mean. **Significant at the 5 percent level. * Significant at the 10 percent level.

Table 4 Effect of Decriminalization on Transaction Characteristics

Dependent variable:	**White**		**Asian**		**Hispanic**		**Black**		**Oral condom**		**Oral bare**		**Vaginal Sex**		**Anal Sex**	
RI decriminalization	0.010	0.023	0.200**	0.178**	-0.013	-0.012	0.012	0.021	0.084	0.080	-0.222	-0.212	-0.140*	-0.135*	-0.189**	-0.177**
Placebo tests (other states)																
5th percentile	-0.125	-0.141	-0.183	-0.163	-0.055	-0.055	-0.040	-0.048	-0.184	-0.186	-0.303	-0.306	-0.133	-0.127	-0.064	-0.061
95th percentile	0.104	0.123	0.084	0.080	0.078	0.078	0.070	0.069	0.349	0.342	0.112	0.109	0.136	0.134	0.083	0.074
Two-tailed test p-value	0.79	0.60	0.05	0.05	0.47	0.47	0.84	0.47	0.60	0.60	0.23	0.28	0.09	0.09	0.05	0.05
Observations	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135	83135
Baseline mean RI	0.44	0.44	0.22	0.22	0.06	0.06	0.00	0.00	0.56	0.56	0.39	0.39	0.94	0.94	0.22	0.22
Geographic and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

These are DD regressions (equation 1) using The Erotic Review data (1999-2007). We present 5th and 95th percentile confidence intervals from from permutation tests and p-values from a two-tailed test based on the distribution of placebo effects. All models include year and TER geographic fixed effects. Controls include whether the worker is an independent contractor. The baseline mean is the 1999-2003 RI mean. **Significant at the 5 percent level. * Significant at the 10 percent level.

Table 5 Effect of Decriminalization and Re-criminalization on Arrests, Massage Provision, Prices, Rape and Gonorrhea

Dependent variable:	**Prostitution Arrests**		**Massage Provision**		**Ln Price**		**Rape Offenses**		**Ln Female Gonorrhea**		**Ln Male Gonorrhea**	
					Panel A							
RI decriminalization	-13.633*	-8.706	0.164	0.162	-0.335	-0.333	-12.607**	-14.178**	-0.762**	-0.698**	-0.364*	-0.351**
Placebo tests (other states)												
5th percentile	-12.348	-15.330	-0.168	-0.165	-0.282	-0.283	-7.548	-7.677	-0.292	-0.289	-0.331	-0.301
95th percentile	12.072	12.352	0.156	0.158	0.246	0.245	11.584	10.655	0.482	0.371	0.482	0.397
Two-tailed test p-value	0.08	0.35	0.14	0.14	0.14	0.14	0.04	0.04	0.04	0.04	0.08	0.04
					Panel B							
RI re-criminalization	-4.816	-3.393	-0.108**	-0.109*	0.226*	0.226*	3.963	4.026	-0.148	-0.110	-0.002	0.073
Placebo tests (other states)												
5th percentile	-9.904	-9.303	-0.083	-0.077	-0.256	-0.255	-6.696	-6.288	-0.309	-0.372	-0.265	-0.332
95th percentile	7.698	8.125	0.099	0.098	0.202	0.201	6.156	5.003	0.722	0.693	0.463	0.368
Two-tailed test p-value	0.27	0.35	0.05	0.09	0.09	0.09	0.20	0.31	0.31	0.47	1.22	0.71
Observations	695	695	159805	159805	159467	159467	714	714	714	714	714	714
Geographic and year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

These are DD regressions (equation 3) where we present 5th and 95th percentile confidence intervals from permutation tests and p-values from a two-tailed test based on the distribution of placebo effects. Columns 1-2 and 7-8 use 1999-2012 Uniform Crime Reports data (Arrests and Rape Offenses); columns 3-6 use 1999-2012 The Erotic Review data; and columns 9-12 use 1999-2012 CDC data (Gonorrhea). Columns 1-2 and columns 7-12 include year and state fixed effects. Columns 3-6 include year and TER geographic fixed effects. Controls in columns 2, 8, 10, and 12 include female population, male population, unemployment rate, share of population below poverty line, share of population in military, share of white population, share of black population, share of population that is male and single, share of population that is female and single, share of population that is male and married, and share of population that is female and married. TER controls in columns 4 and 6 include whether the worker is an independent contractor. **Significant at the 5 percent level. * Significant at the 10 percent level.

Table 6 Effect of Decriminalization and Re-criminalization on Transaction Characteristics

Dependent variable:	White		Asian		Hispanic		Black		Oral condom		Oral bare		Vaginal Sex		Anal Sex	
Panel A																
RI decriminalization	0.057	0.062	0.068	0.059	0.038	0.039	0.047	0.050	0.074	0.075	-0.188	-0.187	-0.160	-0.158	-0.184**	-0.180**
Placebo tests (other states)																
5th percentile	-0.133	-0.153	-0.175	-0.147	-0.062	-0.061	-0.038	-0.040	-0.193	-0.190	-0.388	-0.383	-0.161	-0.164	-0.068	-0.075
95th percentile	0.102	0.125	0.057	0.061	0.092	0.087	0.060	0.077	0.407	0.403	0.124	0.124	0.129	0.128	0.090	0.089
Two-tailed test p-value	0.47	0.42	0.14	0.23	0.74	0.74	0.37	0.33	0.60	0.60	0.28	0.28	0.19	0.19	0.05	0.05
Panel B																
RI re-criminalization	0.059	0.060	-0.235**	-0.237**	0.131**	0.131**	0.025	0.026	0.020	0.020	0.003	0.003	0.057	0.058	0.055	0.055
Placebo tests (other states)																
5th percentile	-0.143	-0.135	-0.069	-0.067	-0.039	-0.041	-0.054	-0.046	-0.147	-0.148	-0.141	-0.140	-0.091	-0.088	-0.047	-0.045
95th percentile	0.119	0.111	0.134	0.117	0.078	0.079	0.074	0.069	0.124	0.124	0.169	0.168	0.059	0.066	0.042	0.046
Two-tailed test p-value	0.37	0.37	0.05	0.05	0.05	0.05	0.56	0.60	0.74	0.74	1.02	1.02	0.28	0.23	0.14	0.14
Observations	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805	159805
Geographic & year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

These are DD regressions (equation 3) using The Erotic Review data (1999-2012). We present 5th and 95th percentile confidence intervals from from permutation tests and p-values from a two-tailed test based on the distribution of placebo effects. All models include year and TER geographic fixed effects. Controls include whether the worker is an independent contractor. **Significant at the 5 percent level. * Significant at the 10 percent level.

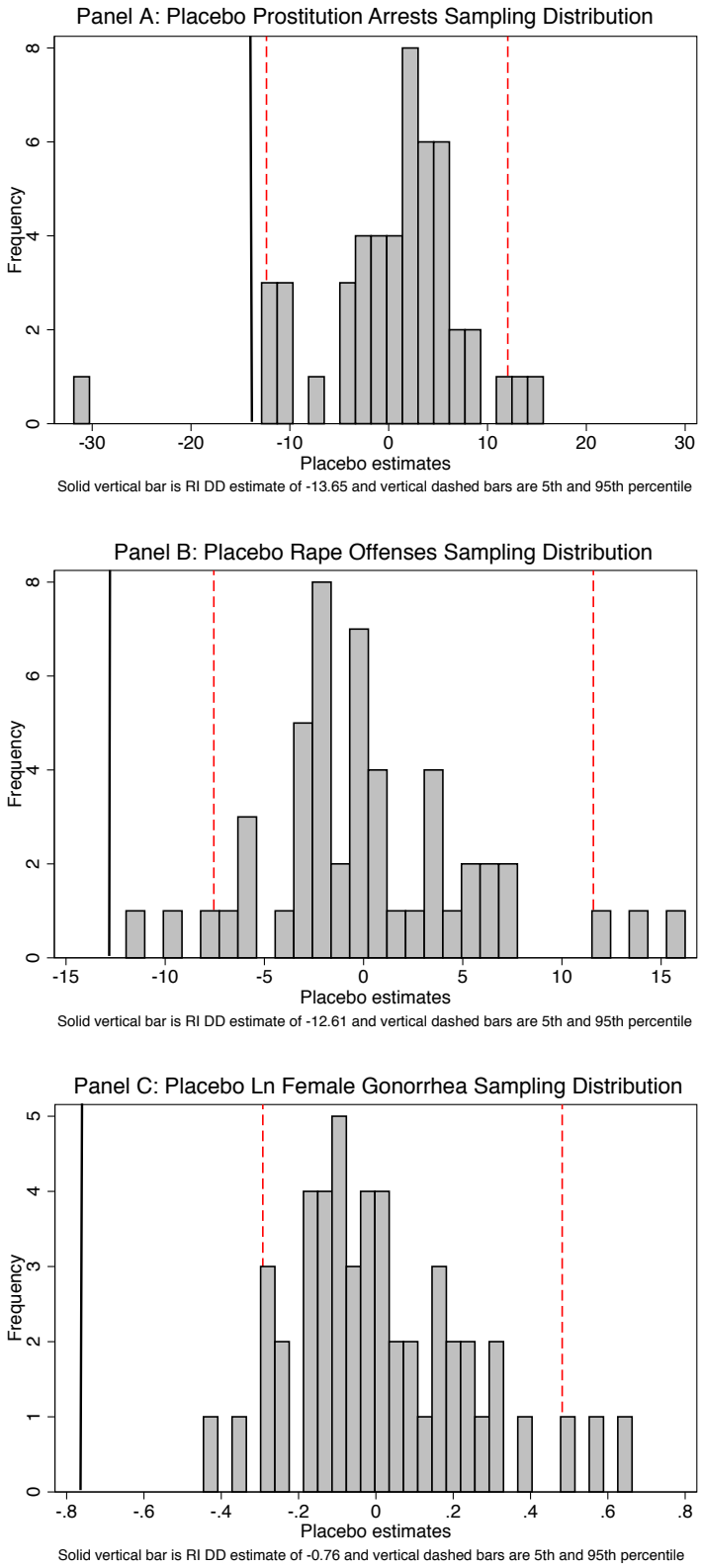


Figure 1 Figure shows state effects estimated from permutation tests in Table 2 (cols 1,7, & 9). The dashed lines are 5th and 95th percentile values (other than RI). The solid line is the Rhode Island value.

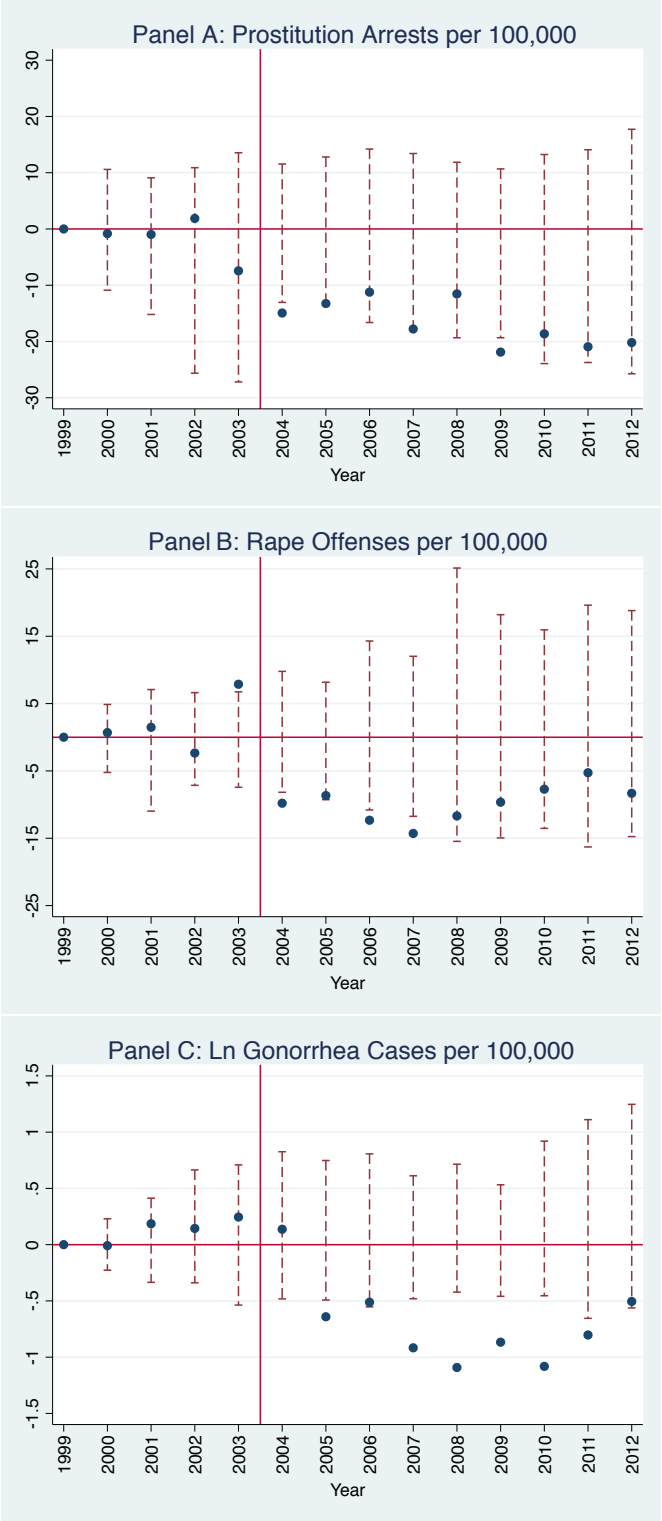
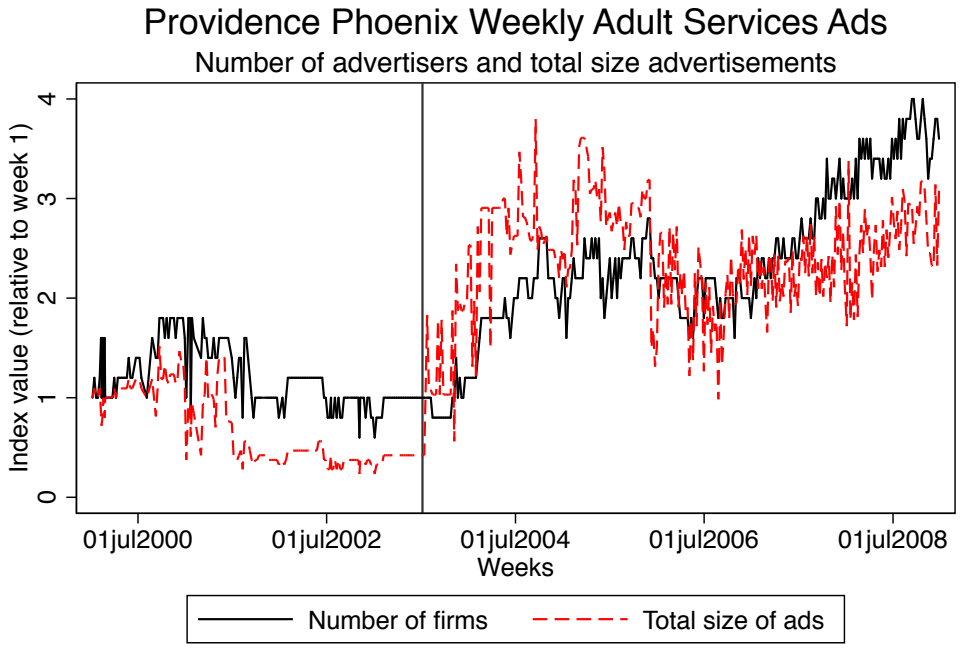


Figure 2 This figure plots the coefficients on Rhode Island-specific year effects (β_t from equation 2) for each outcome of interest. The solid vertical line denotes decriminalization. The dashed vertical lines are the sampling distribution for the placebo estimates from the 5th-95th percentile for each year.



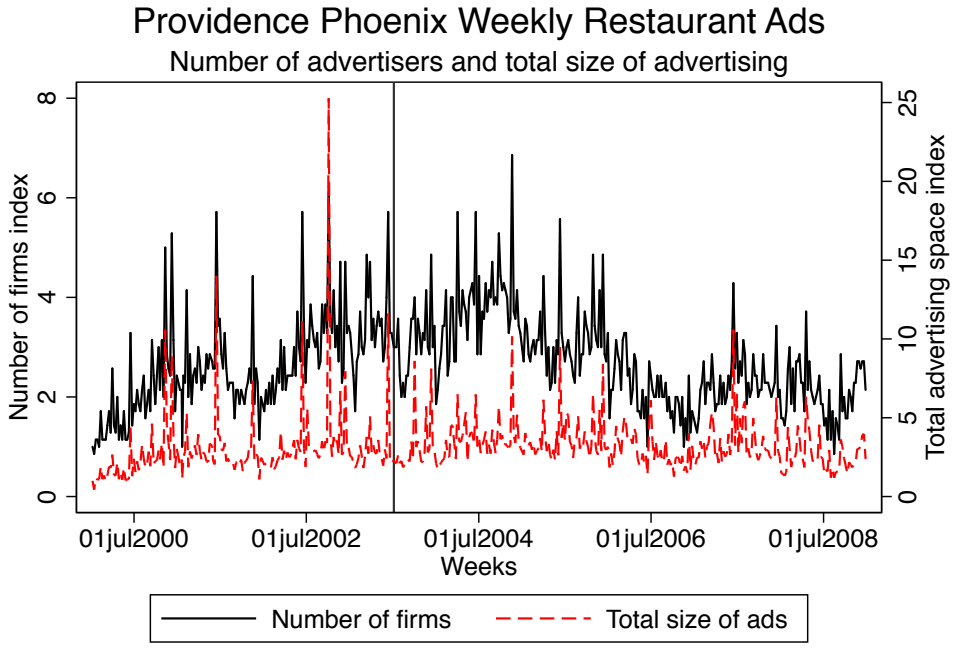


Figure 3 "Adult services/spa" Section of the *The Providence Phoenix* (Top panel), "Restaurants" Section of the *The Providence Phoenix* (Bottom panel)

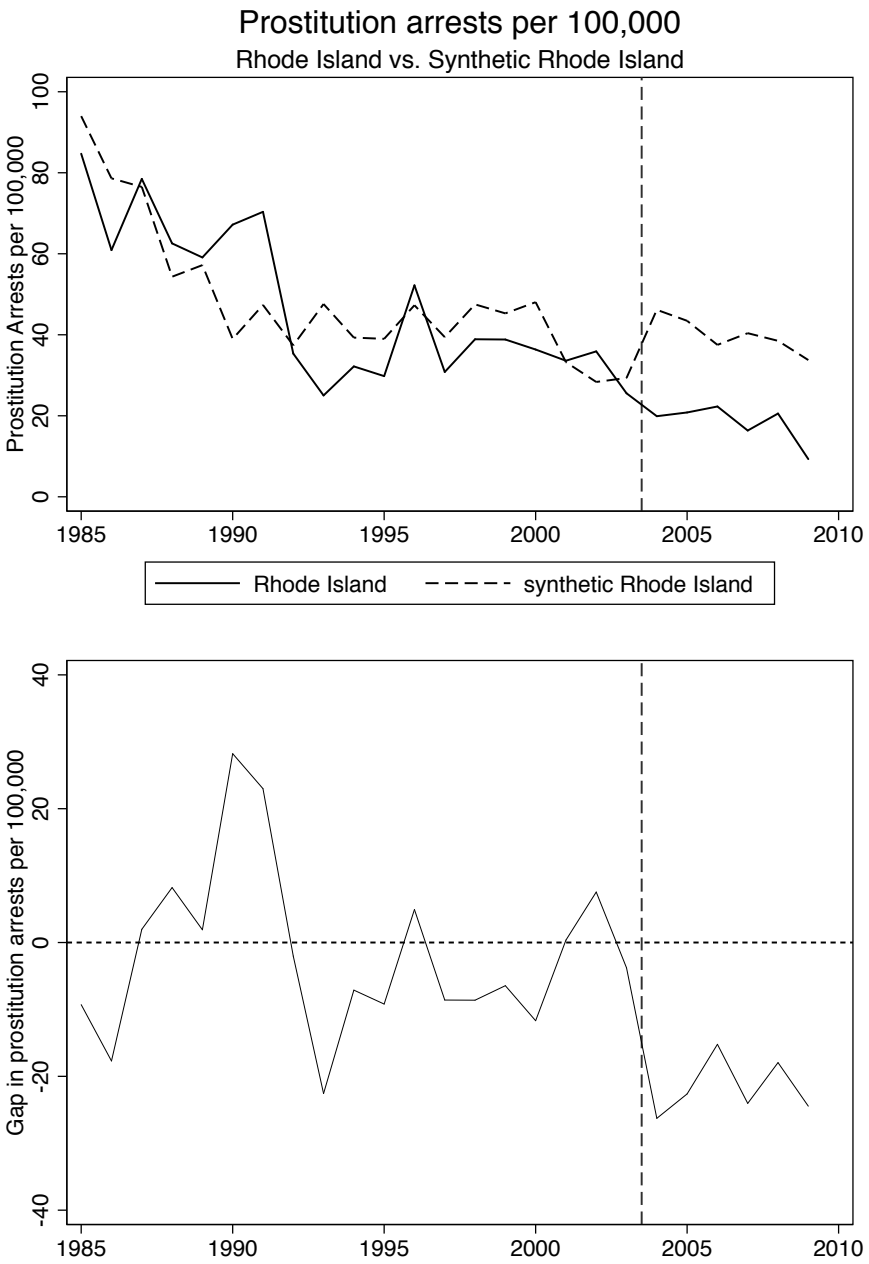


Figure 4 Top panel: Trends in prostitution arrests: RI and synthetic RI
Bottom panel: Arrest gap between RI and synthetic RI

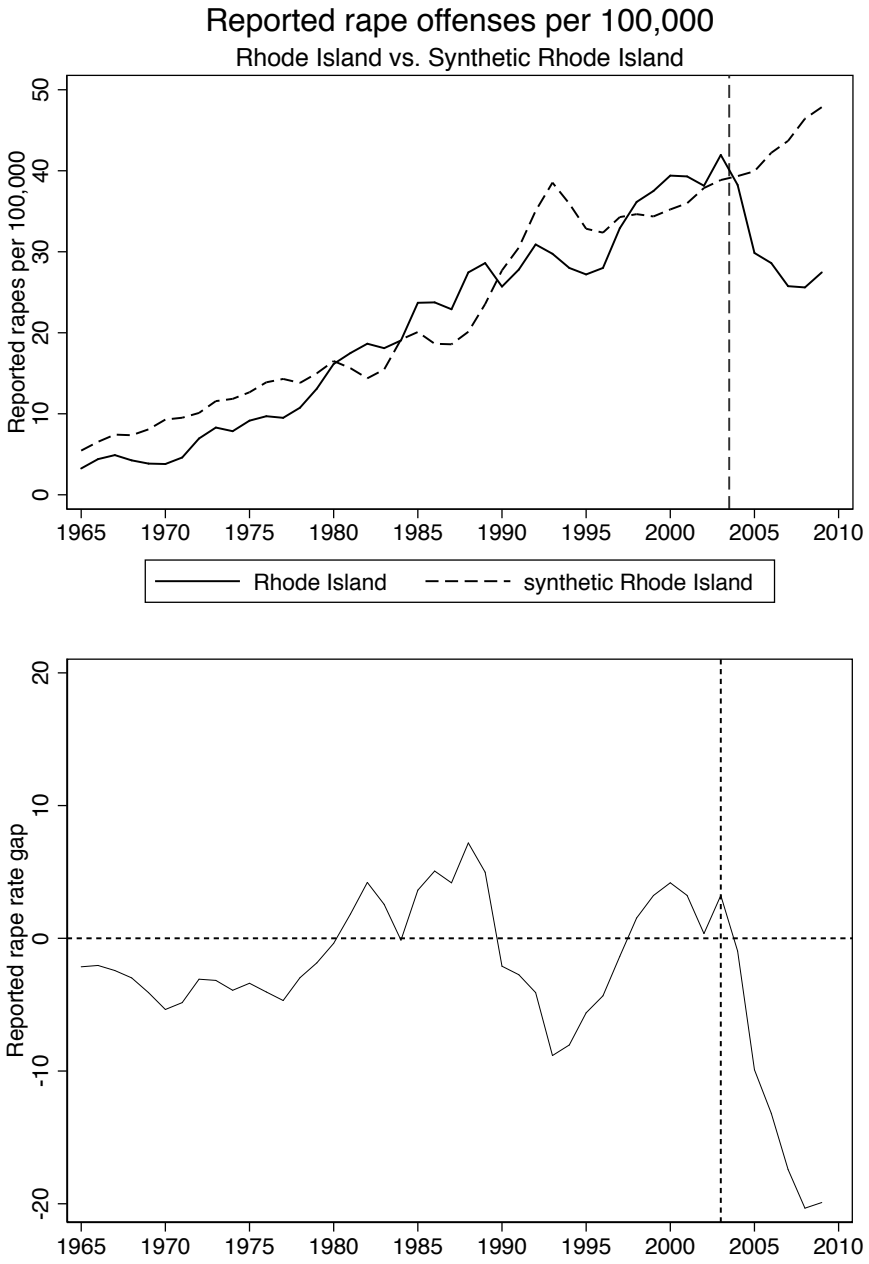


Figure 5 Top panel: Trends in rape: RI and synthetic RI
Bottom panel: Rape gap between RI and synthetic RI

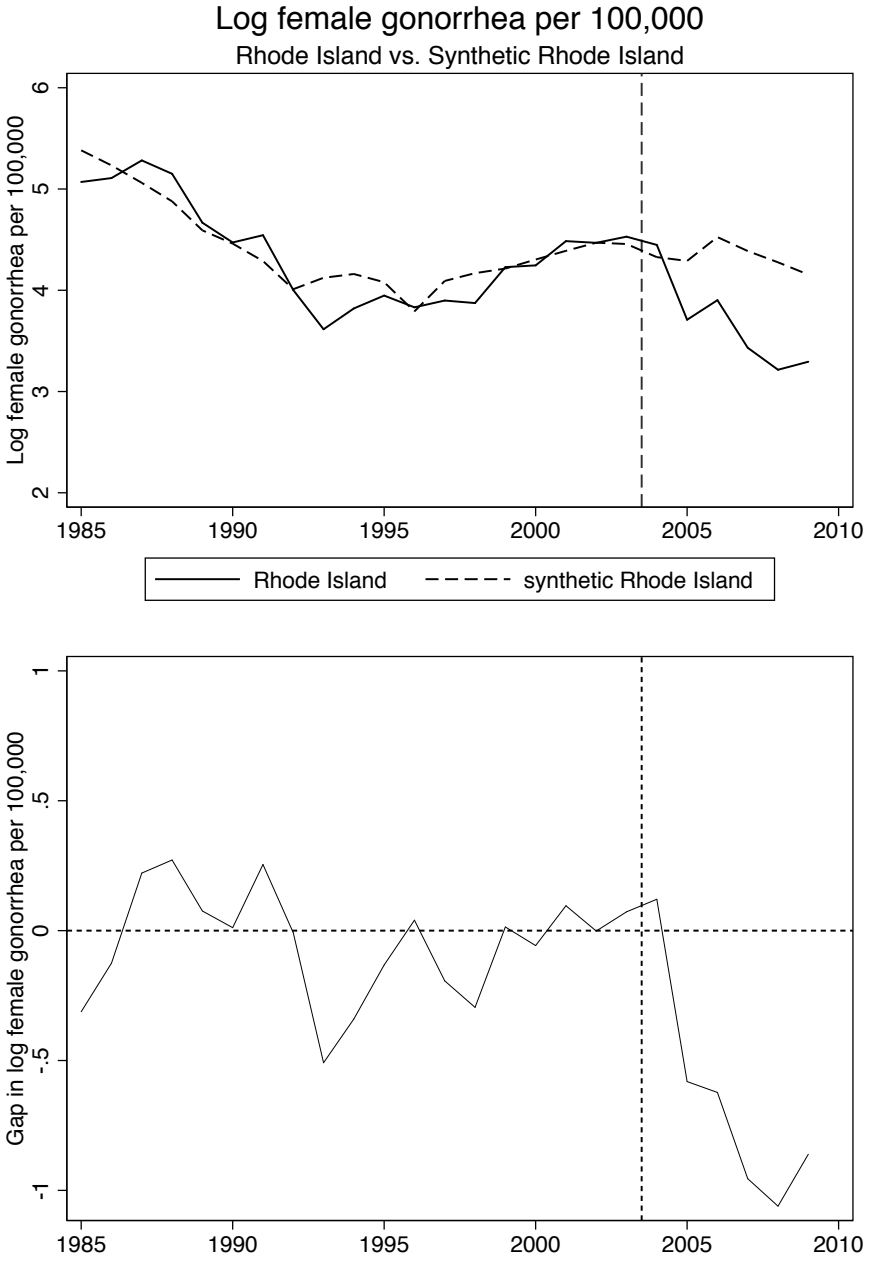


Figure 6 Top panel: Trends in female gonorrhea: RI and synthetic RI
Bottom panel: Gonorrhea gap between RI and synthetic RI

10 Appendix

In this section, we describe the figures and tables in the Appendix. Table 7 shows that prostitution, either as a male client or a female sex worker, is positively associated with ever having had gonorrhea, but not with chlamydia. In Table 8, we-restimate equation (1) using rape offense data based on jurisdiction level files (see Chalfin and McCrary (forthcoming) for a description of these data). We do this with both a balanced and unbalanced panel of jurisdictions to test whether jurisdiction attrition is responsible for the sizable declines in reported rapes in Rhode Island following decriminalization. Table 8 shows it is not.

Figure 7 shows the changing trajectories of police employment for Rhode Island and the United States (excluding Rhode Island) before and after decriminalization using the FBI's Uniform Crime Report Law Enforcement Officers Killed or Assaulted (LEOKA) dataset. The data is available through 2005. The Figure shows that police employment trends in Rhode Island did not change after decriminalization.

Figure 8 shows the effect that re-criminalization had on the number of sex worker reviews using Total Erotic Review data for both Rhode Island (solid line) and the United States (excluding Rhode Island). The number of reviews fell by approximately one-third in 2010, but immediately rose afterwards, catching up with the national trend. The overall effect of re-criminalization appears to have been a temporary large disruption in the market.

We used synthetic control methods to estimate the effect of decriminalization on arrests, reported rape offenses, and log gonorrhea incidence as a robustness exercise. Inference in this methodology requires calculating the post- and pre-treatment root mean squared prediction error (RMSPE), and then taking the ratio. A larger ratio implies that the post-treatment RMSPE is larger than the pre-RMSPE, whereas a ratio closer to unity implies the effect sizes are similar pre- and post-treatment. In the rape model (middle panel of Figure 9), the ratio is ranked third in the distribution of all ratios, in the gonorrhea model (bottom panel of Figure 9), the ratio is ranked first, and in the arrests model (top panel) the ratio is ranked sixth.

In Table 9 we describe the covariates used in the synthetic control models, and Table 10 presents the weights from the synthetic control models. All weights are constrained to be non-negative and sum to unity.

Table 7 Correlation between Participation in Sex Markets and STIs

Dependent variable: STI Diagnosis Ever	**Females**				**Males**			
	Gonorrhea		**Chlamydia**		**Gonorrhea**		**Chlamydia**	
Ever engaged in compensation for sex	0.123**	0.095*	0.068	0.069	0.157***	0.122***	0.007	0.011
	(0.060)	(0.054)	(0.049)	(0.052)	(0.034)	(0.033)	(0.014)	(0.015)
Observations	1,556	1,556	1,556	1,556	1,154	1,154	1,154	1,154
Mean of dependent variable	0.034	0.034	0.038	0.038	0.075	0.075	0.019	0.019
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

These are OLS regressions using the NHSLS 1992 data where dependent variable in each model is dichotomous variable equalling 1 if the respondent has ever had gonorrhea or chlamydia. All models include Census region fixed effects and NHSLS household sampling weights. Even numbered columns additionally include controls for race, sex, age, age squared, marital status, maternal education, alcohol drinking behavior, whether respondent lived with parent at age 14, whether alternative living arrangements occurred at age 14, and residence location at age 14.Heteroskedastic robust standard errors in parenthesis.* p<0.10, ** p<0.05, *** p<0.01

Table 8 Effect of Decriminalization on Rape Using Alternate Dataset

Dependent variable:	**Rape Offenses (balanced)**		**Rape Offenses (unbalanced)**	
RI decriminalization	-11.60**	-11.114**	-11.575**	-10.97**
Placebo tests (other states)				
5th percentile	-7.084	-6.176	-6.732	-6.496
95th percentile	12.868	12.879	13.698	13.015
Two-tailed test p-value	0.04	0.04	0.04	0.04
Observations	561	561	561	561
Baseline mean RI	36.06	36.06	36.48	36.48
State and year FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

These are DD regressions (equation 1) using jurisdiction level raw Uniform Crime Reports data (1999-2009) from Chalfin and McCrary (forthcoming). We present 5th and 95th percentile confidence intervals from permutations tests and p-values from a two-tailed test based on the distribution of placebo effects. Each dependent variable is arrests/per crime. All models include state and year fixed effects. Controls include female population, male population, unemployment rate, share of population below poverty line, share of population in military, share of white population, share of black population, share of population that is male and single, share of population that is female and single, share of population that is male and married, and share of population that is female and married. The baseline mean is the 1999-2003 RI mean. **Significant at the 5 percent level. * Significant at the 10 percent level.

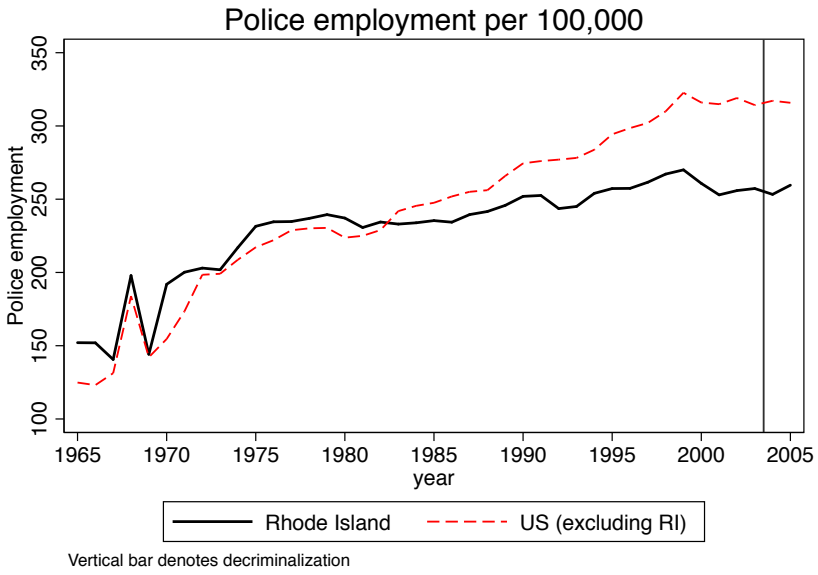


Figure 7 Police employment does not change post–decriminalization

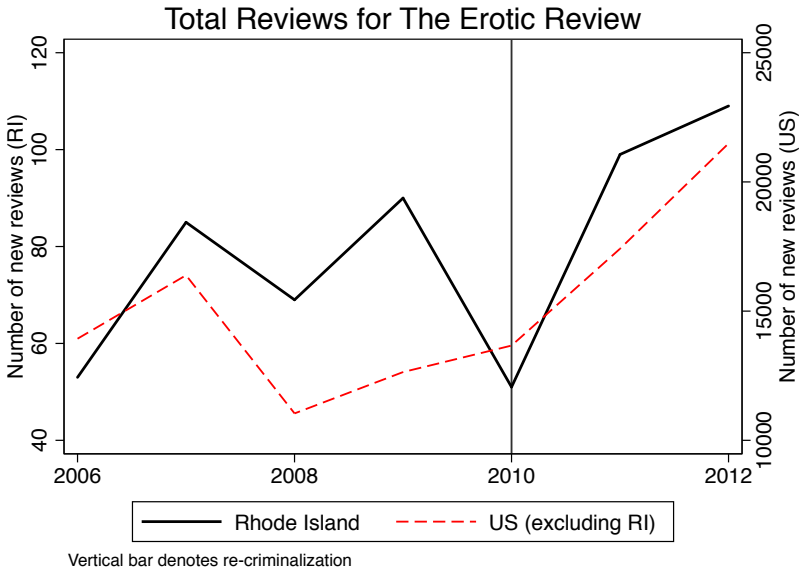


Figure 8 Total Erotic Review Data after Re-criminalization

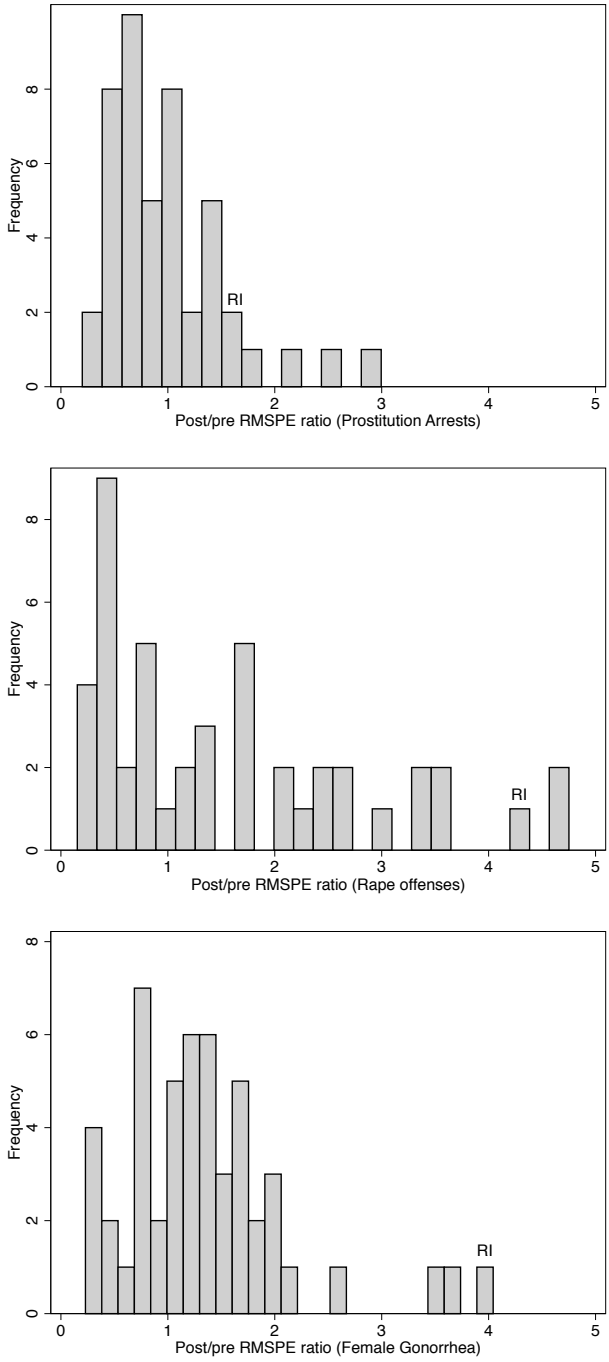


Figure 9 Ratio of post–decriminalization and pre-decriminalization RMSPE for arrests, rape, gonorrhea: Rhode Island and control states

Table 9 Actual Versus Synthetic Rhode Island Characteristics

Variable names	Prostitution Arrests model Rhode Island	 Synthetic Rhode Island
Prostitution arrests (1988 & 1989)	60.82	55.77
Prostitution arrests (1987)	78.48	76.51
Prostitution arrests (1992 & 1994 & 1995)	32.44	38.56
Prostitution arrests (1996)	52.21	47.28
Prostitution arrests (2001)	33.60	33.24
Prostitution arrests (2002 & 2003)	30.73	28.84
Prostitution arrests (2003)	25.55	29.34
Vehicle offenses (1992)	738.57	463.91
Vehicle offenses (2000)	441.21	412.30
Vehicle offenses (1996 & 1998 & 1999)	416.50	467.36
Vehicle offenses (2000 & 2003)	422.37	449.62
Assault offenses	1,134.39	1,320.35
Variable names	**Reported rape offenses model** **Rhode Island**	 **Synthetic Rhode Island**
Rape offenses (1979)	13.10	15.01
Rape offenses (1992(1)1995)	28.96	35.64
Rape offenses (1995)	27.20	32.88
Rape offenses (2001)	39.30	36.03
Rape offenses (2002)	38.15	37.92
Rape offenses (2001 & 2002)	38.73	36.97
Rape offenses (2002 & 2003)	40.05	38.41
Rape offenses (2003)	41.95	38.90
Variable names	**Ln female gonorrhea model** **Rhode Island**	 **Synthetic Rhode Island**
ln Female gonorrhea incidence (1991 & 1992 & 1994)	4.12	4.15
ln Female gonorrhea incidence (1995)	3.95	4.08
ln Female gonorrhea incidence (1996)	3.83	3.79
ln Female gonorrhea incidence (1997)	3.90	4.09
ln Female gonorrhea incidence (1998)	3.87	4.17
ln Female gonorrhea incidence (1999)	4.23	4.21
ln Female gonorrhea incidence (2000 & 2001)	4.37	4.35
ln Female gonorrhea incidence (2001 & 2002)	4.48	4.43
ln Female gonorrhea incidence (2002)	4.47	4.47

Table 10 Rhode Island Synthetic Control Weights

State name	Estimated weight
Prostitution arrests model	
Delaware	0.233
Minnesota	0.210
Nevada	0.117
New York	0.015
Oregon	0.426
Reported rape offenses model	
Idaho	0.342
New Hampshire	0.162
North Dakota	0.140
South Dakota	0.356
Ln female gonorrhea model	
Louisiana	0.582
Montana	0.234
Vermont	0.153
Wisconsin	0.031