Decriminalizing Prostitution:

Surprising Implications for Sexual Violence and Public Health*

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Abstract

Most governments in the world including the United States prohibit prostitution due to moral repugnance, though disease and victimization risks associated with sex markets are salient policy concerns. 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 prostitution in 2003 to provide the first causal estimates of the impact of decriminalization on the composition of the sex market, rape offenses, and population sexually transmitted infection outcomes. Not surprisingly, we find that decriminalization increased the size of the indoor market. However, somewhat unexpectedly, we find that decriminalization caused both forcible rape offenses and gonorrhea incidence to decline for the overall population. Our synthetic control model finds 824 fewer reported rape offenses and 1,035 fewer cases of female gonorrhea from 2004 to 2009. The combined benefits of six years of decriminalization are estimated to be approximately 200 million USD. Decriminalization appears to benefit the population at large, especially women—and not just sex workers.

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1 Introduction

In the last 15 years, the American prostitution market appears to have 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) which makes the commercial sex industry bigger than the NFL, NBA, and major league baseball combined. A 2004 poll reports that 30 percent of single men over the age of 30 have paid for sex in the US (Langer, Arnedt and Sussman, 2004).

Most governments in the world including the United States prohibit prostitution due to moral repugnance, though disease 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 22.9% of female prostitutes report they have ever had gonorrhea relative to 4.7% of non-prostitute females. Given the average prostitute sees 200-300 clients per year, and men have a 25% chance of catching gonorrhea from an infected partner and for women, the odds are as high as 66% per unprotected transaction (Groopman, 2012); the spread of disease from sex markets to the population at large is a significant public health concern. Sex market related violence is also common. One study finds that 68% of women engaged in street-level prostitution have been raped by clients and another reports that one third of all serial murder victims are prostitutes (Farley and Barkan, 1998*a*; Brewer et al., 2006).

The aim of this paper is to provide the first quasi-experimental estimates of the causal effect of decriminalizing indoor prostitution on the composition of the sex market (size, supply, and price), population sexually transmitted infection (STI) outcomes, and forcible female rape offenses by using an unanticipated legal interpretation of a longstanding state statute. We focus on rape and gonorrhea due to the high association each has with prostitution (Farley and Kelly, 2000; Ross et al., 2012). We estimate the causal impact of decriminalization by exploiting the fact that a Rhode Island (RI) District Court judge

effectively decriminalized indoor prostitution in 2003 (Arditi, 2009). This decision was unexpected and caused a significant and sustained *de facto* decriminalization of indoor prostitution. Neither the event nor its consequences have been widely understood or studied by researchers. Indoor prostitution was ultimately re-criminalized in 2009, but from 2003 to 2009, Rhode Island was the only state in the US with unbridled decriminalized indoor prostitution and prohibited street prostitution. And it is arguably the only government in history to change its prostitution policy in such a significant and unanticipated way.

We show that this judicial decision which resulted in decriminalization of the indoor sex market decreased prostitute arrests, increased indoor prostitution advertising, and expanded the size of the indoor prostitution market itself. We estimate the causal effect of decriminalization on per-capita rape offenses and gonorrhea incidence using differences-in-differences (DD) and synthetic control models and find robust evidence across all models that decriminalization caused rape and gonorrhea to dramatically decrease. Our synthetic control model finds 824 fewer reported rape offenses and 1,035 fewer cases of female gonorrhea from 2004 to 2009 as a result of decriminalization. The combined benefits of six years of decriminalization are estimated to be $200 million in 2010 USD.

Our knowledge of whether laws and regulation can reduce the potential costs associated with prostitution is poorly understood. 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; Wren, 1967; Dunlop, Lamb and King, 1971; Potterat, Rothenberg and Bross, 1979), rape and sexual assault (Farley and Barkan, 1998*b*; Church et al., 2001*a*). However, none of these studies provide causal estimates, and most are plagued by statistical problems due to scholars' over reliance on small, non-representative samples based on convenience sampling. In addition, despite the greater prevalence of indoor sex work, research has focused on street work (Lever et al. 2005). Given these types of laws rarely change and

are fairly uniform across regions, our knowledge about the impact of decriminalizing indoor sex work is largely conjectural. These factors make the added value of this study's contribution large.

Our contribution to this literature is twofold. First, as far as we know, we are the first social scientists to evaluate the decriminalization of prostitution using a natural experiment. This allows us to provide the first causal estimates on the impacts of decriminalization. It is important to note that the outcomes of interest are not only prostitution related—we are using *population* STI outcomes and 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. Secondly, police agencies, lawmakers, and prosecutors all over the US have responded to the growth on 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 away. This research can influence change in policies related to police effort of enforcement of laws against prostitution, particularly related to indoor sex work. Decriminalization of indoor prostitution has experienced the most political traction as an alternative to uniform criminalization.[1] Some regions where decriminalization policies have been debated and/or implemented besides the US include various Northern European countries, various Latin American countries, as well as Australia, Canada, New Zealand, Thailand, and South Africa (Platt, 2001; Kohm and Selwood, 2004; Jordan, 2005). This study has the potential to inform policy makers by providing the first credible causal evidence regarding the potential costs and benefits of decriminalizing indoor sex markets.

2 Conceptual Framework

In this section we provide some of the theoretical arguments for the expected impact of decriminalizing indoor prosecution. Decriminalization should expand the size of the

[1] Americans are not necessarily averse to decriminalization. For example, a 2004 ballot measure to ban brothels in one of Nevada's counties was defeated: 63 percent voted to retain legal prostitution in Churchill County. Support comes largely from the tax revenues that counties derive from the brothels. In the 1996 General Social Survey, 47 percent (52 percent of men, 43 percent of women) agreed that, "There is nothing inherently wrong with prostitution, so long as the health risks can be minimized. If consenting adults agree to exchange money for sex, that is their business" (Weitzer, 2007).

indoor sex market by reducing the costs of entry both for sex workers and firms (i.e massage parlors, brothels, etc.). Once the activity is decriminalized, sex workers do not have to worry about being arrested, harassed by police, etc. 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 by positively selecting stigma-sensitive sex workers and clients at the extensive margin (Guista, Tommaso and Strom, 2009). Therefore, we can predict an unambiguous increase in the size of the indoor sex market post-decriminalization.[2]

Therefore, decriminalization leads to an unambiguous increase in the number of women employed in indoor commercial sex work, and if indoor and outdoor sex workers are imperfect substitutes, a net increase in the number of women employed overall. Interestingly, decriminalization of indoor sex work has a theoretically ambiguous effect on both public violence and disease transmission.

2.1 Sexual Violence

Decriminalization will increase violence if violence is an increasing function of the number of women employed in the sex market, and if decriminalization increased the size of the 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, would cause violence against women to increase (Farley, 2005).

However, most of the evidence lends itself to hypotheses suggesting decreases in violence. For example, 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

[2]Unfortunately we do not have data on the 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. Therefore, it is unlikely that street workers are transitioning into the indoor market and we assert that 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 and Blevins, 2009).

violence (Brents and Hausbeck, 2005). Decriminalization may also reduce violence by increasing sex worker's willingness to cooperate with police and reducing opportunities for police corruption. Prostitutes commonly report a reluctance to contact the police when they are the victims of theft or violence. Church et al. (2001*a*) find that only 34% of prostitutes who were victims of violence by clients report it to the police. Levitt and Venkatesh (2007) find that a high prevalence of police offers 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).[3] It also implies that police can extract less rents from these women.

So far we have only considered hypotheses where sex workers might benefit from decriminalization. However, the next few hypotheses suggest potential benefits for the population at large. 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 to decrease (Draca, Machin and Witt, 2011). A final mechanism by which decriminalization could reduce male violence is if prostitution is a substitute for violence against women for some men (Posner, 1992). This theoretical possibility dates as far back as Catholic theologian and moral philosopher, Thomas Aquinas (Dever, 1996). The proposed hypothesis is that men on the margin of raping a woman vs. seeing a prostitute may substitute from rape to seeing a prostitute since it becomes cheaper and more easily available post-decriminalization.

[3]Philip Markoff, the so-called "Craigslist Killer", was charged with the armed robbery and murder of an alleged prostitute 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. While anecdotal, it supports the point that legalized sex work removes some of sex worker's unwillingness to cooperate with police.

2.2 Public Health

In terms of public health outcomes, theory also predicts that 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. Negative effects on STI epidemics 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. Gertler and Shah (2011) find that law enforcement efforts in Ecuador that shift prostitution transactions indoors and away from streets lower STI rates. Similarly, Jeal and Salisbury (2007) find that massage parlor sex workers in the UK use condoms more consistently, receive STI screens more recently, and report fewer weekly episodes of intercourse with fewer men than their street-based counterparts. Seib et al. (2009) and Seib, Fischer and Najman (2009) find higher gonorrhea incidence and more requests for sex without condoms among the illegal street workers than the licensed indoor sex workers in Queensland, Australia.

Given decriminalization of prostitution has the potential to exacerbate or ameliorate sexual violence and public health outcomes, we will investigate these issues empirically.

3 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 caused the *de facto* decriminalization of indoor sex work after 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 reducing street solicitation from a felony to a misdemeanor and deleting a reference to prostitution as a crime.[4] The amended statute's careful wording explicitly forbade street prostitution and street solicitation as well as pimping but by failing to identify non-street prostitution (e.g., massage parlor prostitution), the new law had created a legal technicality which no longer prohibited indoor sex work (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.[5] Surviving members of the 1980 legislature have said their intention was to reduce the time between arrest and penalties for street prostitutes, not decriminalize indoor prostitution (Arditi 2009).[6]

The *de facto* decriminalization of indoor prostitution became effective policy in 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"

[4]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). Therefore, 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).

[5]For example, Lexis Nexus searches show that the first time "decriminalization prostitution Rhode Island" occurs is 2005 in Breton (2005), two years after the 2003 judicial decision and 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 (e.g., pimping, streetwalking), no one thought to press the issue until the law was interpreted in 2003.

[6]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).

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). Breton (2005) describes that police were now powerless to crack down on prostitutes or their customers inside massage parlors.

4 Data

Our study uses six separate datasets: weekly classified advertisements from the "adult services" section and restaurant advertisements from *The Providence Phoenix*; data on prostitutes and their transactions from a popular website called The Erotic Review; prostitution arrests and criminal offenses (including rape) from the Uniform Crime Reports; gonorrhea cases from the Centers for Disease Control's Gonorrhea Surveillance Program, sexual behavior outcomes from the 1992 National Health and Social Life Survey (NHSLS), and state level covariates from the Current Population Survey (CPS).

The Providence Phoenix is a local weekly arts and adult entertainment publication. We collected information on every advertisement by week from the first week of January 2000 until the last week of December 2008. The "adult entertainment" section was used by the massage parlor establishments in Providence and surrounding areas for advertising. Shapiro (2009) notes that the *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 Providence-based restaurant advertisements. Summary statistics for these data are reported in Table 1. The mean number of weekly massage parlor advertisements increased from 6.18 to 12.5 after the 2003 decision. The control group, restaurant advertisements only saw an increase from 17.3 to 18.7 after the 2003 decision.

Though *Phoenix* advertisements measure advertising by prostitutes who use it, advertisements do not contain information on the number and types of indoor transactions. In addition, it omits the entire online sex market. To supplement, we harvest data from an online review site called The Erotic Review. The Erotic Review, a reputation website similar to Yelp.com, is one of the largest sex websites in the country and only covers indoor prostitutes. Customers use it primarily to provide feedback on transactions with

prostitutes in a particular area. We collect approximately 90,000 records from the The Erotic Review database from 1998 to 2008 from which we identified Rhode Island based prostitutes by using phone number area codes. We primarily use the data to focus on the number of indoor sex workers by state as well as the price and type of sex acts purchased. Summary statistics for the individuals used from these raw data are listed in Table 1. The mean number of Rhode Island indoor sex worker reviews increases twelve-fold post-decriminalization from 3.6 to 44.8, and the mean number of unique sex workers reviewed in Rhode Island increases from 2.6 to 37.4 post-decriminalization.

Prostitution arrest data is obtained from the Summary Uniform Crime Reports (UCR) Part II offenses database. This data measures the total number of prostitution arrests and allows us to determine whether the 2003 decision did in fact constrain police efforts. In addition, we collected information on reported female forcible rape *offenses*, as well as other Schedule I crimes from the Part I Summary UCR database for every state from 1960 to 2010. For the purposes of their data collection, the 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.[7] We do not use any of the newer National Incident Based Reporting System (NIBRS) crime data as Providence (the largest city in RI) did not adopt NIBRS until 2007.[8]

The 1992 National Health and Social Life Survey is one of the most comprehensive representative survey 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. As far as we know, it is the only data set in the United States that collects information on sexual coercion (rape), participation in prostitution markets, and STIs for each person.

Our measure of gonorrhea is from the Centers for Disease Control (CDC) Gonor-

[7]This definition goes all the way back to 1928. Interestingly, 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 analysis.

[8](`http://www.risp.ri.gov/docs/UCR/2012.pdf`, page 8)

rhea Surveillance program. State-level data is available from 1985 to 2010 and summary statistics based on these data are presented in Table 1. We use the gender specified aggregate STD data because in recent work, Colman, Dee and Joyce (2013) have noted that the CDC Surveillance Data has measurement error (i.e. many unknown cases) when working with race. 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 that its movements suggest a heterosexual vector, compared to syphilis which is almost exclusively concentrated among men-having-sex-with-men community (CDC 1997, 2010). In fact, Wren (1967) concludes that "there is no doubt that [prostitutes], as a group, must be the largest source of continual [gonorrhea] infection and reinfection in any community." In Table 11 in the Appendix, we show that prostitution is significantly correlated with gonorrhea and not chlamydia for both men and women using NHSLS data.

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 and HIV, which are almost entirely asymptomatic. Given how observable the gonorrhea symptoms are, most people except for highly active individuals (e.g. sex workers and their clients) 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. Over time, small differences in the STI's symptoms can cause an infection to become predominantly contained within particular sexual networks. 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.

Finally, we present state-level covariates from the Current Population Survey on demographics and economic factors in Table 1 as well. We use these variables as control variables in the regression analysis.

5 Empirical Framework and Results

5.1 Did Decriminalization Increase the Indoor Sex Market?

Before we can causally infer whether decriminalization exacerbated or improved public health outcomes, we must show that the 2003 decriminalization decision significantly changed indoor sex markets. For example, if prostitution arrests decrease post-decriminalization we might expect to see an increase in the size of the prostitution market. We would expect to observe increases in indoor prostitution advertising, increases in the supply of women participating and possibly changes in the types of services being provided since new women might be entering the market. We might also observe increases in client demand. In this section we test some of these hypotheses and provide broad support that we do observe a decrease in prostitution arrests, an increase in advertising and the number of providers, as well as a decrease in price (which is consistent with the supply increase) post-2003.

The key factor that resulted from decriminalization which may have had a large impact on observable prostitution activity was the effect of the decision on policing of massage parlors. Breton (2005) quotes local police officials who claim they were arresting employees of massage parlors for prostitution violations until the 2003 decision, at which point they stopped. In Figure 1, we present a plot of the 1996 to 2009 Rhode Island prostitution arrests series from the Summary UCR database. The figure shows that there is a steep decrease in arrests when decriminalization occurs in 2003 from 381 arrests per year to 275, and arrests continue to decline from then onward.

We also examine the effect of the 2003 decriminalization decision on arrests more formally using a differences-in-differences (DD) strategy. The model we estimate is:

$$A_{st} = \beta_1 RI_s + \beta_2 D_t + \beta_{3t} RI_s \cdot D_t + X_{st}\xi + \epsilon_{st}, \tag{1}$$

where A is the natural log of prostitution arrests in state s and year t; RI_s equals 1 if state s is Rhode Island, 0 otherwise; D_t is a vector of dummies for every post-2003 year; X_{st} is a vector of covariates that also includes state and time trends; and ϵ is an error

term.

Table 2 reports the results from this regression. Standard errors are clustered at the state level. The results indicate that immediately following decriminalization, there is a 28 percent decrease in arrests which corresponds to the raw data in the figure (381 to 275 arrests is a 28 percent decrease). This decline in arrests continues through 2009, at which time there is a 62 percent decline in arrests. The results suggest that the 2003 decision reduced the number of prostitution arrests.

We now empirically investigate the supply side response using both the newspaper and online data. In Figure 4, we present an index showing weekly advertisements in the "adult services" (top panel) section and local restaurants (bottom panel) of the *Providence Phoenix* newspaper.[9] 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 2003 decision corresponds immediately to an increase in the size of newspaper space advertisers purchased. This is illustrated in Figures 2 and 3 where the Spa Midori advertisement becomes much larger post-decriminalization. One week following the 2003 decision, incumbents purchasing of advertising space increases from 0.5 to almost 1.9. As the number of unique advertisers lagged the 2003 decision by several months, this suggests the immediate response to the 2003 decision was an increase in advertising space by incumbents in the indoor sex market. Within several months, the number of unique advertisements also increases suggesting new entrants into the market. By July 2004, the number of unique advertisers doubled, and by the middle of 2005, both series declined to an index value of 2.0, where each remained until 2007 before rising again. The majority of this growth occurred in Providence and neighboring cities such as Warwick.

In the bottom panel of Figure 4, we also report comparable indices for local restaurant advertising as a placebo. There is no noticeable effect visible from the series, but restaurant advertising appears more volatile. In Table 3, we present regression results from a simple DD linear panel model containing both the treatment group (adult services) and

[9]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.

control group (restaurant ads) from the *Phoenix*. Our specification is:

$$Y_{at} = \beta_1 A_a + \beta_2 D_t + \beta_{3t} A_a \cdot D_t + \delta_d + \epsilon_{at}, \tag{2}$$

where Y is the natural log of the number of unique advertisements (or the ad size) in each section (a) and week (t), A_a is a binary variable equalling 1 if it is the adult services section and 0 if it is the restaurant section, D_t is a vector of dummies for every post-2003 year and β_{3t} is the DD parameter estimate of interest. We also control for national calendar week fixed effects, δ_d.

Our DD regression results in Table 3 conform generally speaking to the simple visualized time series. The size of ads increases immediately by 100 percent. The number of unique weekly advertisers increased but not immediately after decriminalization. This delayed response may be due to the impact that decriminalization had on entry and the extensive margin of supply. New ads increased 15 percent in the first year after decriminalization, but they continue to increase. By 2007 new ads also increased by 100 percent. This differential response in the two data series is likely a reflection of the effect that decriminalization had on incumbents versus new entrants. Incumbents responded immediately by spending more on advertisements. Since decriminalization would have increased the return on capital, we would expect a delayed response as challengers acquired the necessary capital to enter.

Using the data we harvest from the online sex market, we also examine the effect of the 2003 decision on the number of indoor sex workers, massages, and prices that indoor sex worker charge using the following DD specification:

$$P_{irt} = \beta_1 RI_r + \beta_2 D_t + \beta_{3t} RI_r \cdot D_t + \gamma_3 X_{irt} + \epsilon_{irt}, \tag{3}$$

where P is the dependent variables in Tables 4 (ln number of indoor, massage provided, etc.) and 5 (ln price), for a provider i in region r and year t; RI_r is a dummy equal to 1 if region r is Rhode Island; D_t is a vector of dummies for every post-2003 year; X_{prt} includes individual-level and transaction-specific covariates as well as region, month, and

year fixed effects; and ϵ_{prt} is a provider-specific error term.

The first two columns of Table 4 present coefficient estimates from two separate DD models: ln number of new indoor reviews and whether a massage was provided. We find that the decriminalization was followed by a large increase in reviews and massage provision. By 2007, the number of indoor sex worker increased by 200 percent. Massage provision also increased. This is not surprising given that early awareness of the implication of the ruling was concentrated among the defendants, all of whom were massage parlor employees.

As the decision in 2003 appears to have been concentrated among knowledgeable individuals connected to the supply-side of the market (at least initially), we would expect a right-ward shift in supply to cause real prices to decrease. In Table 5, we present evidence supporting this hypothesis. We use four different specifications of the model with various covariates, but do not find substantial variation in our results. Real prices fall 20 percent in 2004 and 30 percent in 2005 relative to pre-treatment levels. Then, after 2005, the effect on real prices begins rising and by 2008, real prices are 7 percent below their pre-treatment levels. This has two potential explanations. First, large scale media coverage about decriminalization does not start until 2005 (Breton, 2005). It could be that the 2005 media coverage of the decision caused real prices to rise by increasing the demand for indoor sex work. An alternative explanation is that the 2003 decision caused an increase in supply and a decrease in price, but in the long run, firms entered and prices gradually increased to the minimum of average total cost, which given the drop in variable costs was 7 percent below pre-treatment levels.

5.2 Impact of Decriminalization on Sexual Violence and Public Health

As shown above, decriminalization increased the size of the indoor sex market in Rhode Island. However, the conceptual framework indicates that an increase in the sex market could either improve or exacerbate sexual violence and public health outcomes.

In the top panel of Figure 5, we plot female forcible per-capita rape offenses from the Uniform Crime Report for Rhode Island overlaid against the United States. There is a large decrease in rapes following decriminalization in 2003 but it is important to note

there is also a large increase in rapes from 1995 to 2003 which is not the case in the rest of the United States. In the bottom panels of Figure 5 and Figure 6 we plot other crimes (robbery, murder, assault, burglary, assault, and motor vehicle theft) in Rhode Island and the US. None of these other crimes exhibit similar declines post-2003.

In the top panel of Figure 9 we plot per-capita female gonorrhea incidence. Similar to the rape time series, there is a large reduction in gonorrhea incidence post-2003 for women. However, there is also a slight increase from 2000–2003 that we do not observe in the rest of the country. The changes in Rhode Island rapes and gonorrhea from 2000 to 2003 suggest possible idiosyncratic dynamics that might be unique to Rhode Island. We will address these issues through a variety of strategies which we explain below.

We first estimate the impact of decriminalizing indoor prostitution on per-capita rape offenses and gonorrhea incidence using the following DD model:

$$G_{st} = \beta_1 RI_s + \beta_2 D_t + \beta_3 RI_s \cdot D_t + \xi X_{st} + \epsilon_{st} \tag{4}$$

where G_{st} is per-capita rape offenses (or ln per-capita gonorrhea incidence) by state s and year t, RI_s is a dummy variable for RI, and D_t is a treatment dummy variable equal to one following the 2003 decriminalization. The DD coefficient, β_{3t}, estimates the relative change in per-capita rape offenses (or per-capita gonorrhea incidence) in Rhode Island following decriminalization compared with a composite aggregate of all other states in the sample. We also control for several canonical control variables in the STI regression, X_{st}, such as state population, demographics and economic conditions (Chesson and Pinkerton, 2000). In addition, X_{st}, includes controls for state fixed effects, year fixed effects, and state-specific trends. All regressions are clustered at the state level. Estimation results are presented in Panel A of Tables 6 and 7.

The DD strategy requires decriminalization to be uncorrelated with unobservable factors that also influence rape and STI dynamics in RI after 2003. The pre-treatment increasing rate of rape and gonorrhea leading up to decriminalization (see Figure 5 and 9) suggests possible heterogeneous dynamics in RI that may not be simply modeled with linear state trends. Therefore, we estimate some DD models with state quadratics, and

we also estimate synthetic control models to account for possible dynamic heterogeneity between groups in Section 5.4.

In addition, 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 treatment occurred in only one state. We implement the method described in Buchmueller, DiNardo and Valletta (2011) which they write is basically a variant of Fisher's permutation or randomization test (Fisher, 1935). To implement the procedure, we estimate equation 4 using OLS. Then we compare our estimate to 50 placebo estimates obtained by running 50 additional regressions in each case replacing RI with an indicator for one of the other 49 states or the District of Columbia. With 50 placebo estimates, achieving 10 percent significance 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 bottom (Buchmueller, DiNardo and Valletta, 2011). This is a very demanding statistical test which is also why we emphasize the 10 percent significance level. We report the results from this placebo based inference exercise in Panel B of Tables 6 and 7. We also graph these results in Figures 13 and 14 in the Appendix.

5.3 DD Results

Tables 6 and 7 present the DD coefficient of interest for the rape and gonorrhea regressions. Column 1 includes state linear trends and no controls, column 2 includes both state linear trends and controls, and column 3 adds state quadratic trends.[10] The top panels report results from standard DD estimation with standard errors clustered at the state level. The bottom panels report the results from placebo based inference. We list the 5th and 95th percentiles of the distribution of the placebo estimates. These tests are based on

[10]These regressions use a single post-2003 dummy to model the DD parameter unlike the previous DD regressions which include post-2003 years individually because we are interested in the net effect of decriminalization on public health and crime, unlike our earlier estimates of price, advertising and prostitution arrests in which we were interested in the dynamics of decriminalization on the sex markets themselves. However, we have estimated the rape and gonorrhea models using the dynamic interaction and the results are similar. Results are available upon request.

much more conservative and appropriate confidence intervals than those produced using the standard clustering alternative (Buchmueller, DiNardo and Valletta, 2011).

Regardless of the specification, all of the DD coefficients in Table 6 (Panel A) are negative and precise. Decriminalization results in a statistically significant decrease in rape offenses by approximately 19 rapes per-capita or 41 percent. While the results in Panel A are statistically significant at the 1 percent level, the more conservative estimates in Panel B range in statistical significance from the 5 to 10 percent level.

Table 7 presents DD coefficients for gonorrhea incidence. For females, decriminalization reduced gonorrhea incidence by 39 (column 1-2) to 45 (column 3) percent. All specifications are statistically significant at the 1 percent level in Panel, but for the more conservative placebo based results, statistical significance ranges from the 5 to 10 percent level.

In Figures 13 and 14 in the Appendix, we provide graphical illustrations (histograms) from the placebo based inference results in column 3. 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. In the figures, estimates that achieve 5 percent significance are identified by their position outside the span of the placebo histogram (rape). The impact on female gonorrhea is statistically significant at the 10 percent level.

5.4 Synthetic Control Model

The DD research design is only as correct as the selection of the control group units with comparable parallel trends. It is possible that our estimates may be biased due to the use of state units which do not resemble pre-treatment Rhode Island. Therefore, we implement the synthetic control approach which is a generalization of the DD framework (Abadie, Diamond and Hainmueller, 2010). However, unlike DD models, the synthetic control model uses a subset of units for controls for comparison (as opposed to all states). This method selects control states that exhibit the same pre-treatment dynamics as RI. If there is some concern that the DD results presented above are biased as control states may have different pre-treatment trends, then the synthetic control method addresses this

issue. In addition, synthetic control estimation allows us to test whether the post-2003 decline in rape and gonorrhea is simply due to spurious regression to the mean. Finally, the synthetic control model allows us to identify dynamic treatment effects.

Let Y_{st} be the outcome of interest (per-capita rape or gonorrhea) for unit s of $S+1$ state units at time t, and treatment group be $s = 1$. The synthetic control estimator models the effect of decriminalization at time T_0 on the treatment group using a linear combination of optimally chosen states as a synthetic control. For the post-decriminalization period, the synthetic control estimator measures the causal effect as $Y_{1t} - \sum_{s=2}^{S+1} w_s^* Y_{st}$ where w_s^* is a vector of optimally chosen weights. Matching variables, X_1 and X_0, are chosen as predictors of post intervention outcomes and must be unaffected by decriminalization. We describe the covariates used in both models in Table 8.

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 then calculate the RMSPE for the post-treatment period. 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 our Rhode Island results will be the rank order of Rhode Island in that distribution divided by the number of units (e.g., 51). This exercise 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.

5.4.1 Rape Synthetic Control Results

Our analysis of rape uses the same data from the DD models from the Uniform Crime Reports but we go back to 1960, since Abadie et al. (2010) show that if the number of

pre-intervention periods in the data is large, then matching on the pre-treatment measures helps control for the unobserved factors that affect the outcome of interest as well as control for any heterogeneity of unobserved and observed factors on the outcome of interest. To minimize the volatility in the series we smooth the rape series using the moving average of the current and previous year's level of rapes. We present the actual and synthetic characteristics from our model in Table 8. The states which make up synthetic Rhode Island are reported in Table 9. Our synthetic control is a weighted average of Iowa (0.156), Idaho (0.245), and South Dakota (0.599). In Figure 18 in the appendix, we plot the trends in per-capita rape for the states which make up synthetic RI. Interestingly, they all exhibit similar increases leading up to 2003, but only Rhode Island exhibits the large decrease post-2003.

The top panel in Figure 7 shows the synthetic Rhode Island trajectory before and after decriminalization compared to the actual outcome. The bottom panel of Figure 7 shows where our model fits the data well and at which points it does not. The gap between the dashed line and the solid line in the top panel is the gap between the synthetic control (dash) and Rhode Island (solid), which is the gap between Y_{1t} and $Y_{st}w^*_{st}$ for all $s = 2, ..., S + 1$. Evidence of a causal effect is reflected in an increase in the relative size of the gap post-decriminalization relative to pre decriminalization. The post/pre RMSP ratio for the Rhode Island rape model is 2.86.

Next we apply the synthetic control model to all 42 additional state-units for the placebo analysis.[11] Applying the placebo inference to each of the 42 other state units allows us to construct an empirical distribution of all state units' ratios of post/pre-RMSPE. We report the results from this analysis in Figure 8. We use this distribution to compute the empirical distribution of all possible state-level changes in the fit of our data post-decriminalization to calculate the probability that the Rhode Island ratio is due to chance.[12]

[11]There are not 51 state units because we generate a balanced panel of jurisdictions from 1960-2010. However, the results are almost identical if we use an unbalanced panel.

[12]We present visualizations of the placebo inference in Figures 15-17. Figure 15 displays the estimated effect for Rhode Island against all the other 41 placebo gaps. Figure 16 limits the placebo gaps to those state units with a pre-treatment RMSPE that is no more than twice that of RI's, and Figure 17 limits it to the units with a pre-treatment RMSPE no more than 1.5 times higher than RI. In each of these figures, it is clear that RI's estimated effect is both considerably larger than the placebo estimates as well

The state with the largest such ratio is Arkansas (7.4) and Rhode Island is second largest (2.86). This result implies that if one were to assign decriminalization at random in the data, the probability of obtaining a post/pre 2003 RMSPE ratio as large as Rhode Island's is 0.048 ($\frac{2}{42} = 0.048$).[13] The synthetic control model estimates 824 fewer rape offenses caused by decriminalization between 2004-2009.

5.4.2 Gonorrhea Synthetic Control Results

Our analysis of gonorrhea uses the same data from the DD models from the Center for Disease Control's Gonorrhea Surveillance Program for 1985 to 2009. We present results from our synthetic control model in Figure 10 and map the gap in prediction error in the bottom panel. We use log gonorrhea incidence to reduce the variability in the series and because gonorrhea is distributed log normal. The optimal state weights are presented in the bottom panel of Table 9.

We conduct the same placebo inference described above. Figure 11 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 that the probabilty chance could have produced these results is 0.0196. We estimate that decriminalization resulted in 1,035 fewer cases of female gonorrhea relative to the estimated counterfactual from 2004 to 2009.[14]

We have also estimated our synthetic control models for rape in natural log and gonorrhea in levels and the results are qualitatively similar. In the Appendix we report results from synthetic control models where the dependent variables are rape offenses and ln gonorrhea cases (see Figures 24-27, Tables 15-16). Interestingly the results are quite similar

as having one of the largest negative estimated effects in the placebo distribution.

[13] We plot the prediction gap in rape predictions for Arkansas (AR) and synthetic AR as a final check (see Figure 19 in appendix). Interestingly, AR shows a positive effect (unlike RI which is negative). AR fits the pre-treatment data much better as its series is less volatile compared to Rhode Island. The pre-2003 RMSPE is 2.3 compared to RI's which is 4.48. RI's worse fit is primarily caused by South Dakota, the state which has the largest weight for synthetic RI, because it experienced a large spike relative to its trend in the early 1990s (see Figure 18 in appendix). That penalty makes RI's pre-RMSPE larger. The post-RMSPE for RI is 12.85 and AR is 17.36.

[14] In Figures 20-22, we present graphs of Rhode Island's gap overlaid against all of the placebo gaps. As we did with rape, we drop state units with pre-treatment RMSPEs more than two times higher than RI (Figure 21) as well as 1.5 times higher (Figure 22). Again, we see that the estimated causal effects is strikingly large and negative when compared to the placebo distribution.

and Rhode Island again ranks number 2 for rape offenses and number 1 for log gonorrhea in the placebo inference.[15]

5.5 Comparing the DD and Synthetic Control Results

We use the cases averted for rape and gonorrhea from the synthetic control models to estimate percent decreases. The synthetic control model estimates a 31 percent decrease in per-capita rape offenses and a 39 percent decrease in per-capita female gonorrhea. The linear DD models estimate a 41 percent decrease in rapes and a 45 percent decrease in female gonorrhea due to decriminalization. The results are quite consistent across the two models, though the synthetic control model estimates are slightly more conservative. Therefore, we use the more conservative estimates when calculating the net benefits associated with decriminalization below.

6 Exploring the Pathways

While we would like to say something conclusive about the mechanisms post-decriminalization which lead to the observed decreases in rape offenses and gonorrhea incidence, we are careful to note that these pathways are merely suggestive. We are not claiming to have identified the causal channels which link the change in decriminalization to the behavioral outcomes of interest. Below we present several hypotheses which could explain the results and offer suggestions as to why some are more plausible than others as potential mechanisms.

[15]We also estimate DD and synthetic control models for male gonorrhea incidence. We find that decriminalization decreased male gonorrhea 35 percent (DD model presented in Table 12 in appendix) or by 982 cases (synthetic control model). However, the male model is more difficult to fit and the results are at most statistically significant at the 10 percent level once we run the placebo inference. Male impacts might be smaller and harder to detect due to biology. Male to female disease transmission rates in the absence of condoms are higher than female to male transmission rates for most sexually transmitted infections (Garnett and Bowden, 2000). For example, on an annual basis, without the use of antivirals or condoms, the transmission risk of HSV-2 from infected male to female is approximately 8-10% while transmission risk from infected female to male is approximately 4-5% (Kulhanjian, Soroush and Au, 1992). The same is true for chlamydia and gonorrhea: men are more effective transmitters of disease. Similarly, male to female transmission of HIV/AIDS is 1.9 times more effective than female to male transmission (European Study Group on Heterosexual Transmission of HIV, 1992).

6.1 Sexual Violence Pathways

We first consider several potential hypotheses that relate decriminalization to the falling rape offenses. We conclude with the hypotheses we believe to be most likely to be explaining the decrease in rape offenses.

First, it is possible that the ruling caused rapes to fall through an indirect effect involving inframarginal reallocation of police resources. If police stop arresting indoor sex workers (which we find), then these same police resources could be reallocated elsewhere in the agency including the policing of rape and other sex crimes. This reallocation could reduce rapes through either deterrence or the incapacitation of serial rapists. While we believe a police resource explanation is plausible, conversations with law enforcement officials suggest that it was unlikely in this particular case. In Rhode Island, the Office of Narcotics and Organized Crime had been the principal agency responsible for arrests of massage parlor employees, and this is not the same office of police officers who work rape and other sexual crimes. We also check police employment data in general to test whether there are any changes in overall employment post-decriminalization. Our data comes from the FBI's Uniform Crime Report Law Enforcement Officers Killed or Assaulted (LEOKA) dataset. We create a balanced panel of jurisdictions (ORIs) which report police records and associated ORI population annually from 1962 to 2005. Figure 12 plots this data for Rhode Island and the rest of the US, and we do not find any changes in police employment post-2003.[16]

Second, we investigate whether changes in data definitions or data collection over this period could explain the findings, and fail to find evidence for this. Our rape models are estimated using a balanced panel of data from each jurisdiction in Rhode Island.[17] We re-estimate the models using the unbalanced panel and the results do not change. In addition, we re-estimate the rape models using the FBI's online UCR Summary files (downloaded from `http://www.ucrdatatool.gov/Search/Crime/State/StatebyState.cfm`) as opposed to the raw FBI data obtained from McCrary and the results do not change.

[16]We also estimate DD models of police employment and do not find any significant evidence that decriminalization impacts police employment in RI.

[17]The authors wish to thank Justin McCrary for providing us with ORI specific LEOKA and UCR data.

Therefore, we do not find any evidence that ORI attrition is responsible for the sizeable declines in reported rapes in Rhode Island following decriminalization in 2003.[18] 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 are accurate and definitions did not change during our study period. We also inquired about personnel changes around this time 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 since numerous Rhode Island jurisdictions adopted NIBRS. 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, examination of ORI-level rape levels in the UCR Summary files show that Providence experienced the largest reduction of any ORI from 2003 to 2004, and since Providence did not adopt NIBRS until 2007, the NIBRS theory cannot explain the decline that occurred in Providence.

One possible threat to our research design is unobserved shocks that may have altered the reporting of all criminal statistics, including secular changes in crime itself, in Rhode Island after 2003. To examine this we estimate difference-in-difference-in-differences (DDD) models in which non-rape crimes are used to model within-state unobservable changes in crime. Insofar as decriminalization of indoor sex work affected rape only, then the DDD model allows us to isolate the effect net of secular changes in crime and the reporting of crime in Rhode Island after 2003. The DDD results do not change from what is reported in the DD results.

Thirdly, decriminalization could reduce rapes among prostitutes by improving the bargaining position of female sex workers relative to clients. Recent work in economics has shown that changes in female bargaining threat points has the potential to reduce

[18] Alternative regression analysis available upon request.

violence against women (Aizer, 2010; Stevenson and Wolfers, 2006). 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*b*; Farley and Barkan, 1998*a*). 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. Hence, even if decriminalization did reduce actual rapes among sex workers, it would not have reduced reported rapes by too much since pre-treatment reporting was 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. While speculative, there is anecdotal evidence for this. 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 that she believes the men she services would have raped other women had they not come to see her.

We examine the association between prostitution and rape for males and females more formally using the 1992 NHSLS data. Female respondents were asked if they have ever been the victim of sexual assault and whether they have ever exchanged sex for money. Males were asked if they have ever forced a female to have sex and whether they have ever purchased sex with money. We estimate the same linear probability model separately for males and females by regressing prostitution on rape controlling for age, age-squared, maternal education, own-education, marital status, household structure in adolescence, race, age of sexual debut, family size, birth order, and Census divisional fixed effects both at the survey and at age 14.

The results are presented in Table 10. We find a weakly positive ($p<.10$) correlation between rape victimization and prostitution experience for females. Female victims of rapes are 2.5 percentage points more likely to report prostitution experience (17 percent increase). Interestingly, we find a large and statistically significant positive correlation

for men who admit forcing a female to have sex and being a customer of transactional sex. Men admitting to rape are 18 percentage points more likely to have ever visited a prostitute. This is about a 6 percent increase over the mean and the result is statistically significant at the .05 level.

While we cannot provide definitive evidence on the exact mechanism of the decrease in rapes, it appears likely that some of the decrease is due to men substituting away from rape toward prostitution. In addition, there might be a decrease in prostitutes being raped, but this is likely to be a small effect.

6.2 Public Health Pathways

In this section we provide suggestive evidence about why decriminalization 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. Post-decriminalization we observe significant entry of White and Asian workers, and these races have the lowest gonorrhea prevalence. Therefore, post-decriminalization men are more likely to match with a safe (i.e. gonorrhea free) sex worker which could result in overall reductions in gonorrhea incidence.

First, columns 1-2 of Table 4 suggests the supply of indoor sex workers increases 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 tend to 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 13 in the appendix we show the increase in indoor sex workers by racial category. The large increases are coming from White and Asian women (see columns 1-2). In fact, Asian providers increase the most and Asians also have the lowest rates of gonorrhea incidence. Table 14 shows the mean rates of female gonorrhea in Rhode Island from 1985-2009. Asian women have .327 cases of gonorrhea, white women 12.66 cases, whereas Hispanic and Black women have 4.66 and 11.86 cases, respectively. Therefore, it

is clear that more White and Asian women entering the market results in an overall lower risk pool.

In addition, Table 4 (columns 3-6) shows the estimates from DD models using the Total Erotic Review data on four sex act outcomes associated with risk behaviors: fellatio with and without a condom, vaginal sex and anal sex.[19] We find that higher risk sex acts, such as oral sex without a condom and anal sex, decreased substantially following decriminalization and that oral sex with a condom increased. Therefore, risky sex amongst indoor transactions declined following the decriminalization. This is consistent with other empirical evidence showing that prostitutes 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). In addition, evidence from Nevada suggests that employees report that they feel safe, are free to come and go, and are bound only by their contract in legal brothels. Of the workers, 84 percent said that their job felt safe. Workers report that they felt safe largely because the police, employers and co-workers were there to protect them (Brents, Jackson and Hausbeck, 2009). Conditions like these also promote safe sex as workers feel more empowered to reject risky sexual propositions.

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 prostitutes. The prediction is that we should observe an overall decrease in gonorrhea– which we do. In the appendix (Table 12) we also show that male gonorrhea decreases as a result of decriminalization, though the standard errors increase for the placebo inference exercises. Interestingly, Gertler and Shah (2011) find that increasing enforcement by one standard deviation per month in the street prostitution market in Ecuador 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 (i.e. decreases the supply) and increases transaction prices (which decreases transactions in the more risky

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

street market).

7 Estimated Net Benefits of Decriminalization

In this section we attempt to quantify the benefits from decriminalization's effect on rape and gonorrhea incidence. Various studies have attempted to quantify the cost of rape. We use McCollister, French and Fang (2010) estimate which includes tangible costs such as lost productivity for the perpetrator as well as short-term medical expenses, lost earnings, and property damage/loss for the victim and intangible costs which includes indirect losses suffered by victims such as pain, suffering, decreased quality of life, and psychological distress. Adding up all these costs, McCollister, French and Fang (2010) estimate tangible costs at $41,252 and intangible costs at $199,642 for a total of $240,776 per rape offense.

We estimate the cost per case of treating gonorrhea at $303 for females (F) (Chesson et al. 2006). This provides an underestimate of the cost of STIs since we are not examining changes in HIV/AIDS or male gonorrhea. The total social costs (or benefits) related to decriminalization we will estimate equals:

$$\Delta Rapes \times \$240,776 + F[\Delta Gonorrhea \times \$303] \tag{5}$$

The synthetic control model, which is our most conservative estimates, finds that decriminalization resulted in 824 fewer rapes and 1,035 fewer female gonorrhea cases from 2004 to 2009. Using Equation 5, we find that the reduction in social costs from reduced rapes is $198,399,424 and $313,605 from reduced gonorrhea incidence. The combined benefits from decriminalized indoor sex work is $198,713,029.[20]

In one of the most comprehensive studies conducted on the financial costs of policing prostitution, Pearl (1987) estimates the costs of enforcing uniform criminalization of prostitution in 16 US cities is $240 million (in 2010 USD). Including the opportunity costs of police time pushes this estimate even higher since 90% of police man-hours devoted to

[20]As a comparison, Cohen (2004) using contingent valuation method estimate the cost of rape as $286,277 per rape. Using this estimate implies that the benefits associated with decriminalization of sex work are $236,205,853.

enforcing prostitution laws are "spent at the precinct station, in court, in hotel rooms, bars, or massage parlors" (Pearl, 1987). Our estimate of the size of net gains from decriminalization over a six year period for only Rhode Island is similar in magnitude to Pearl's 1987 cost estimates of 16 US cities in one year. It is also important to note that our estimate is a conservative estimate since it excludes the benefits from potential HIV cases averted since HIV transmission is more efficient when an individual has another STI (Laga, 1995) as well as reductions in male gonorrhea and other STIs. In addition, our estimate does not include the opportunity cost estimate of criminal justice resources, which Pearl (1987) shows is significant. And finally, since it is believed that a considerable portion of total rape offenses go unreported, if decriminalization reduced both reported and unreported rapes, this is likely a lower bound estimate of the gains.[21]

8 Conclusion

This study provides the first causal estimate of the impact of decriminalization on sexual violence and public health outcomes. The results suggest that decriminalization could have potentially large social benefits for the population at large—not just sex market participants. In addition, the results from both empirical models (DD and synthetic control) are quite consistent speaking to the strength of the results.

Decriminalization reduces sexual violence by 824 fewer reported rapes. We provide suggestive evidence that the decline in rapes is likely due to men substituting away from violent sexual behavior toward prostitution since decriminalization increases the supply of sex workers and decreases prices.

Decriminalization also improves public health outcomes by decreasing female (and male) gonorrhea incidence by approximately 2000 cases. As the presence of comorbid STIs such as gonorrhea, can increase the likelihood of HIV transmission, finding a reduction in gonorrhea is likely understating the gains to public health. The decline in

[21] We merely estimate the associated benefits from our results because it is difficult to get a sense of costs associated with decriminalization. For example, prostitution is morally repugnant for some individuals so legalizing the indoor market may impose moral costs that are difficult to quantify. Others have argued that decriminalization may increase human trafficking (Cho, Dreher and Neumayer, 2011). However, good data on numbers trafficked is extremely difficult to uncover given the clandestine nature of this market.

gonorrhea is consistent with several hypotheses. First, we provide evidence that suggests the sexual network within which prostitution transactions occurred became less risky post-decriminalization. However, we should note that we are unable to disentangle whether the decline was caused by increased condom use and decreased risky sex acts in the massage parlors, or by some more nuanced change in the sex network brought upon by decriminalization that in turn made STI transmission less efficient overall.

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Table 1 Summary Statistics

Dependent Variables	**Mean**	**Std. Error**	*N*
Prostitution Arrests	4733.5	168.5	1,166
Number of weekly massage parlor advertisements	9.59	0.2	458
Number of weekly restaurant advertisements	18.71	0.31	469
Size of weekly massage parlor advertisements	1.16	0.03	458
Size of weekly restaurant advertisements	2.57	0.07	469
Annual number of new indoor sex workers by city	440.9	28.8	428
Massage provider	0.13	0.001	85,905
Fellatio (no condom)	36	0.001	85,905
Fellatio (condom)	0.47	0.002	85,905
Vaginal Sex	0.838	0.001	85,905
Anal Sex	0.115	0.001	85,905
Real price	$275.19	1.1	85,709
Hourly adjusted price	$317.12	1.5	85,709
Asian provider	0.156	0.001	85,984
White provider	0.506	0.002	85,984
Hispanic provider	0.153	0.001	85,984
Black provider	0.107	0.001	85,984
Reported rapes of females per capita	32.8	.035	1,179
Female gonorrhea incidence per capita	9,019.6	206.9	1,203
Male gonorrhea incidence per capita	10,727	332.75	1,203
Other Control Variables	**Mean**	**Std. Error**	*N*
Average length of session (minutes)	59.94	0.119	85,709
Burglary per capita	898.4	11.411	1,179
Robbery per capita	179.6	3.125	1,179
Assault per capita	1,212	13.33	1,179
Murder per capita	6.73	0.111	1,179
Vehicle theft per capita	466.5	6.864	1,179
State unemployment rate	6.13	0.051	1,203
Share of households in poverty	13.65	0.0001	1,203
Share employed by military	0.003	0	1,203
Share of state population white	81.99	0.258	1,203
Share of state population black	12.8	0.245	1,203
White sex ratio 0-14	105.5	0.241	1,203
White sex ratio 15-24	103.4	0.307	1,203
White sex ratio 25-39	101.9	0.201	1,203
Share of households below poverty line	13.45	0.094	1,203
Share of population 15-24	14.25	0.037	1,203
Male share of male population single	47.02	0.084	1,203
Female share of female population single	40.17	0.08	1,203
Male share of male population married	42.7	0.084	1,203
Female share of female population married	40.8	0.078	1,203
State female population	6,133,011	138,043	1,203
State male population	5,931,449	137,022	1,203
Total state population	12,020,871	267,479	1,203

Table 2 Did Decriminalization Decrease Prostitution Arrests?

Outcome:	**Ln(Prostitution arrests)**	
Rhode Island × 2004	-0.208*	-0.301*
	(0.114)	(0.162)
Rhode Island × 2005	-0.151	-0.205
	(0.108)	(0.179)
Rhode Island × 2006	-0.045	-0.115
	(0.101)	(0.156)
Rhode Island × 2007	-0.281**	-0.370
	(0.123)	(0.227)
Rhode Island × 2008	0.016	-0.087
	(0.146)	(0.247)
Rhode Island × 2009	-0.690***	-0.979***
	(0.148)	(0.263)
State fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
State linear trends	Yes	Yes
Time variant controls	No	Yes
N	1,166	1,166
Mean of dependent variable	8.26	8.26

These are OLS regressions using Uniform Crime Reports Data 1985-2009. Regression controls include state population by gender, unemployment rates, white sex ratios, share of white, black, young, married, single, employed by military, and share of households below poverty line. State population is used as analytical weights. Results are clustered at the state level. * p<0.10, ** p<0.05, *** p<0.01

Table 3 Impact of Decriminalization on Number and Size of Advertisements

Dependent Variable:	**Ln(Number of ads)**	**Ln(Aggregate ad size)**
Adult × 2004	0.154***	1.103***
	(0.046)	(0.075)
Adult × 2005	0.514***	1.135***
	(0.048)	(0.081)
Adult × 2006	0.812***	1.085***
	(0.053)	(0.082)
Adult × 2007	0.958***	1.023***
	(0.046)	(0.082)
Adult × 2008	1.376***	1.458***
	(0.055)	(0.086)
Calendar week fixed effects	Yes	Yes
Adult classified fixed effect	Yes	Yes
N	926	926
Mean of dependent variable	2.52	0.38

These are OLS regressions using data from *The Providence Phoenix* adult classifieds, 2000-2008. Heteroskedastic robust standard errors are shown in parenthesis. * p<0.10, ** p<0.05, *** p<0.01

Table 4 Impact of Decriminalization on Supply Side of Market

Dep var:	**Indoor**	**Massage**	**Fellatio Condom**	**Fellatio No condom**	**Vaginal sex**	**Anal sex**
RI × 2004	0.309**	0.085***	0.229***	-0.049**	0.227***	-0.063***
	(0.124)	(0.010)	(0.024)	(0.019)	(0.014)	(0.009)
RI × 2005	0.333***	0.158***	0.302***	-0.247***	0.136***	-0.166***
	(0.104)	(0.009)	(0.020)	(0.021)	(0.016)	(0.008)
RI × 2006	1.051***	0.139***	0.041**	-0.083***	-0.028***	-0.193***
	(0.113)	(0.008)	(0.017)	(0.018)	(0.008)	(0.009)
RI × 2007	1.240***	0.077***	0.049***	-0.061***	-0.009	-0.168***
	(0.136)	(0.008)	(0.016)	(0.016)	(0.007)	(0.009)
RI × 2008	1.330***	0.004	-0.016	-0.044***	-0.028***	-0.168***
	(0.144)	(0.009)	(0.019)	(0.016)	(0.007)	(0.010)
Year and City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Month fixed effects	No	Yes	Yes	Yes	Yes	Yes
Year × Month fixed effects	No	Yes	Yes	Yes	Yes	Yes
City × Month fixed effects	No	Yes	Yes	Yes	Yes	Yes
N	428	85,905	85,905	85,905	85,905	85,905
Mean of dependent variable	5.04	0.13	0.47	0.36	0.84	0.12

These are OLS regressions using The Erotic Review data, 1999–2008. This data is record specific, meaning we have information on individual prostitute reviews. Columns 2-6 use the disaggregated data, and in Column 1 we aggregate reviews to the city/year level creating a variable of review counts. Columns 2-6 also include controls for session length, employment status, and size of reputation site. Standard errors are heteroskedastic robust and clustered at the city level. * p<0.10, ** p<0.05, *** p<0.01

Table 5 Did Decriminalization Affect Transaction Price?

Dependent variable:	**ln(Price)**			
RI × 2004	-0.411***	-0.403***	-0.247***	-0.230***
	(0.043)	(0.039)	(0.027)	(0.019)
RI × 2005	-0.588***	-0.565***	-0.376***	-0.360***
	(0.031)	(0.027)	(0.020)	(0.020)
RI × 2006	-0.444***	-0.339***	-0.216***	-0.220***
	(0.045)	(0.039)	(0.026)	(0.026)
RI × 2007	-0.372***	-0.178***	-0.110***	-0.112***
	(0.049)	(0.043)	(0.032)	(0.030)
RI × 2008	-0.238***	-0.071*	-0.067**	-0.074**
	(0.049)	(0.042)	(0.033)	(0.033)
Size of reputation site	-0.001*	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.000)	(0.000)
Ln(Minutes)		0.642***	0.609***	0.605***
		(0.024)	(0.022)	(0.020)
Provided massage to client			-0.576***	-0.599***
			(0.039)	(0.038)
Escort			-0.079**	-0.065
			(0.034)	(0.042)
Self-employed			-0.012	-0.010
			(0.021)	(0.020)
Vaginal sex				-0.008
				(0.031)
Anal sex				-0.029***
				(0.011)
Fellatio with condom				-0.079***
				(0.025)
Fellatio without condom				-0.018
				(0.021)
Year, Month, and City fixed effects	Yes	Yes	Yes	Yes
Year×Month fixed effects	Yes	Yes	Yes	Yes
City×Month fixed effects	Yes	Yes	Yes	Yes
N	85,709	85,709	85,709	85,709
Mean of dependent variable	5.50	5.50	5.50	5.50

These are OLS regressions using The Erotic Review data, 1999–2008. The dependent variable in each model is the log of inflation adjusted gross price paid by the client for a completed session. Standard errors are heteroskedastic robust and clustered at the city level. * p<0.10, ** p<0.05, *** p<0.01

Table 6 Does Decriminalization Impact Rape Offenses?

Dependent variable:	**Rape offenses (per-capita)**		
Panel A: Clustered Standard Errors			
RI effect post-decriminalization	-17.30***	-16.91***	-19.01***
	(0.717)	(0.920)	(1.315)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-17.30*	-16.91*	-19.01**
5th percentile	-11.36	-10.31	-5.64
95th percentile	13.59	13.42	7.64
N	1179	1179	1179
State and year fixed effects	Yes	Yes	Yes
State linear trends	Yes	Yes	Yes
Time variant controls	No	Yes	Yes
State quadratic trends	No	No	Yes

These are OLS regressions using UCR data, 1985-2009. State population is used as analytical weights. Time-variant controls include state population by gender, unemployment rates, white sex ratios, share of white, black, young, married, single, employed by military, and share of households below the poverty line. Panel A presents clustered standard errors and Panel B presents 5th and 95th percentile confidence intervals from placebo-based inferential calculations. * p<0.10, ** p<0.05, *** p<0.01

Table 7 Does Decriminalization Impact Public Health Outcomes?

Dependent variable:	**Ln(Female gonorrhea per-capita)**		
Panel A: Clustered Standard Errors			
RI effect post-decriminalization	-0.426***	-0.50***	-0.606***
	(0.078)	(0.076)	(0.066)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-0.426*	-0.50**	-0.606*
5th percentile	-0.346	-0.346	-0.437
95th percentile	1.154	0.971	0.345
N	1203	1203	1203
State and year fixed effects	Yes	Yes	Yes
State linear trends	Yes	Yes	Yes
Time variant controls	No	Yes	Yes
State quadratic trends	No	No	Yes

These are OLS regressions using CDC Gonorrhea Surveillance Program Data, 1985-2009. State population is used as analytical weights. Time-variant controls include state population by gender, unemployment rates, white sex ratios, share of white, black, young, married, single, employed by military, and share of households below the poverty line. Panel A presents clustered standard errors and Panel B presents 5th and 95th percentile confidence intervals from placebo-based inferential calculations. * p<0.10, ** p<0.05, *** p<0.01

Table 8 Actual Versus Synthetic Rhode Island Characteristics

Variable names	Reported per-capita rape model Rhode Island	 Synthetic Rhode Island
Rape per-capita (1979)	12.36	13.45
Rape per-capita (1992)	31.19	35.69
Rape per-capita (1995)	26.26	31.86
Rape per-capita (2001)	38.86	34.53
Rape per-capita (2002)	37.46	37.45
Rape per-capita (2001 & 2002)	38.16	35.99
Rape per-capita (2002 & 2003)	39.10	38.82
Rape per-capita (2003)	40.74	40.20
Population	910,550.4	1,072,008
Variable names	**Ln female per-capita gonorrhea model Rhode Island**	** Synthetic Rhode Island**
Ln Female gonorrhea per-capita (1991 & 1992 & 1993 & 1994)	3.44	3.45
Ln Female gonorrhea per-capita (1995)	3.25	3.47
Ln Female gonorrhea per-capita (1996)	3.26	3.29
Ln Female gonorrhea per-capita (1997)	3.24	3.31
Ln Female gonorrhea per-capita (1998)	3.27	3.51
Ln Female gonorrhea per-capita (1999)	3.45	3.54
Ln Female gonorrhea per-capita (2000 & 2001)	3.64	3.65
Ln Female gonorrhea per-capita (2001 & 2002)	3.76	3.75
Ln Female gonorrhea per-capita (2002)	3.81	3.79

Table 9 Rhode Island Synthetic Control Weights

State name	Estimated weight
Reported rape rate model	
Idaho	0.245
Iowa	0.156
South Dakota	0.599
Log female gonorrhea rate model	
Louisiana	0.588
Montana	0.254
Vermont	0.158

Table 10 Are Prostitution and Rape Correlated?

Dep var: Prostitution	**Females**	**Males**
Female sexual assault victim	0.025*	
	(0.015)	
Admitted rape		0.177**
		(0.081)
R-squared	0.071	0.147
N	1,504	1,085
Mean of dependent variable	0.03	0.16

These are OLS regressions using the NHSLS 1992 data where the dependent variable in each model equals 1 if the person has ever had engaged in compensation for sex. Heteroskedastic robust standard errors in parenthesis. All models use household size sampling weights as analytical weights and include controls for age, age-squared, maternal education, own-education, marital status, household structure in adolescence, race, age of sexual debut, family size, birth order, and Census divisional fixed effects both at the survey and at age 14. * p<0.10, ** p<0.05, *** p<0.01

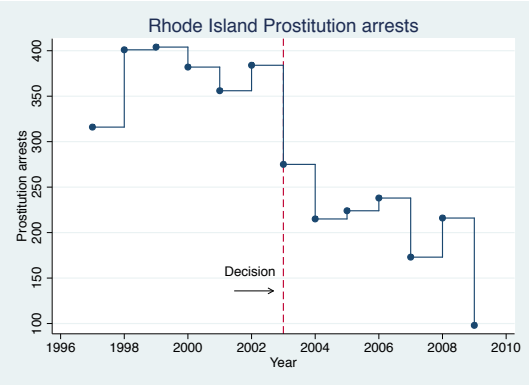

Figure 1 Rhode Island prostitution arrests

Figure 2 *Providence Phoenix* Advertising (Before)

Figure 3 *Providence Phoenix* Advertising (After)

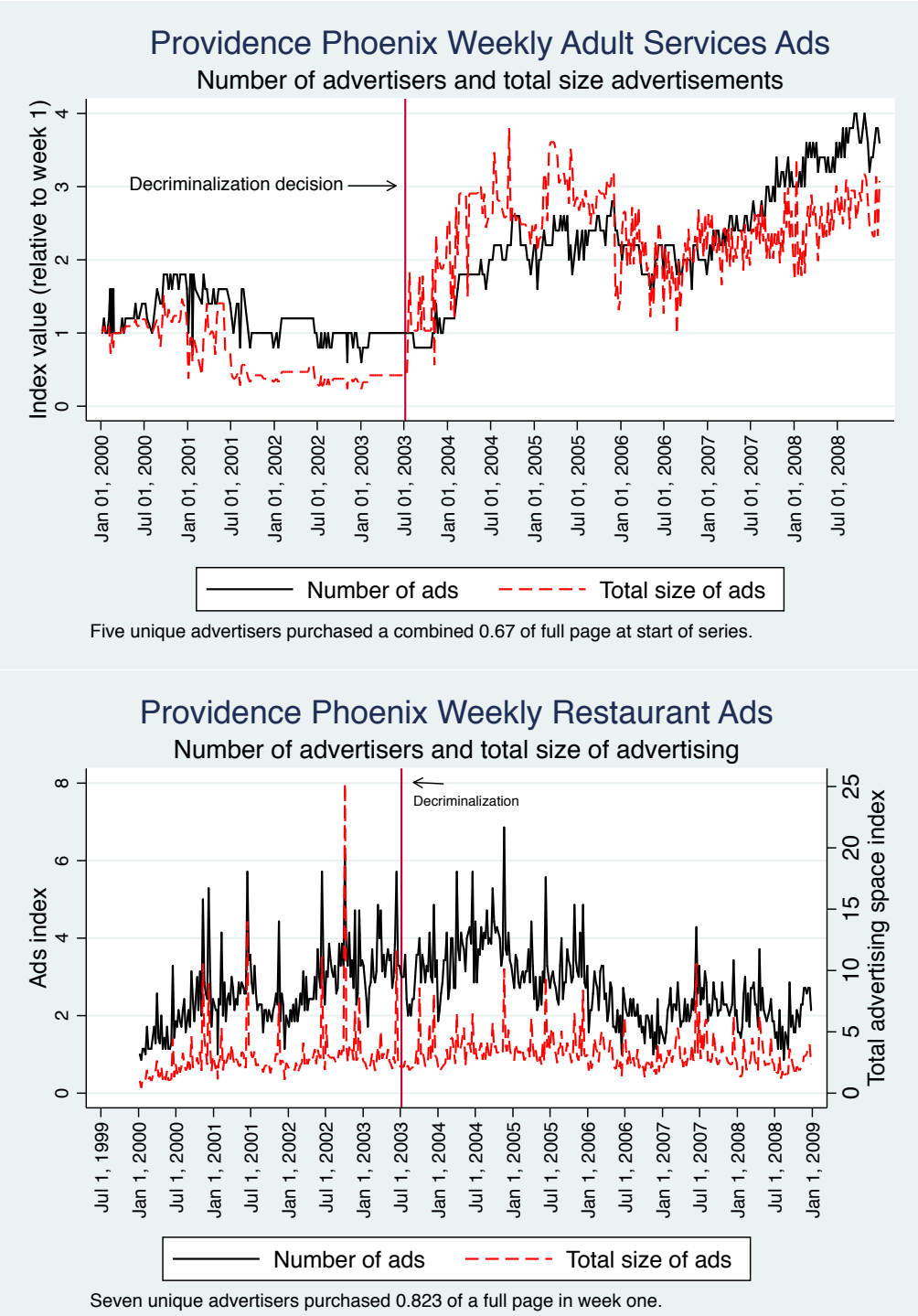

Figure 4 The number of unique advertisers and the cumulative size of total advertisements per week published in the *Providence Phoenix* alternative weekly newspaper from January 1, 2000 to December 31, 2008. Top panel restricts the sample to the "adult services/spa" section of the newspaper, and the bottom panel restricts the sample to the "restaurants" section. Each data series has been transformed into an index by dividing every observation by the initial value in week one.

Figure 5 Rape, Robbery, and Murder (per-capita), Rhode Island and the US

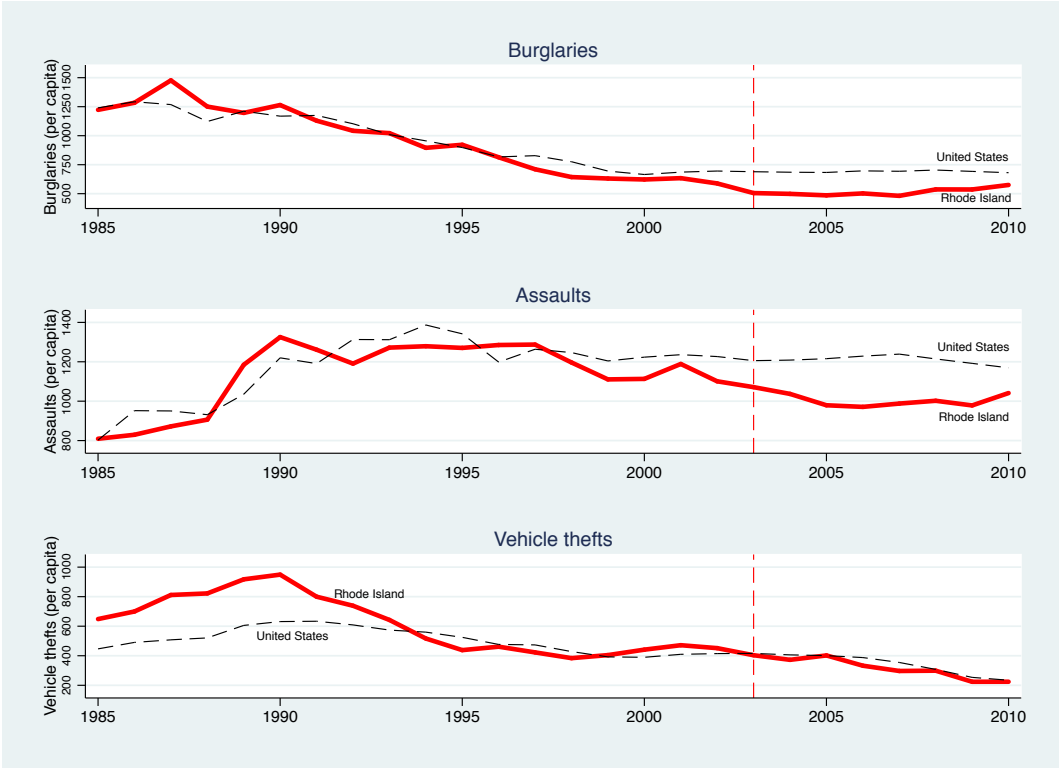

Figure 6 Other Crimes (per-capita), Rhode Island and the US

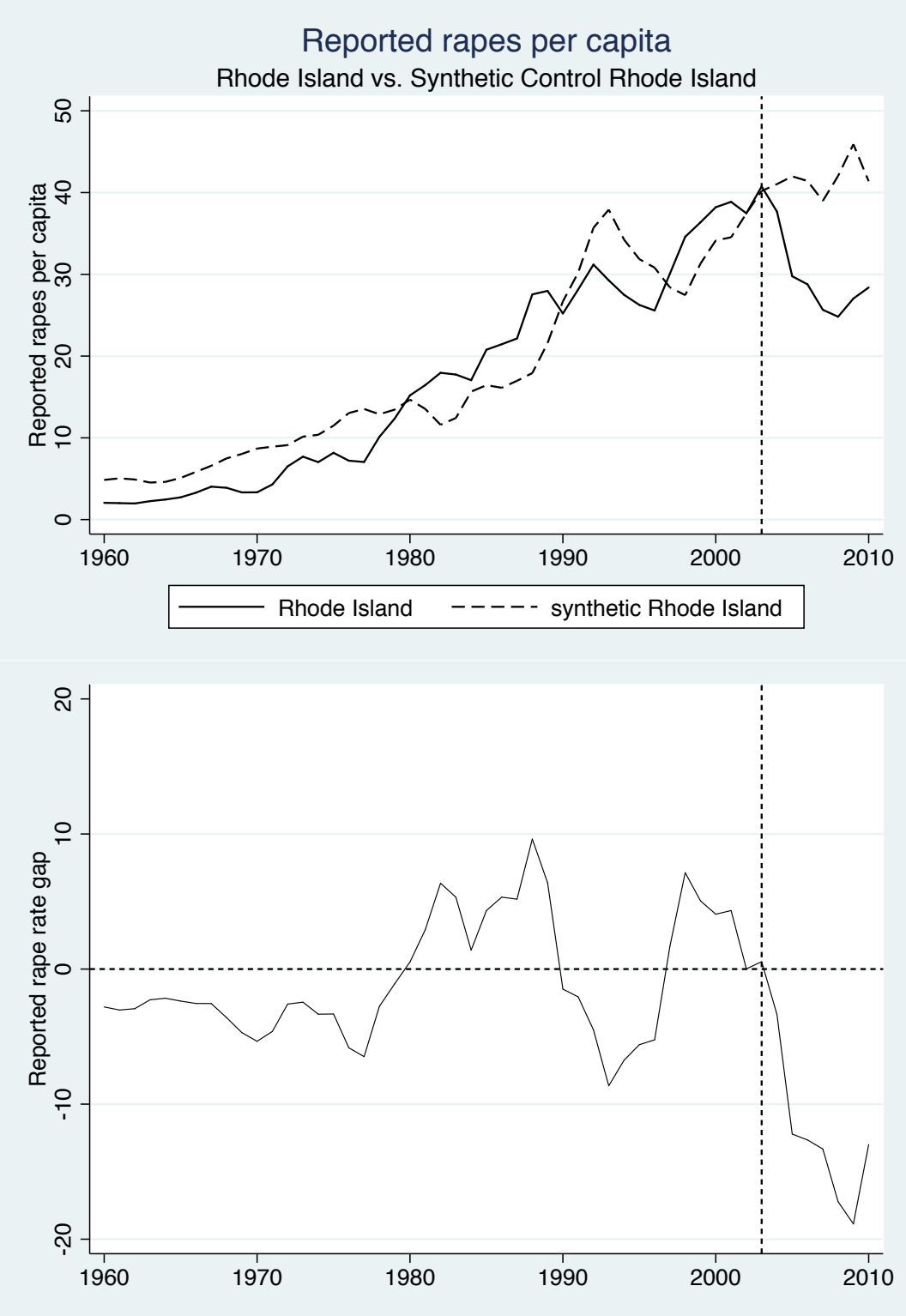

Figure 7 Top panel: Trends in per-capita rape: RI and synthetic RI
Bottom panel: Per-capita rape gap between RI and synthetic RI

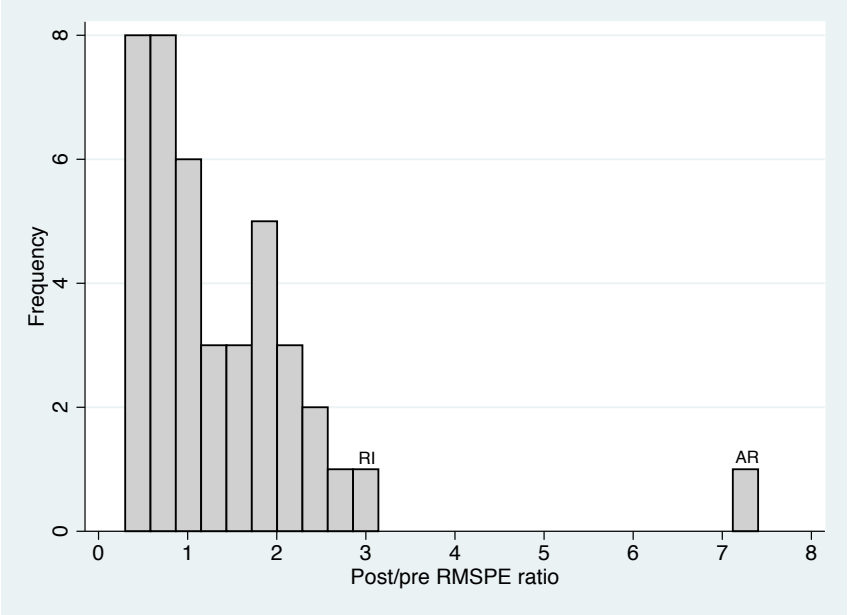

Figure 8 Ratio of post-decriminalization and pre-decriminalization RMSPE for per-capita rape: Rhode Island and 41 control states

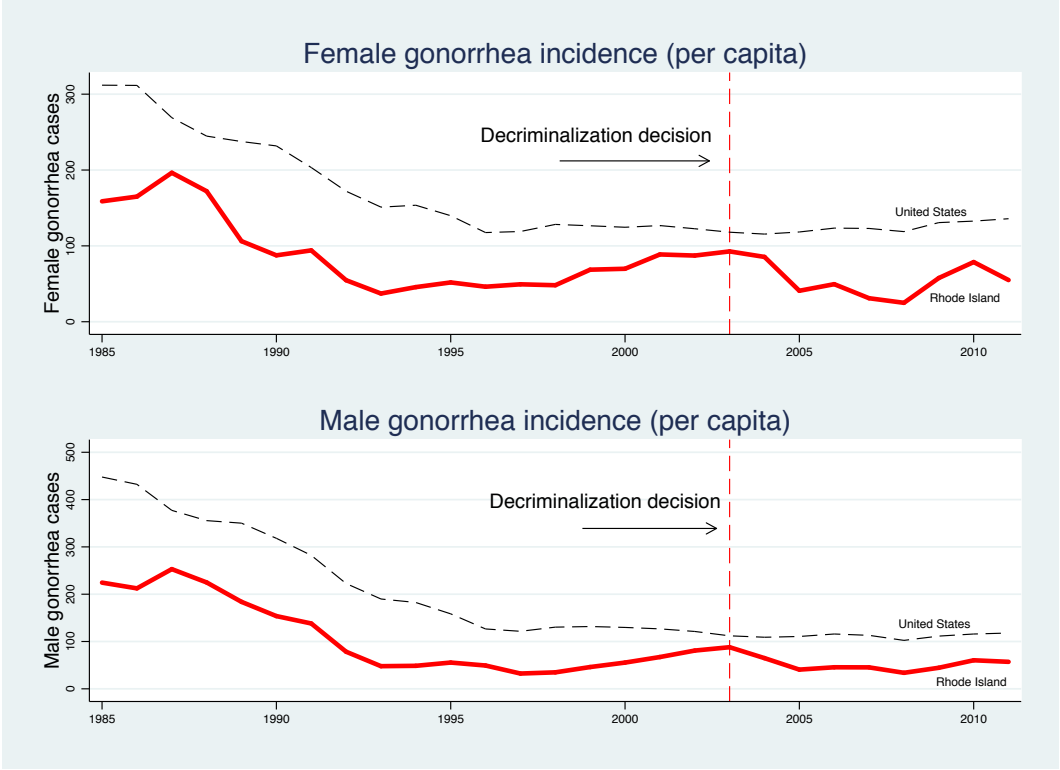

Figure 9 Female and male per-capita gonorrhea incidence, Rhode Island and the US

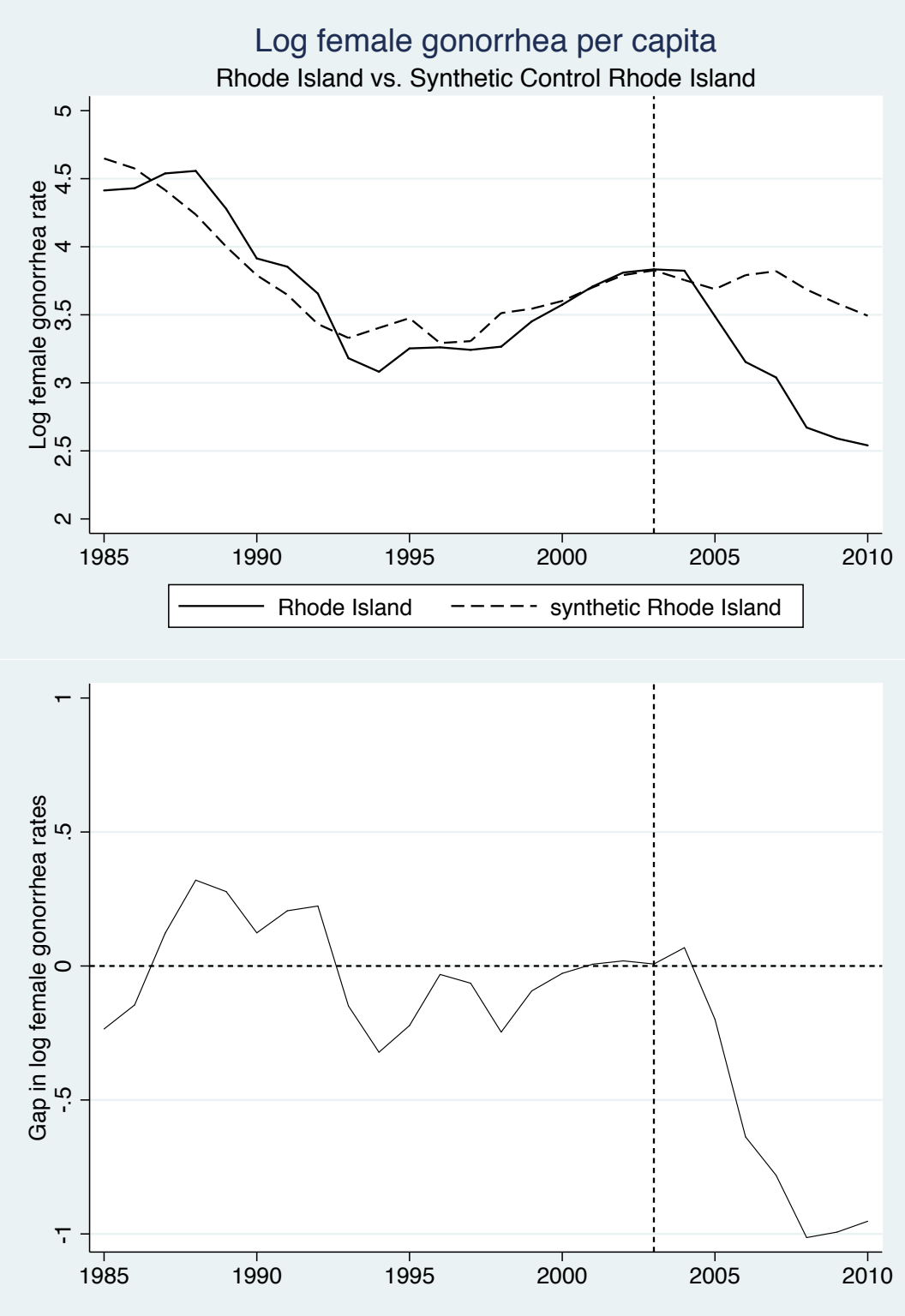

Figure 10 Top panel: Trends in per-capita female gonorrhea: RI and synthetic RI
Bottom panel: Per-capita gonorrhea gap between RI and synthetic RI

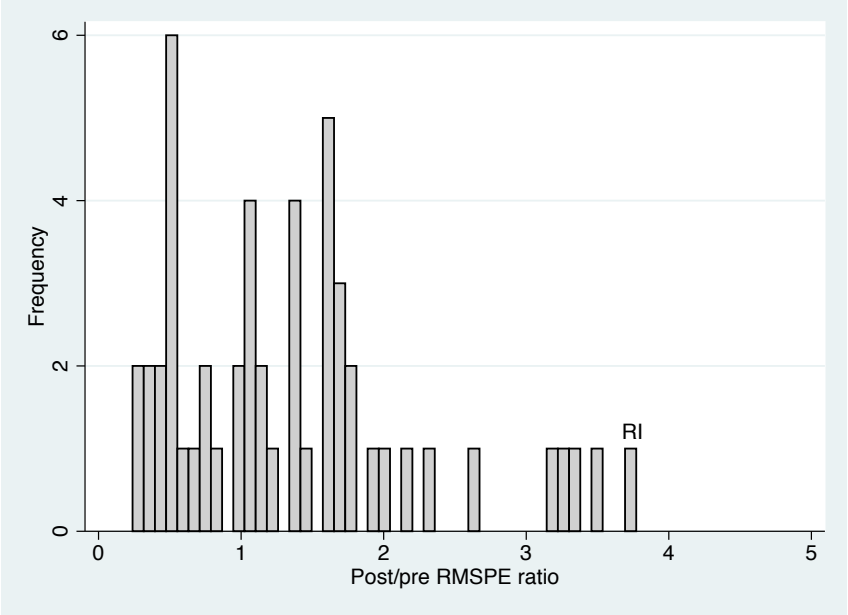

Figure 11 Ratio of post-decriminalization and pre-decriminalization RMSPE for per-capita gonorrhea: Rhode Island and 51 control states

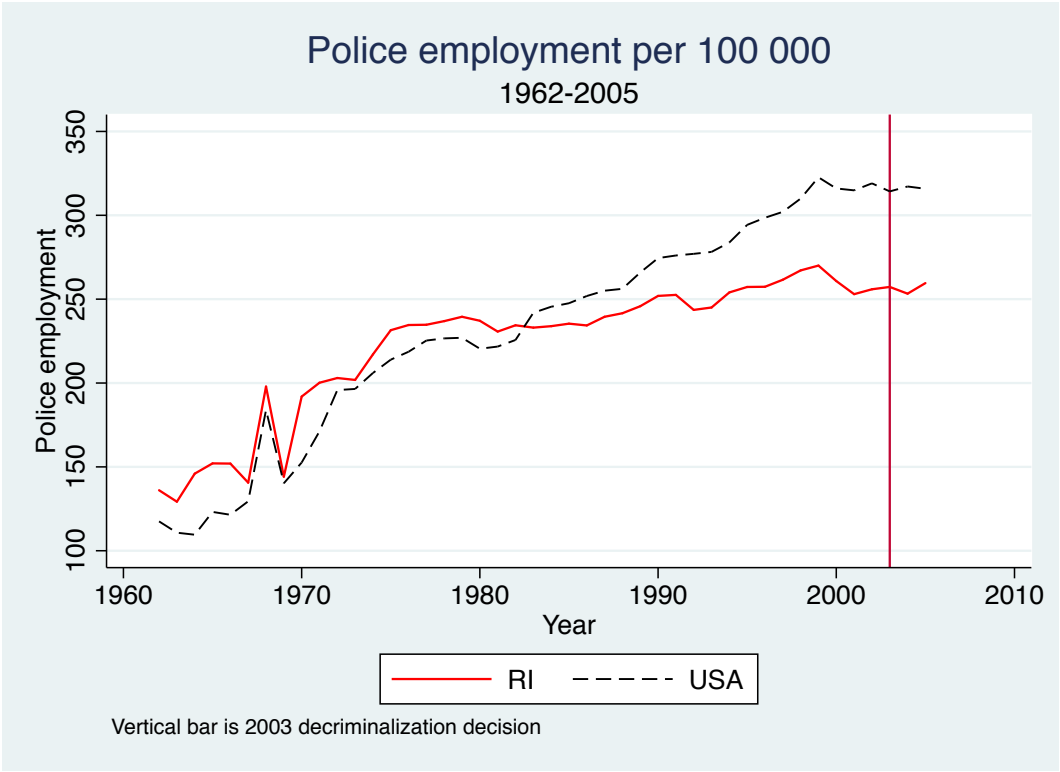

Figure 12 Police employment does not change post-decriminalization

9 Appendix

Table 11 Correlation between Participation in Sex Markets and STIs

Depvar: STI Diagnosis Ever	**Females**		**Males**	
	Gonorrhea	**Chlamydia**	**Gonorrhea**	**Chlamydia**
Ever engaged in compensation for sex	0.113**	0.054	0.145***	0.011
	(0.056)	(0.047)	(0.033)	(0.013)
N	1,654	1,649	1,229	1,223
Mean of dependent variable	0.03	0.04	0.08	0.02

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. Heteroskedastic robust standard errors in parenthesis. All models use household size sampling weights as analytical weights and included census division regional fixed effects both in 1992 (year of survey) and their residence at age 14. * p<0.10, ** p<0.05, *** p<0.01

Table 12 Does Decriminalization Impact Public Health Outcomes?

Dependent variable:	**Ln(Male gonorrhea per-capita)**		
Panel A: Clustered Standard Errors			
RI effect post-decriminalization	-0.070	-0.128	-0.449***
	(0.091)	(0.076)	(0.055)
Panel B: Placebo-based confidence intervals			
RI effect post-decriminalization	-0.071	-0.128	-0.449
5th percentile	-0.472	-0.458	-0.553
95th percentile	0.886	0.780	0.384
N	1203	1203	1203
State and year fixed effects	Yes	Yes	Yes
State linear trends	Yes	Yes	Yes
Time variant controls	No	Yes	Yes
State quadratic trends	No	No	Yes

These are OLS regressions using CDC Gonorrhea Surveillance Program Data, 1985-2009. State population is used as analytical weights. Time-variant controls include state population by gender, unemployment rates, white sex ratios, share of white, black, young, married, single, employed by military, and share of households below the poverty line. Panel A presents clustered standard errors and Panel B presents 5th and 95th percentile confidence intervals from placebo-based inferential calculations. * p<0.10, ** p<0.05, *** p<0.01

Table 13 Impact of Decriminalization on Sex Worker Race

Dependent variable:	**White Provider**	**Asian Provider**	**Hispanic Provider**	**Black Provider**
RI effect post-decriminalization	0.070***	0.076***	-0.039***	-0.014
	(0.023)	(0.022)	(0.009)	(0.008)
N	85,984	85,984	85,984	85,984
Mean of dependent variable	0.55	0.16	0.13	0.11

These are OLS regressions where the dependent variable in each model is a 0/1 for race of the worker, using Total Erotic Review Data, 1999–2008. Standard errors are heteroskedastic robust and clustered at the city level. * p<0.10, ** p<0.05, *** p<0.01

Table 14 Gonorrhea Rates by Race

Dependent variable:	**White**	**Asian**	**Hispanic**	**Black**
Mean (1985-2009)	12.66	.327	4.66	11.86
Mean pre-decriminalization (1985-2003)	14.66	.299	4.82	14.2
Mean post-decriminalization (2004-2009)	7.58	.338	3.64	5.93

These are Rhode Island gonorrhea means calculated from the CDC Gonorrhea Surveillance Data, 1985-2009. Means are calculated as the total number of females who tested positive by racial category per year divided by the total number of females in that racial category per 100,000 people.

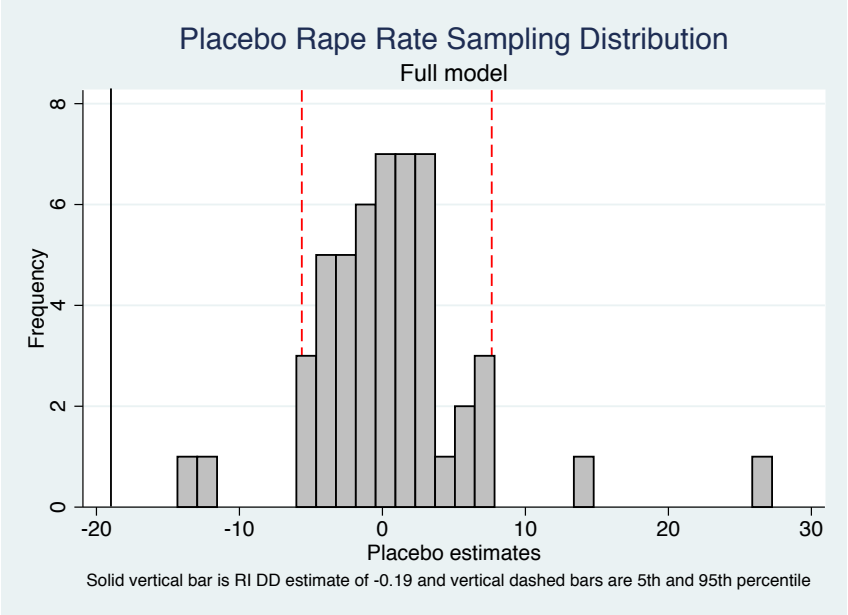

Figure 13 State Effects from Placebo Tests (Rape, Col 3 Table 6)

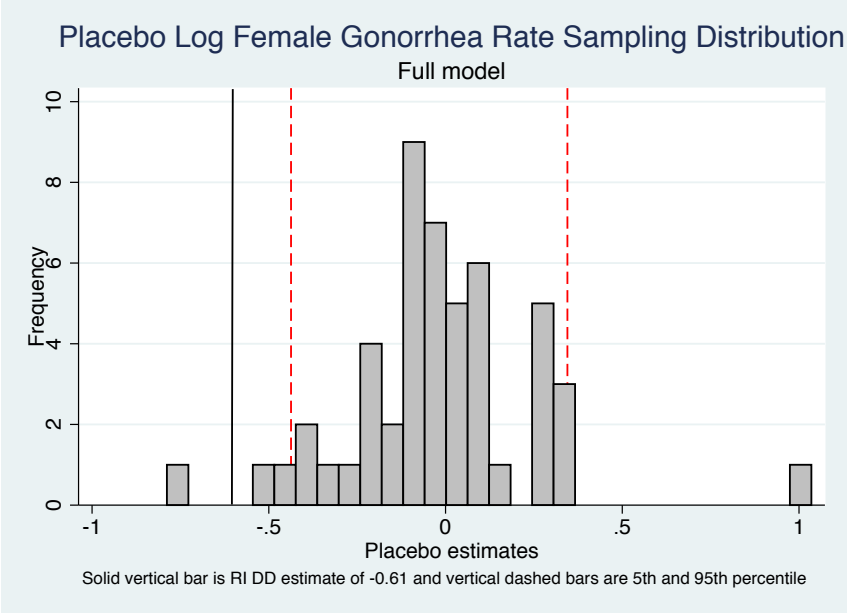

Figure 14 State Effects from Placebo Tests (Female Gonorrhea, Col 3 Table 7)

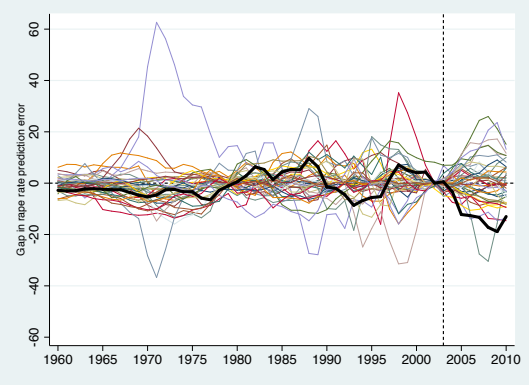

Figure 15 Per-capita rape gaps in Rhode Island and placebo gaps in all 41 control states

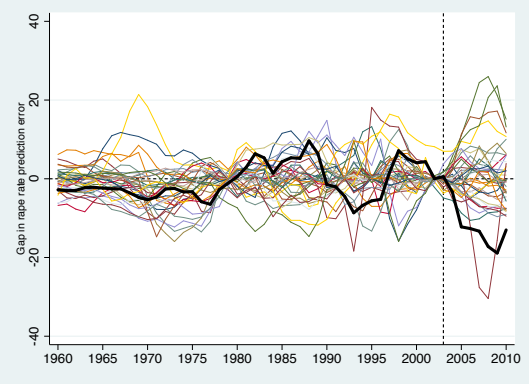

Figure 16 Per-capita rape gaps in Rhode Island and placebo gaps in all 41 control states (discards states with pre-decriminalization RMSPE 2 times higher than RI's)

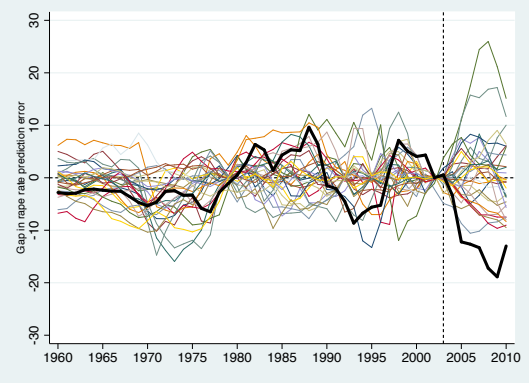

Figure 17 Per-capita rape gaps in Rhode Island and placebo gaps in all 41 control states (discards states with pre-decriminalization RMSPE 1.5 times higher than RI's)

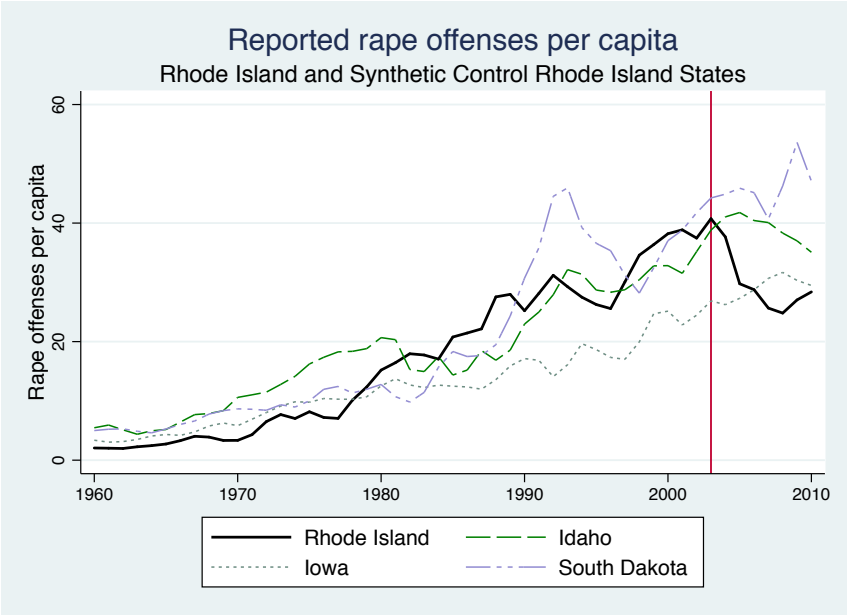

Figure 18 Per-capita rape for Rhode Island and synthetic control Rhode Island states

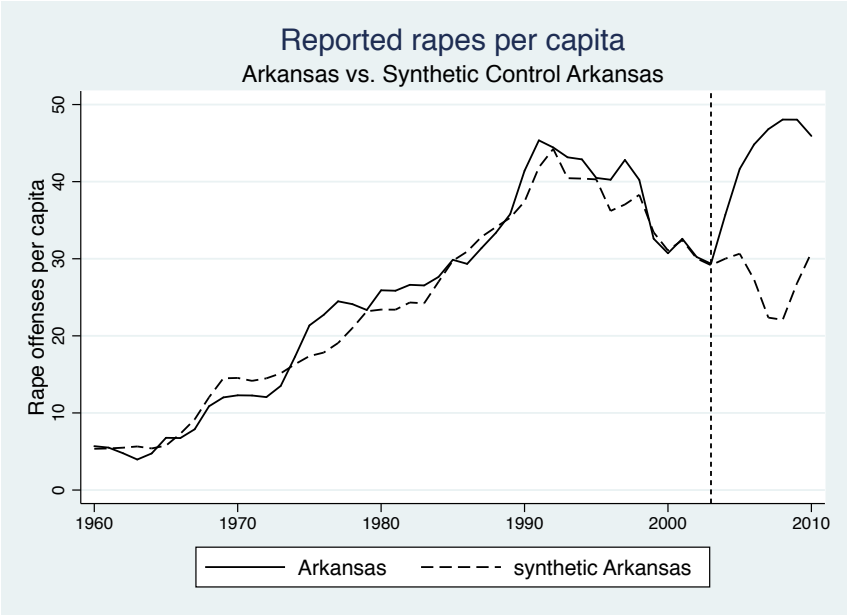

Figure 19 Per-capita rape offenses for Arkansas and synthetic control Arkansas

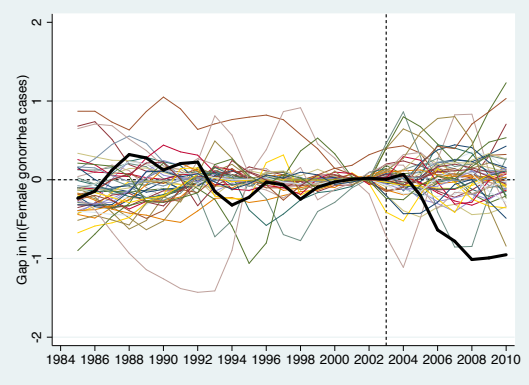

Figure 20 Per-capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states

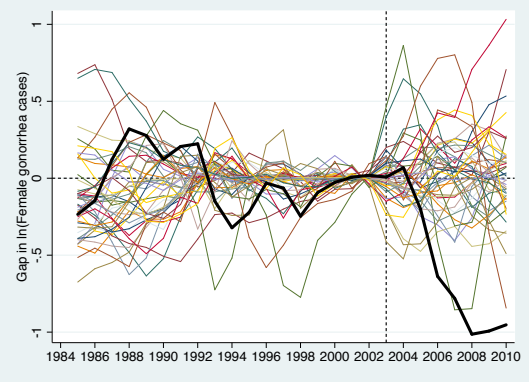

Figure 21 Per-capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states (discards states with pre-decriminalization RMSPE 2 times higher than RI's)

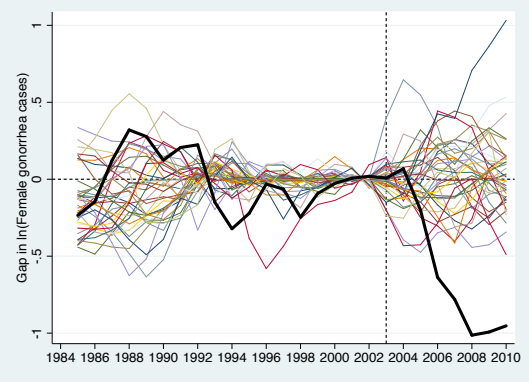

Figure 22 Per-capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states (discards states with pre-decriminalization RMSPE 1.5 times higher than RI's)

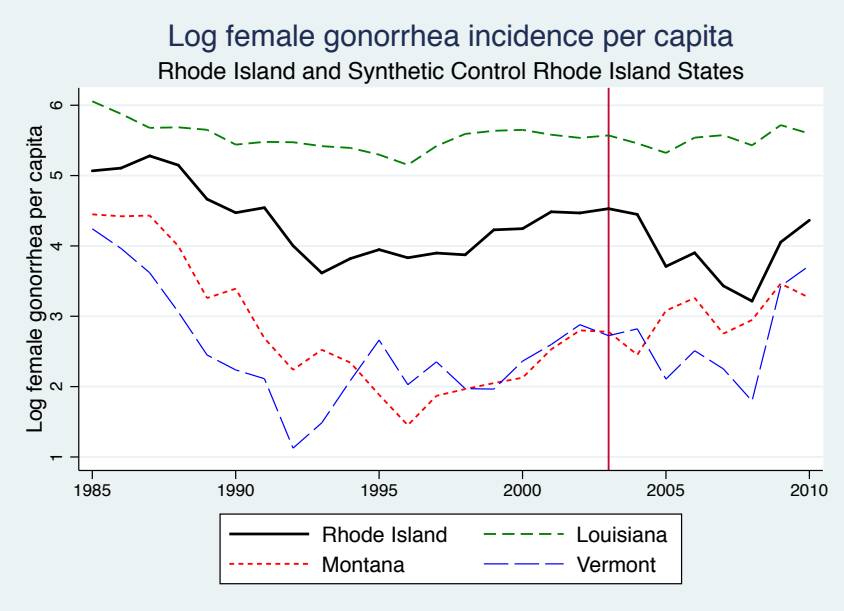

Figure 23 Per-capita gonorrhea for Rhode Island and synthetic control Rhode Island States

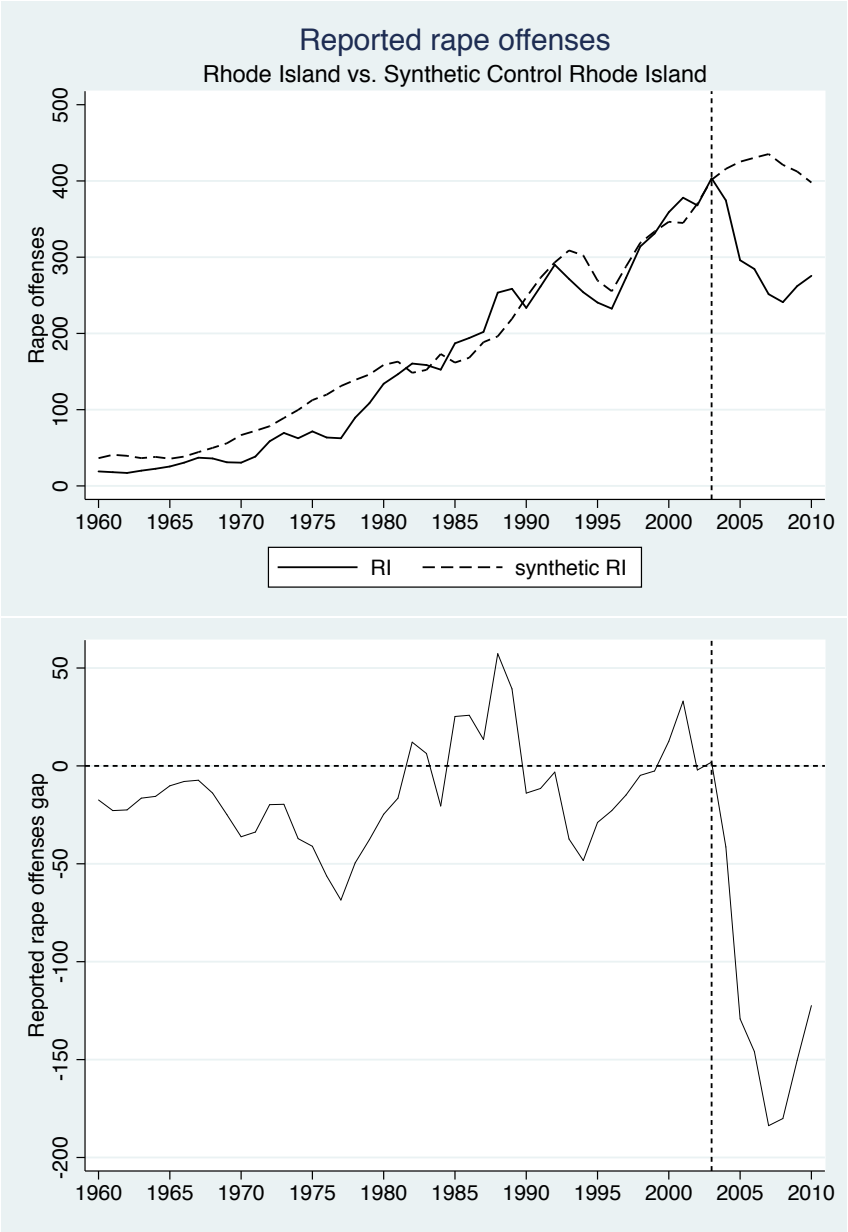

Figure 24 Top panel: Trends in rape: RI and synthetic RI
Bottom panel: Rape gap between RI and synthetic RI

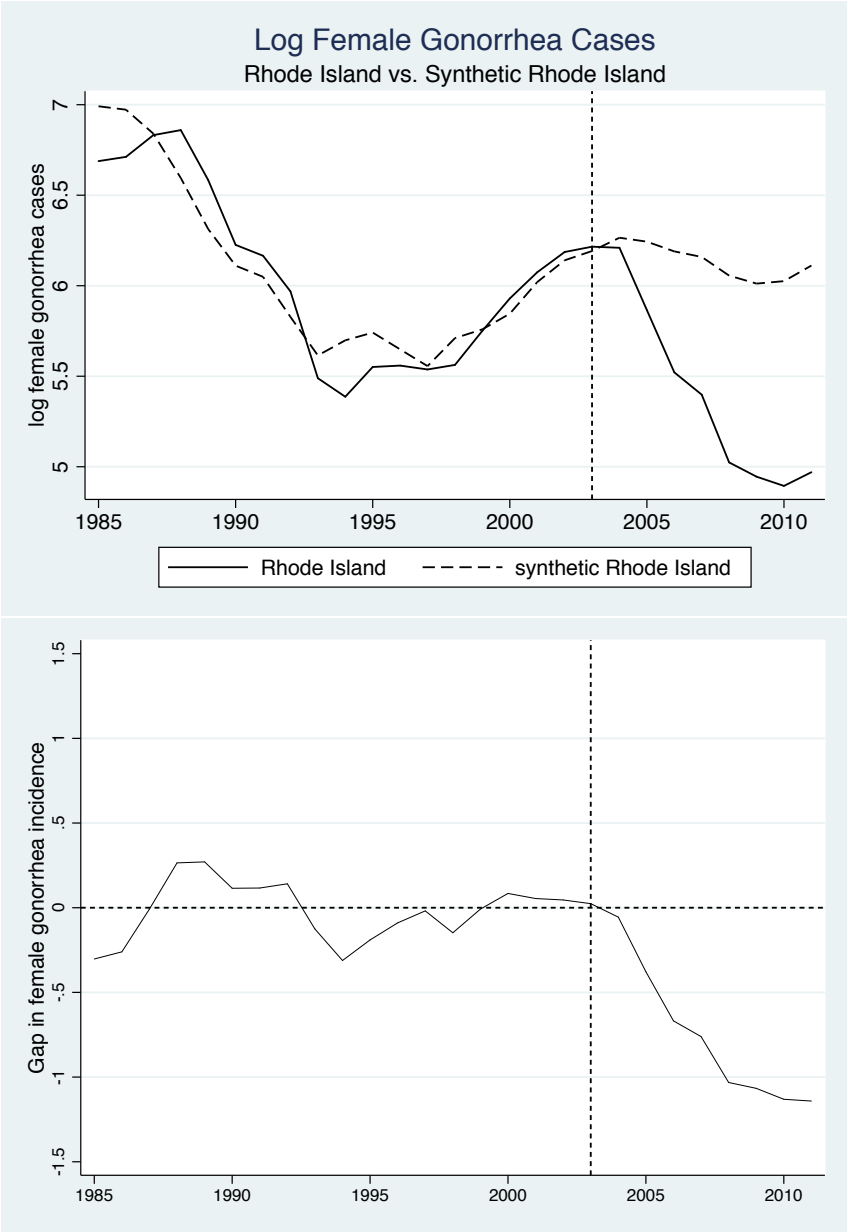

Figure 25 Top panel: Trends in female gonorrhea: RI and synthetic RI
Bottom panel: Gonorrhea gap between RI and synthetic RI

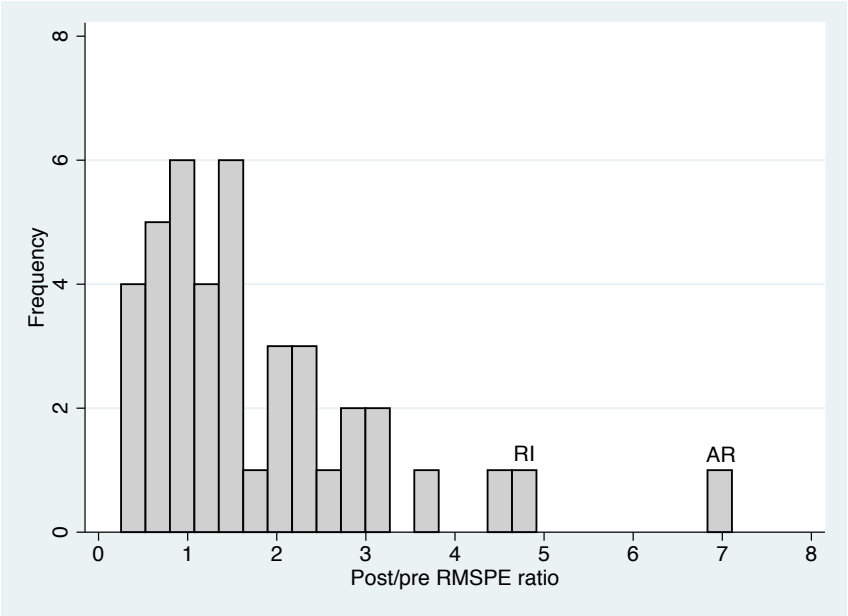

Figure 26 Ratio of post-decriminalization and pre-decriminalization RMSPE for rape: Rhode Island and 41 control states

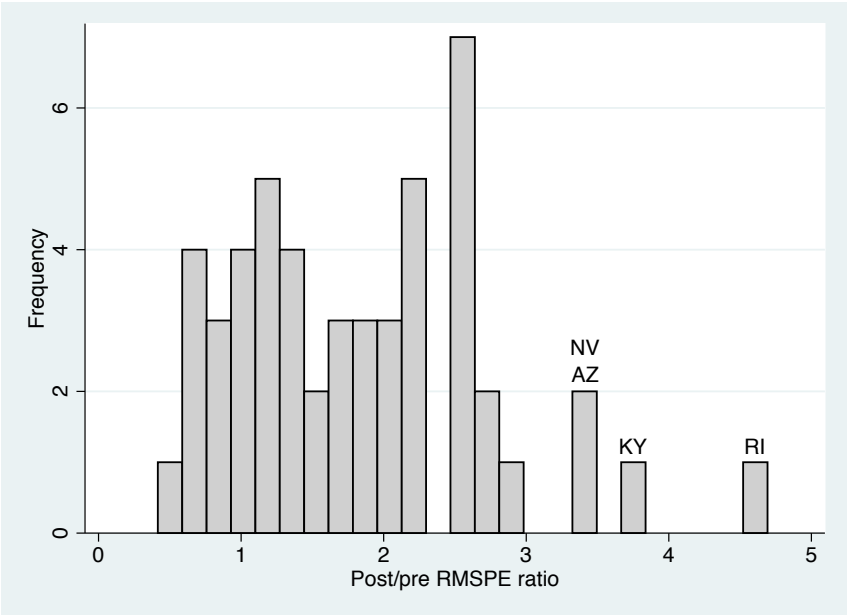

Figure 27 Ratio of post-decriminalization and pre-decriminalization RMSPE for gonorrhea: Rhode Island and 51 control states

Table 15 Actual Versus Synthetic Rhode Island characteristics

Variable names	Reported Rape Model Rhode Island	 Synthetic Rhode Island
Rape (1960, 1970)	24.75	51.55
Rape (1970, 1975, 1977)	54.83	103.42
Rape (1993, 1995, 1997)	261.67	288.70
Rape (1994, 1995)	247.25	285.86
Rape (1979)	108.5	146.15
Rape (1992)	290	293.17
Rape (1998)	314	318.82
Rape (1999)	331	333.60
Rape (2000)	359	346.42
Rape (2001)	378	344.92
Rape (2002)	368	370.10
Rape (2003)	403.5	401.57
Population (1979)	875,182	892,305.7
Population	910,550.4	932,132
Variable names	**Female Ln Gonorrhea Model Rhode Island**	** Synthetic Rhode Island**
Ln Gonorrhea (1991,1992,1993,1994)	5.75	5.80
Ln Gonorrhea (1995)	5.55	5.74
Ln Gonorrhea (1996)	5.56	5.65
Ln Gonorrhea (1997)	5.37	5.56
Ln Gonorrhea (1998)	5.63	5.71
Ln Gonorrhea (1999)	5.75	5.76
Ln Gonorrhea (2000)	5.93	5.85
Ln Gonorrhea (2001)	6.07	6.02
Ln Gonorrhea (2002)	6.19	6.14
Poverty	10.38	12.66
Population	1,017,155	2,167,991

Table 16 Rhode Island Synthetic Control Weights

State name	Estimated weight
Reported rape model	
Delaware	0.186
Idaho	0.511
Iowa	0.027
Kansas	0.016
Maine	0.24
Mississippi	0.02
Female gonorrhea model	
Louisiana	0.144
Nevada	0.316
New Jersey	0.097
North Dakota	0.023
South Dakota	0.190
Vermont	0.231