Decriminalizing Indoor Prostitution: Implications for Sexual Violence and Public Health

Scott Cunningham and Manisha Shah

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ABSTRACT

Most governments in the world including the United States prohibit prostitution. 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 sexually transmitted infection outcomes. Not surprisingly, we find that decriminalization increased the size of the indoor market. However, we also 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 (31 percent decrease) and 1,035 fewer cases of female gonorrhea (39 percent decrease) from 2004 to 2009.

Scott Cunningham
Baylor University
Dept of Economics
One Bear Place #98003
Waco, Texas 76798-8003
(254) 710-4753
scott_cunningham@baylor.edu

Manisha Shah
Department of Public Policy
University of California, Los Angeles
Luskin School of Public Affairs
3250 Public Affairs Building
Los Angeles, CA 90095-1656
and NBER
manishashah@ucla.edu

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). 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. This is likely due to moral concerns though disease transmission and victimization risks associated with sex markets are salient policy concerns (Posner and Silbaugh, 1996). For example, the 1992 National Health and Social Life Survey (NHSLS) shows that 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 20% risk of getting the infection from a single act of vaginal intercourse with an infected woman while women have a 60-80% risk of getting the infection from a single act of vaginal intercourse with an infected man (National Institutes of Health, 2001); the spread of disease is a significant public health concern. Sex market related violence is also common. 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, 1998a; 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

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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 with the decision being made in such a significant and unanticipated way.

We first show that this judicial decision which decriminalized the indoor sex market had bite. Decriminalization decreased prostitute arrests, increased indoor prostitution advertising, and expanded the size of the indoor prostitution market itself. We then 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 offenses and gonorrhea incidence to 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.

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, 1998b; Church et al., 2001a). However, none of these studies provide causal estimates, and most are plagued by statistical problems due to reliance on small, non-representative samples based on convenience sampling. In addition, despite the greater prevalence of indoor sex work, the majority of research has focused on street work (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.

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.[1] 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. 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).

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 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 are less likely to be 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

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

costs of entry to decrease (Guista, Tommaso and Strom, 2009). Therefore, we predict an unambiguous increase in the size of the indoor sex market post-decriminalization, and if indoor and outdoor sex workers are imperfect substitutes,[2] a net increase in the number of women employed overall in the sex market.

2.1 Sexual Violence

Decriminalization will increase violence if violence is an increasing function of the number of women employed in the sex market, since we expect decriminalization to increase 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, will 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 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. (2001a) 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 officers demand sex from prostitutes as part of an implicit exchange to avoid arrest. If decriminalization increases the likelihood of victims reporting crimes to the police, then it lowers the expected return to a potentially violent client in addition to the aforementioned deterrent effects of security

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[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 since street and indoor workers are not substitutes. In terms of client demand, there is some evidence that street and indoor prostitution may be substitutes for clients on lower segments of the demand curve (i.e. men who do not wish to pay too much) (Holt and Blevins, 2009).

(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 (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 vs. seeing a prostitute may substitute from rape to prostitution since it becomes cheaper and more easily available post-decriminalization.

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 pros-

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[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.

titutes 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 indoor 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. 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).[4]

De facto legalization in 2003 dates back to two important events. The first event is COYOTE's lawsuit against Rhode Island in 1976 (Arditi, 2009; *COYOTE et al. v. Dennis J. Roberts, II et al.*, 1980, 1981). COYOTE (or Call Off Your Old Tired Ethics) is a national organization seeking the legal reform of prostitution laws and other forms of sexual behavior. A local chapter of COYOTE sued the Attorney General of Rhode Island and the Chief of Police of the City of Providence in their official capacities arguing that Rhode Island General Laws §11-34-5 – the statute which prohibited prostitution and the

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[4]Much of the following history comes from personal interviews with the Providence police department, executives of the *Providence Phoenix*, journalists, and the defense attorney who represented the defendants in the 2003 case, Michael Kiselica.

commission of other "lewd and indecent acts" (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1980) – was unconstitutional. In Judge Pettine's words, "[COYOTE] charged that the over broad sweep of the statute impermissibly infringed on constitutionally protected rights of privacy and association. . . . They prayed for a declaration that Rhode Island General Laws §11-34-5 was unconstitutional . . . on its face." After an extended period of discovery and preparation, the case went to the Rhode Island Supreme Court on September 25, 1979.

The second event was a series of public outcry against streetwalking in the West End of the city of Providence in the late 1970s. The Speaker of the House at the time, Matthew Smith, worked closely with judges, police and citizens to create a legislative solution to the problem of the highly visible streetwalking in the community. Smith and others believed that in order to get prostitutes off the streets, Rhode Island would need to reduce streetwalking from a felony to a misdemeanor offense so as to speed arrestees through the courts more rapidly (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1981; Arditi, 2009). The amendments to Section §11-34 of the General Laws included an amendment to §11-34-5 ("Transportation for indecent purposes–Harboring prostitution") as well as the creation of a newly enacted law in §11-34-8. The May 1980 amendments to Chapter §11-34 of the Rhode Island General Laws were "both substantive and procedural" (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1980).

The COYOTE case appears to have influenced the May 1980 amendments, because in addition to downgrading street prostitution to a misdemeanor, the legislature decided to amend the challenged statute by removing the troubling language. As the May 1980 amendments occurred before the Supreme Court had rendered a decision on the merits of the COYOTE case, all legal parties involved in the case agreed the language was no longer constitutionally challenging. On September 22, 1980, the case was dismissed as moot (*COYOTE et al. v. Dennis J. Roberts, II et al.*, 1980) while still reserving the question of attorney's fees. On December 17, 1980, Pettine issued his opinion on the issue of attorney's fees.

Pettine's opinion helps elucidate the meaning and ramifications of these amendments. Pettine notes that the changes made to §11-34-5 are quite substantive, because by deleting

the prohibition against committing the *act of prostitution or any other indecent act*, the amendments appeared to him "to have decriminalized the sexual act itself, even when undertaken for remuneration." The main prohibitions that remained in §11-34-5, in Pettine's words, were the outlawing of "certain preliminary or preparatory activities" such as transporting or receiving a person into a house for the purpose of prostitution. The end result of all this is that 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 but also deleted a reference to prostitution as a crime. However, recall that in the 1980s indoor prostitution was not the problem as massage parlor and internet prostitution are a relatively new phenomena.

Surviving members of the 1980 General Assembly deny that the legislature was trying to legalize any part of prostitution. Senator John F. McBurney III from the 1980 General Assembly claims that legislators "didn't know what they were voting for." John Revens, Jr., echoed this sentiment and states in 2009 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). In addition, the author of the bill, then Speaker of the House Matthew Smith, strongly denies that he or anyone else was attempting to legalize the prostitution sex act.

The ramifications of the 1980 amendments are fascinating in part because there is no evidence anyone except Judge Pettine understood the ramifications. Between §11-34-5 outlawing pimping, trafficking and other preparatory activities that support prostitution and §11-34-8 prohibiting streetwalking, there were no additional problems with non-street prostitution to bring this issue to light. This begins to change years later with State v. Robert J. DeMagistriss in June 1998 (*State v. Robert J. DeMagistris*, 1998). Robert DeMagistris was an amateur pornographer charged with violating §11-34-5 and §11-34-8. The state had argued that DeMagristris's amateur pornography constituted prostitution, but since it was neither street prostitution nor an instance of recruiting someone into prostitution, the Supreme Court sided with DeMagristris and concluded that because the content of his amateur pornography videos occurred indoors, it was not a crime under

either statute.[5]

Demographic and economic changes during the late 1990s led to Providence experiencing steady growth in sex tourism (Malinowski, 2002) as well as an increase in Korean immigrants (Arditi, 2009). Throughout the 1990s and early 2000s, police regularly arrested the employees of several new Asian-themed massage parlors. The employees of the massage parlors were charged usually with §11-34-8 or "loitering for indecent purposes" In the early 2000s, a local criminal defense attorney named Michael Kiselica became a popular attorney for defendants in the Korean community. Kiselica recognized early on that *State v. DeMagristris, 1998* clearly favored the defendants since indoor massage parlor prostitution violated neither §11-34-5 nor §11-34-8 given it was indoors. Pre-trial meetings following a new arrest would take place between Kiselica and the prosecution, and during these meetings, Kiselica witnessed the prosecution repeatedly dropping all charges against his clients. But in the spring of 2003, that pattern changed as the District Attorney's office informed Kiselica that they would no longer be dropping charges against his clients, which set the stage for the challenging of the state's prostitution laws.

In the spring of 2003, Providence police arrested a dozen massage parlor employees under a city-wide sting operation called "Operation Rubdown." Operation Rubdown targeted several of the major Asian-themed massage parlors in the city, and unlike earlier arrests, this time the case went to court. Elaine Bucci, then District Court judge, presided over *Rhode Island ex rel. City of Providence v. Choe*, No. 61-2003-03314 (6th Div. Dist. Ct. 2003) and ultimately ruled in favor of the defense. Knowledge about the legality of indoor prostitution became immediately known to the police, the prosecution, and the defendants. Breton (2005) describes from interviews that police were now powerless to crack down on prostitutes or their customers inside massage parlors, and that the indoor sex market grew rapidly after the 2003 decision. However, the spread of information to the general public was still slow in 2003. In private interviews, Kiselica states that the

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[5]The Court writes, "because §11-34-8 is directed at the public solicitation of prostitution, its reach simply does not extend to the prohibition of obscene telephone calls or to the securing of world-be actors for pornographic movies when such solicitation occurs either over the telephone or within the confines of private residences. If [DeMagristris] had directed his recruitment efforts at public passersby or motorists, we would have a different case before us. . . . Accordingly we reverse the defendant's convictions under this statute" (*State v. Robert J. DeMagistris*, 1998).

courtroom was relatively empty the day that Judge Bucci read her decision. No articles appeared that summer in local newspapers. 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.

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

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

Our measure of gonorrhea is from the Centers for Disease Control (CDC) Gonorrhea Surveillance program. State-level data is available from 1985 to 2010 and summary statistics based on these data are presented in Table 1. 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, 2010). In fact, Wren (1967) concludes that "there is no doubt that [pros-

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[6]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.

titutes], as a group, must be the largest source of continual [gonorrhea] infection and reinfection in any community." In Table A5 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 (National Institutes of Health, 2001).

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 at the individual male and female level.

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 infer that the 2003 judicial decision altered the trajectory of population sexual health outcomes, we must first find evidence that it changed indoor sex markets. The conceptual framework suggests that the indoor sex market should increase after decriminalization if the costs to entry decrease. We use prostitution arrests as a measure of costs to entry. We then investigate whether quantity and price changed post–2003.

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:

$$A_{st} = \beta_1 RI_s + \beta_2 D_t + \beta_3 RI_s \cdot D_t + X_{st}\xi + \epsilon_{st}, \tag{1}$$

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 equals 1 for every post-2003 year; X_{st} is a vector of covariates that also includes state and time trends; ϵ is an error term; and β_3 is the DD parameter estimate of interest.

Table 2 reports the results from this regression. All models include state and year fixed effects as well as state time trends. In column 2 and 3 we also include various time variant controls, and in column 3 we include state quadratic trends. Standard errors are clustered at the state level. The results indicate that there is a 45 percent (column 3) decrease in arrests from 2004–2009 which corresponds to the raw data in the figure. The results suggest that the 2003 decision reduced the number of prostitution arrests, thus reducing the costs to entry.

We now empirically investigate the supply side response using both the newspaper and online data. In Figure 2, we present an index showing weekly advertisements in the

"adult services" (top panel) section and local restaurants (bottom panel) of the *Providence Phoenix* newspaper. For each type advertisement, we present the number of advertisements (solid line) and the total amount of newspaper space advertisers purchased (dashed line) that week. The value of the index equals a given week's total counts divided by the starting value in week 1. An index value of 2 is equivalent to a doubling in that week relative to the first week. The 2003 decision corresponds immediately to an increase in the size of newspaper space advertisers purchased. This is illustrated in Figure 3 where the Spa Midori advertisement becomes substantially larger right after decriminalization. It changes from covering 1/16 of the page (top panel) to a full page (bottom panel) two months after decriminalization. In fact, 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, 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 2, 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 control group (restaurant ads) from the *Phoenix*. Our specification is:

$$Y_{at} = \beta_1 A_a + \beta_2 D_t + \beta_3 A_a \cdot D_t + \delta + \epsilon_{at}, \qquad (2)$$

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 equals 1 for the adult services section and 0 for the restaurant section, D_t equals 1 for every post–2003 year and β_3 is the DD parameter estimate of interest. We also control for calendar week fixed effects, δ.

Our DD regression results in Table 3 conform to the simple visualized time series.

The size of adult services advertisements increases immediately by over 100 percent. The number of unique weekly advertisers also increases by over 100 percent during this period from 2004–2008.

The newspaper market is only one snapshot of the market for sex. Therefore we also investigate data from one of the largest online sex websites in the country, the Total Erotic Review. We examine the effect of the 2003 decision on the number of indoor sex worker reviews, massages, and prices that indoor sex worker charge. We expect the number of reviews to increase as well as massages provided since anecdotal evidence suggests the Providence massage parlor sex industry increased post-decriminalization. In fact, the evidence presented above from the *Providence Phoenix* data suggests this to be the case since the number of massage firms more than doubled post-decriminalization. We use the following DD specification:

$$P_{irt} = \beta_1 RI_r + \beta_2 D_t + \beta_3 RI_r \cdot D_t + \gamma_3 X_{irt} + \epsilon_{irt}, \tag{3}$$

where P is the dependent variables in Tables 4 (ln number of indoor reviews, 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 equals 1 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. 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.

In Table 5, we present evidence that prices did decrease after decriminalization. The dependent variable in each model is the log of inflation adjusted gross price paid by the client for a completed session. Additional controls in all models include session length and employment status, and in column 2 we also include services provided. Standard errors are heteroskedastic robust and clustered at the city level. The results are consistent across

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both models and indicate that real prices fall approximately 15 percent from 2004–2008. These results are consistent with the large increase in supply (and a relatively smaller increase in demand, if any).

These results on arrests, quantity, and prices suggest that decriminalization did impact the size of the indoor sex market, and that the 2003 decision was not simply some judicial artifact that never had real world implications. We now turn to the main outcomes of interest: sexual violence and gonorrhea incidence.

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 4, 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. In the bottom panel of Figure 4 and Figure 5 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 6 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 and men.

There is an increase in gonorrhea incidence and rape offenses pre–2003 which is not the case in the rest of the United States. 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, such as synthetic control models, which we explain below. But first we present simple DD models.

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

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

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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 ln gonorrhea incidence) in Rhode Island following decriminalization compared with a composite aggregate of all other states in the sample. We also include several covariates in the STI regression, X_{st}, such as state population, demographics and economic conditions. 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.

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.

Column 1 of Tables 6 and 7 includes state linear trends and no controls, column 2 includes both state linear trends and controls, and column 3 adds state quadratic trends. 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.

Regardless of the specification, all of the DD coefficients in Table 6 are negative and precise in Panel A. Decriminalization results in a statistically significant decrease in rape

offenses by approximately 17 rapes per capita or 39 percent. While the results in Panel A are statistically significant at the 1 percent level, the same coefficients in columns 1-3 of Panel B range in statistical significance from 5 to 10 percent. These tests are based on much more conservative and appropriate confidence intervals than those produced using the standard clustering alternative (Buchmueller, DiNardo and Valletta, 2011).

One might be concerned that policing increased in 2003 resulting in the decrease in rape offenses we observe. If that were the case then we would observe other crime offenses decreasing as well. To address this concern, we also estimate triple difference models using each of the six non-sex crimes as a within-state placebo to net out any unobserved factors that determine crime other than the judicial decision. Our triple difference estimates show that rapes fell between 41 percent (with murder as a control) to 54 percent (with vehicle theft as the control) by 2009, which is comparable to the DD results described in Table 6. (These results are available from the authors upon request.) In fact, one can see from Figures 4 and 5 that rape is the only crime the experiences a sharp decrease post-2003.

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

5.3 City Level Analysis

So far all of the analysis has been at the state level. However, evidence from both the *Providence Phoenix* and the Total Erotic Review data suggest that the majority of the change occurred in Providence since that is where the RI sex industry is concentrated. Since rape offense data is also available at the jurisdiction level, we can re-estimate the DD regressions at the city level. In Table A2 we report results from city-level analysis

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[7]In Figures 12 and 13 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.

using Providence as the treatment group. The control group is US jurisdictions with at least 100,000 population, and the outcome is rapes per capita. In Table A3 we restrict the sample to Northeast jurisdictions only in cities with at least 10,000.[8] We estimate this regression in case there is concern that the Northeast is distinct from the rest of the United States and we should only be using Northeastern states as the control group. The results are consistent across all specifications. In Panel B of Table A3, Rhode Island does rank number two in columns 2 and 3 in the placebo analysis. However, because the sample size is now 14 cities, even a ranking of one would not be statistically significant.

The results in Table A2 suggest that decriminalization reduced rape offenses by approximately 27 percent in Providence. When we use the 14 Northeastern States as the control group, the results suggest that decriminalization reduced rape offenses by 33 percent in Providence. Therefore, as expected, it does seem that the majority of the reduction in rapes is coming from Providence.

5.4 Synthetic Control Model

The DD research design is only as valid 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 also 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. The synthetic control model will select states which had similar upticks in rape and gonorrhea prior to decriminalization. Therefore, the 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

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[8]This leaves us with 14 jurisdictions that are the Amherst, Boston, Bridgeport, Buffalo, Hartford, New York City, Providence (treatment group), Rochester, Springfield, Stamford, Syracuse, Washington Metropolitan, Waterbury, and Yonkers Police Department.

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

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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 17 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.[9] 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 9. 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.[10]

The state with the largest such ratio is Arkansas (7.4) and Rhode Island is second

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[9]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.

[10]We present visualizations of the placebo inference in Figures 14-16. Figure 14 displays the estimated effect for Rhode Island against all the other 41 placebo gaps. Figure 15 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 16 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 as having one of the largest negative estimated effects in the placebo distribution.

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 ($\frac{2}{42} = 0.048$).[11] 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 8 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 10 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 probability 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.[12]

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 A1 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

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[11]We plot the prediction gap in rape predictions for Arkansas (AR) and synthetic AR as a final check (see Figure 18 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 17 in appendix). That penalty makes RI's pre-RMSPE larger. The post–RMSPE for RI is 12.85 and AR is 17.36.

[12]In Figures 19-21, 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 20) as well as 1.5 times higher (Figure 21). Again, we see that the estimated causal effects is strikingly large and negative when compared to the placebo distribution.

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).

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 DD models estimate a 39 percent decrease in rapes and a 39-45 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.

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 this discussion on pathways is 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.

6.1   Sexual Violence Pathways

We first consider several potential hypotheses that relate decriminalization to the falling 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 has 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 11 plots this data for Rhode Island and the rest of the US, and we do not find any changes in police employment post–2003.[13]

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.[14] 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 and the results do not change. Therefore, we do not find any evidence that ORI attrition is responsible for the sizeable declines in reported rapes

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

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

in Rhode Island following decriminalization in 2003 (results available upon request). 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.[15]

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 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., 2001b; Farley and Barkan, 1998a). 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,

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[15]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, 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 are consistent with the DD results.

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.[16] 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 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 A4 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. More White and Asian women entering the market should result in an overall lower risk pool, *ceteris paribus*.

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.[17] We find that higher risk sex acts, such as oral sex without a condom and anal sex, decreased substantially following

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[16]The mean gonorrhea rate per 100,000 from 1985-2009 by race is 44.6 for whites, 29.5 for Asians, 155.92 for Hispanics, and 691.31 for Blacks (CDC Gonorrhea Surveillance data).

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

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 A1) 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 street market).

7 Discussion and Conclusion

This study provides the first causal estimate of the impact of decriminalization on the sex market as well as outcomes related to sexual violence and public health. The results suggest that decriminalization could have potentially large social benefits for the population

at large—not just sex market participants.[18] 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 or 31 percent. We provide suggestive evidence that the decline in rapes may be 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 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.

Rhode Island ultimately re-criminalized indoor sex work in November 2009 with the passage of bill HB5044A. However, the push to re-criminalize first started in 2005. Therefore, the passage of this bill was neither unanticipated nor surprising unlike the initial 2003 judicial decision. Future research may evaluate the impacts of re-criminalizing indoor prostitution on rape offenses and gonorrhea incidence once longer time series of data become available. However, it is important to note that since re-criminalization was anticipated, empirical results may be biased due to anticipatory effects. We scrape additional Total Erotic Review data and interestingly, we do observe a decrease in the number of reviews in Rhode Island immediately following re-criminalization (see Figure 23). However, by 2012, the trend bounces back to the growth trend of the rest of the United States.

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[18]We should note that prostitution is morally repugnant for some individuals so legalizing the indoor market may impose moral costs that are difficult to quantify. In addition, others have argued that decriminalization may increase human trafficking (Cho, Dreher and Neumayer, 2011). However, good data on numbers trafficked is extremely difficult to uncover given the clandestine nature of this market.

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Table 1 Summary Statistics

Dependent Variables	Mean	Std. Deviation	N
Prostitution arrests per capita	31.5	26.7	1,142
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
Number of new indoor sex workers by city	197.97	267.10	428
Massage provider	0.13	0.336	85,709
Fellatio (no condom)	0.363	0.481	85,709
Fellatio (condom)	0.471	0.499	85,709
Vaginal sex	0.839	0.368	85,709
Anal sex	0.116	0.32	85,709
Real price	$275.19	$321.89	85,709
Hourly adjusted price	$318.12	$445.75	85,709
Asian provider	0.156	0.363	85,709
White provider	0.506	0.50	85,709
Hispanic	0.153	0.36	85,709
Black provider	0.107	0.309	85,709
Reported rape offenses per capita	32.8	11.6	1,179
Female gonorrhea incidence per capita	159	109	1,179
Male gonorrhea incidence per capita	191	180	1,179

Other Control Variables	Mean	Std. Deviation	N
Average length of session (minutes)	59.94	0.119	85,709
Murders and non-negligent homicides per capita	6.72	3.8	1,179
Burglaries per capita	898	385	1,179
Robberies per capita	180	109	1,179
Assaults per capita	1,212	449	1,179
Vehicle thefts per capita	466	229	1,179
Larcenies per capita	2,536	764	1,179
State unemployment rate	6.07	1.76	1,179
Share of households below poverty line	13.5	3.31	1,179
Share employed by military	0.004	0.003	1,179
Share of population white	82.1	9.04	1,179
Share of population black	12.6	8.67	1,179
White sex ratio 0-14	106	8.45	1,179
White sex ratio 15-24	103	10.8	1,179
White sex ratio 25-39	102	7.07	1,179
Share of population 15-24	14.2	1.28	1,179
Male share of male population single	46.9	2.92	1,179
Female share of female population single	40.1	2.86	1,179
Male share of male population married	42.7	2.96	1,179
Female share of female population married	40.8	2.72	1,179
State female population	6,173,058	4,946,616	1,179
State male population	5,977,432	4,915,284	1,179
Total state population	12,150,490	9,859,788	1,179

Table 2 Did Decriminalization Decrease Prostitution Arrests?

Dependent variable:	ln(Prostitution arrest per capita)		
Panel A: Clustered Standard Errors			
RI effect post-decriminalization	-0.158	-0.276	-0.628***
	(0.109)	(0.181)	(0.158)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-0.158	-0.276	-0.628
5th percentile	-1.071	-1.021	-1.324
95th percentile	1.597	1.584	1.515
N	1150	1150	1150
Mean of dependent variable	3.16	3.16	3.16
State and year FE	Yes	Yes	Yes
State linear trends	Yes	Yes	Yes
Time variant controls	No	Yes	Yes
State quadratic trends	No	No	Yes

These are DD regressions using UCR data, 1985-2009 where the dependent variable is ln prostitution arrests per 100,000. 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. Panel A presents standard errors clustered at the state level 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 3 Impact of Decriminalization on Number and Size of Advertisements

Dependent variable:	ln(Number of ads)	ln(Aggregate ad size)
Adult classified × post-decriminalization	0.765***	1.162***
	(0.046)	(0.065)
Year x Week fixed effects	Yes	Yes
N	926	926
Mean of dependent variable	2.52	0.38

These are OLS regressions using data from *The Providence Phoenix* classifieds, 2000-2008. Heteroskedastic robust standard errors are shown in parenthesis. All models include week x year fixed effects. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 4 Impact of Decriminalization on Supply Side of Market

Dependent variable:	ln(# Indoor reviews	Massage	Fellatio condom	Fellatio no condom	Vaginal sex	Anal sex
RI effect post-decriminalization	0.853***	0.085***	0.084***	-0.083***	0.027***	-0.161***
	(0.109)	(0.008)	(0.017)	(0.016)	(0.007)	(0.008)
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. All outcome variables are binary dependent variables except for column 1, which is the log of total number of new sex workers reviewed. 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 effect post-decriminalization	-0.169***	-0.168***
	(0.026)	(0.024)
YearxMonth fixed effects	Yes	Yes
CityxMonth fixed effects	Yes	Yes
N	85,709	85,709
Mean of dependent variable	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. Additional controls in all models include session length and employment status, and in column 2 we also include services provided. 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	-16.30***	-17.10***	-19.42***
	(0.686)	(0.951)	(1.222)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-16.30*	-17.10*	-19.42**
5th percentile	-9.68	-9.50	-5.58
95th percentile	15.16	14.58	8.00
N	1179	1179	1179
Mean of dependent variable	32.79	32.79	32.79
State and year FE	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 where the dependent variable is rape offenses per 100,000. 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	-0.434***	-0.494***	-0.616***
	(0.081)	(0.078)	(0.064)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-0.434**	-0.494*	-0.616**
5th percentile	-0.370	-0.352	-0.445
95th percentile	1.078	1.001	0.361
N	1203	1203	1203
Mean of dependent variable	4.86	4.86	4.86
State and year FE	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 where the dependent variable is ln gonorrhea incidence per capital for females.. 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 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 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
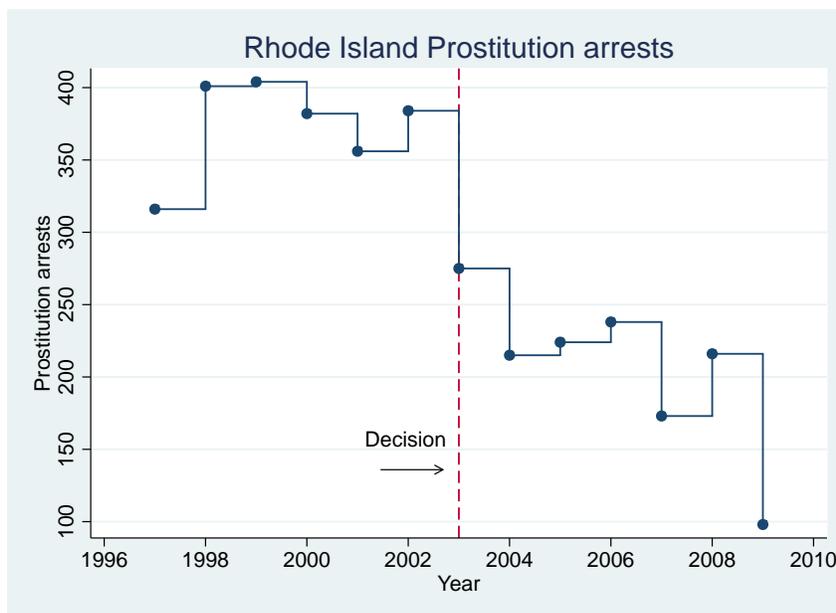
Figure 1 Rhode Island Prostitution Arrests

Providence Phoenix Weekly Adult Services Ads
Number of advertisers and total size advertisements
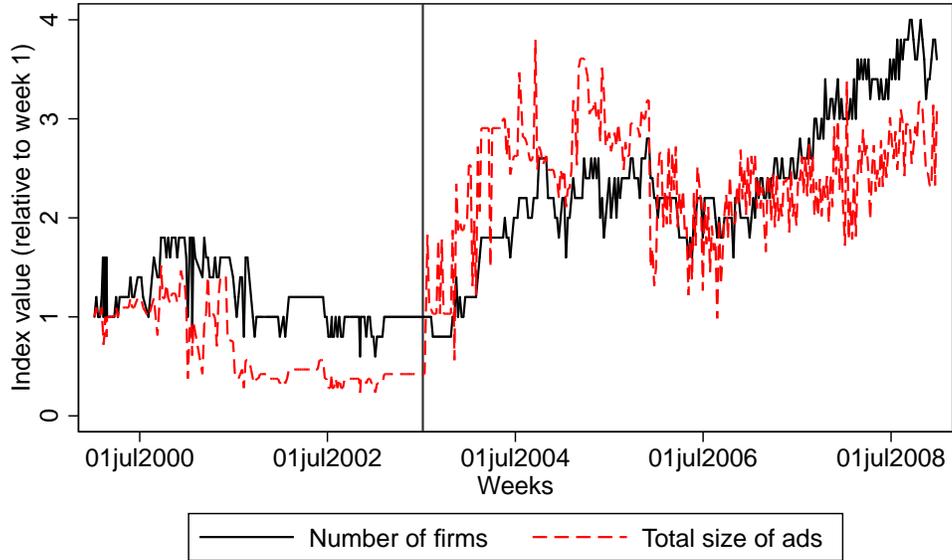
Five unique advertisers purchased a combined 0.67 inches at start of series.

Providence Phoenix Weekly Restaurant Ads
Number of advertisers and total size of advertising
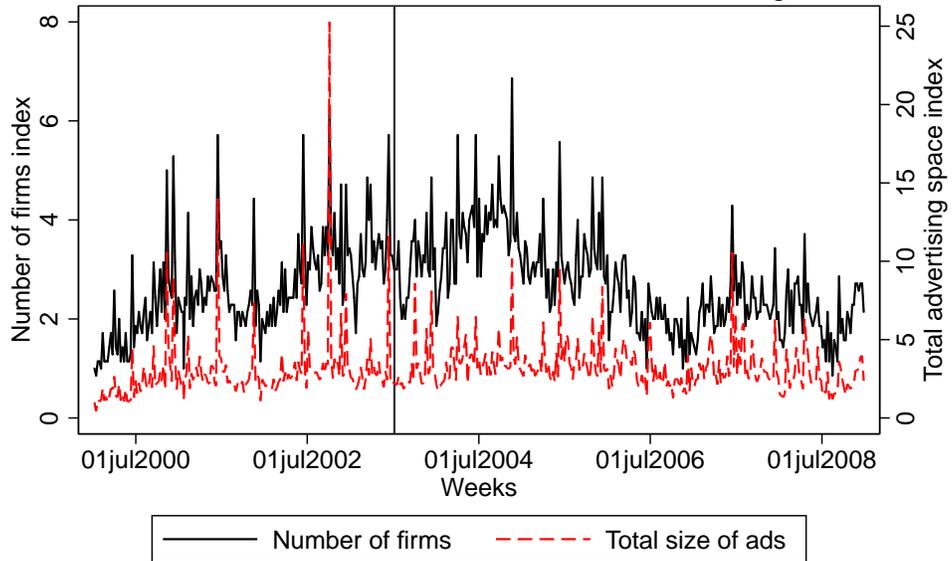
Seven unique advertisers purchased 0.823 inches of advertising space in week one.

Figure 2 "Adult services/spa" Section of the *Providence Phoenix* (Top panel), "Restaurants" Section of the *Providence Phoenix* (Bottom panel)

Figure 3 *Providence Phoenix* Advertising Before (Top panel) and After Decriminalization (Bottom panel)
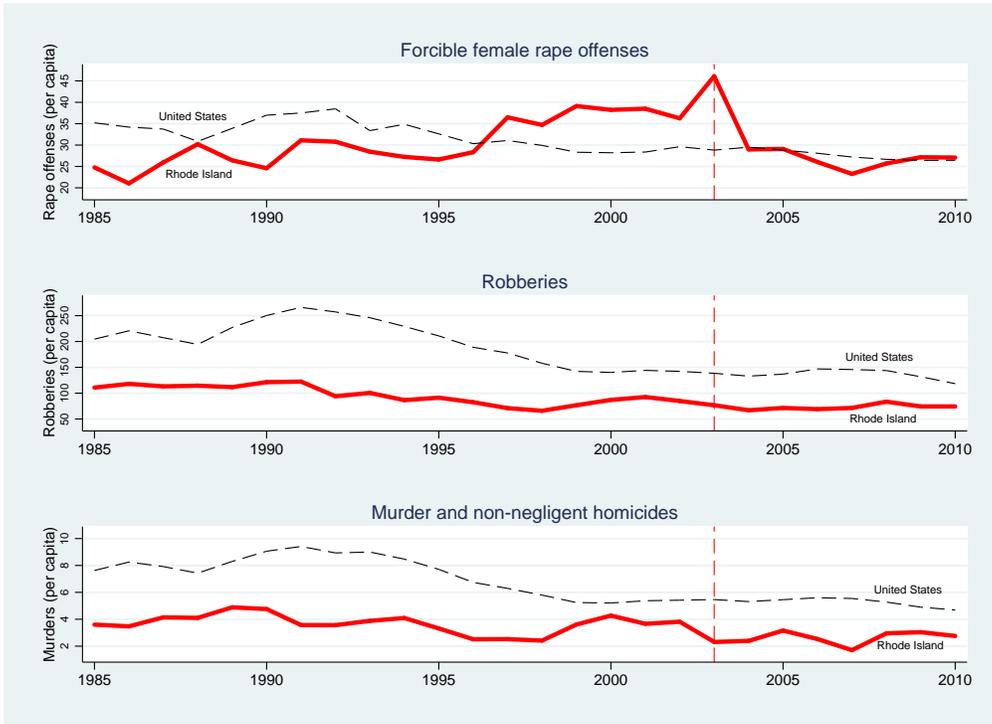
Figure 4 Rape, Robbery, and Murder (per capita), Rhode Island and the US
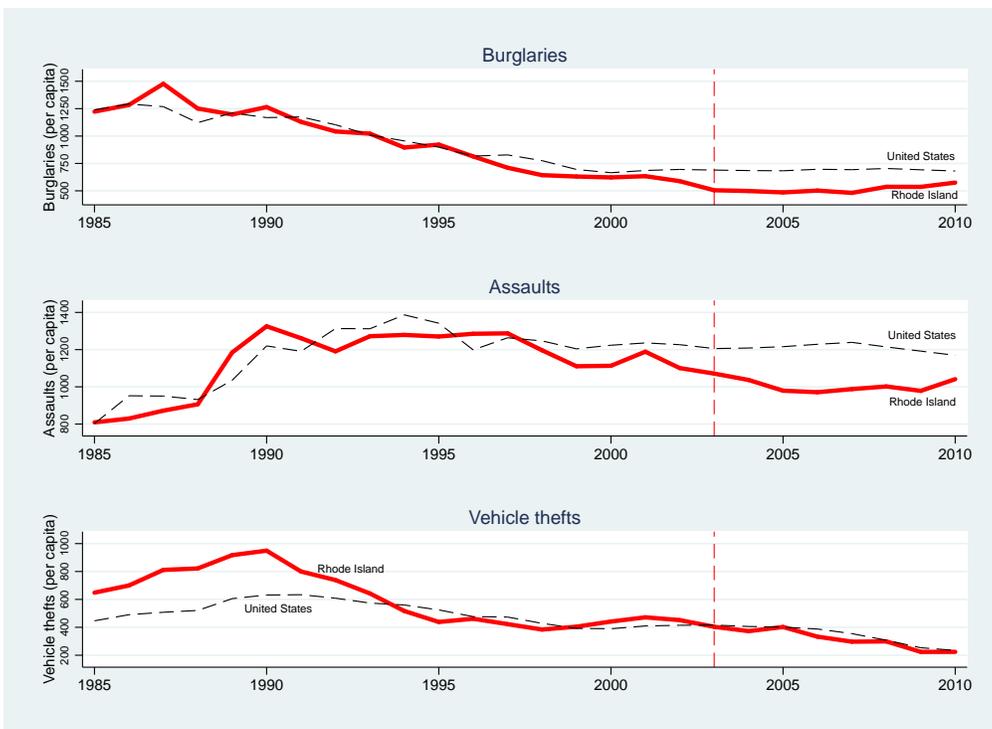
Figure 5 Other Crimes (per capita), Rhode Island and the US

42
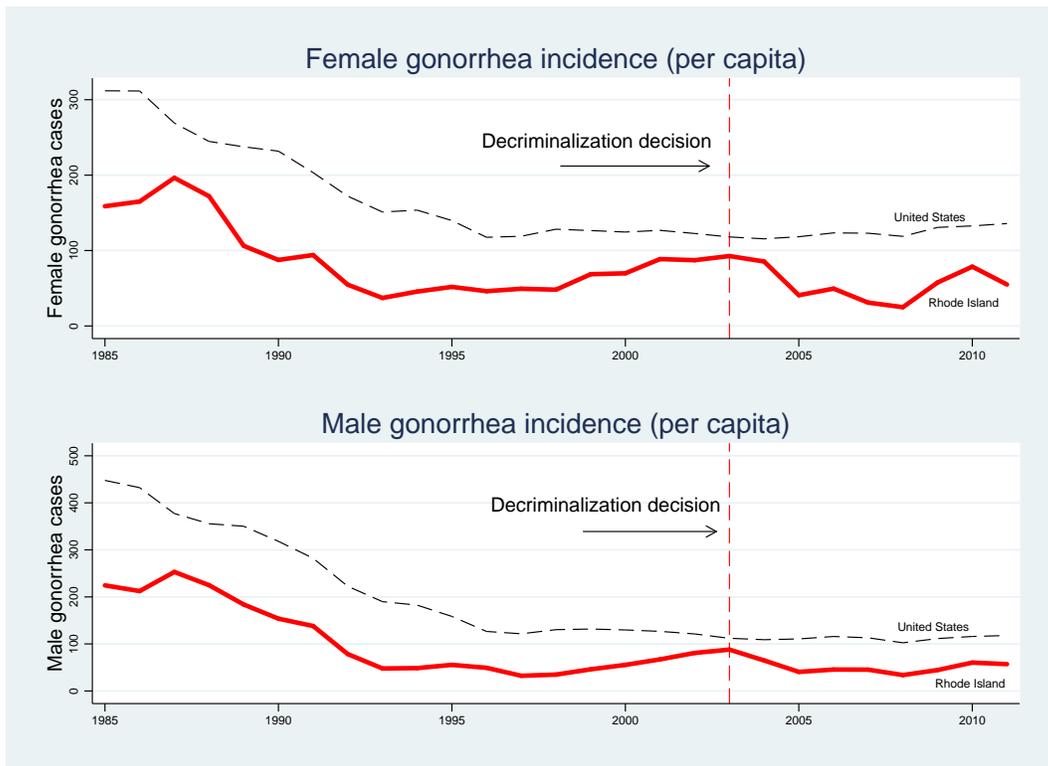
Figure 6 Female and male per capita gonorrhea incidence, Rhode Island and the US
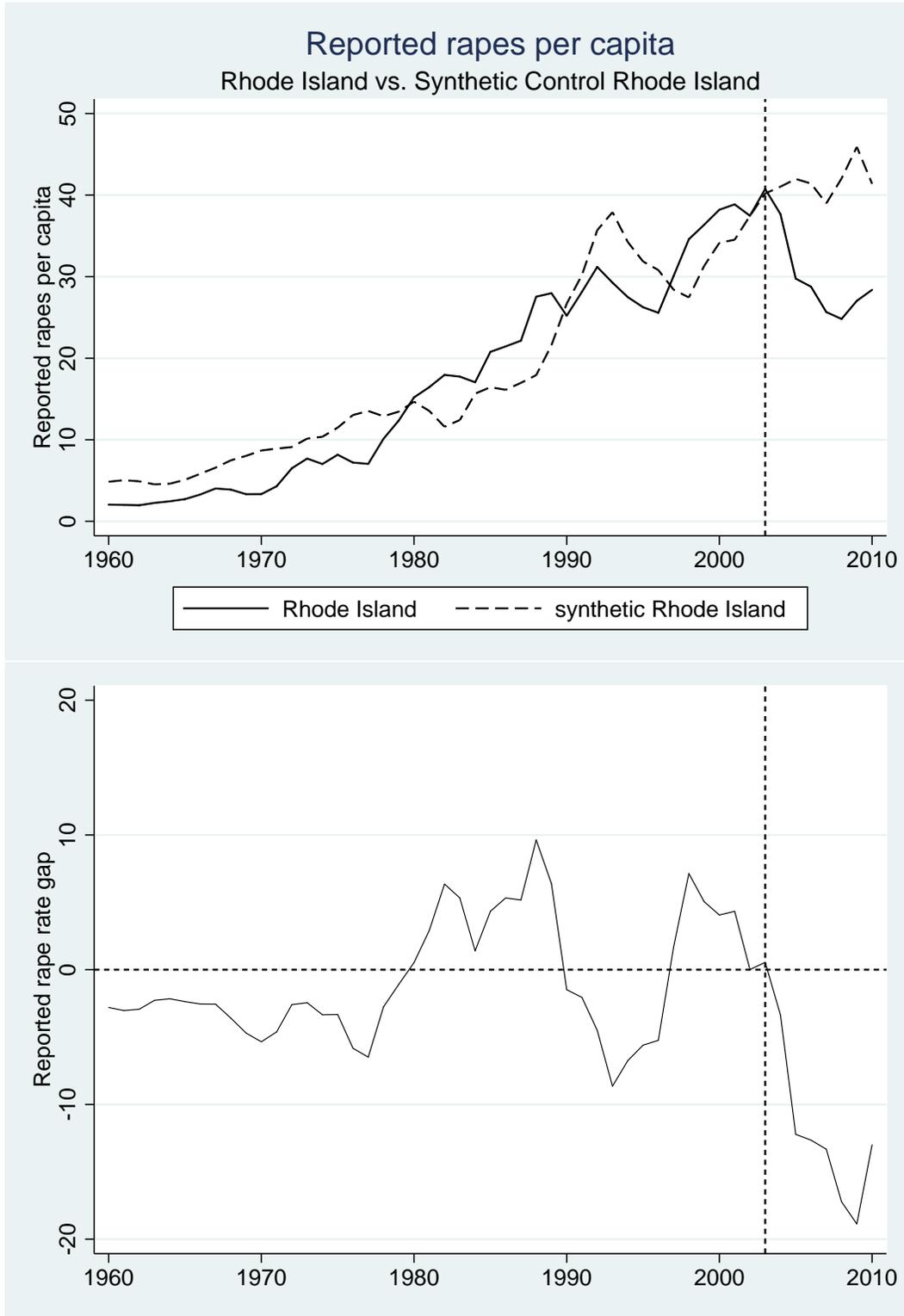
Figure 7 Top panel: Trends in per capita rape: RI and synthetic RI
Bottom panel: Per capita rape gap between RI and synthetic RI
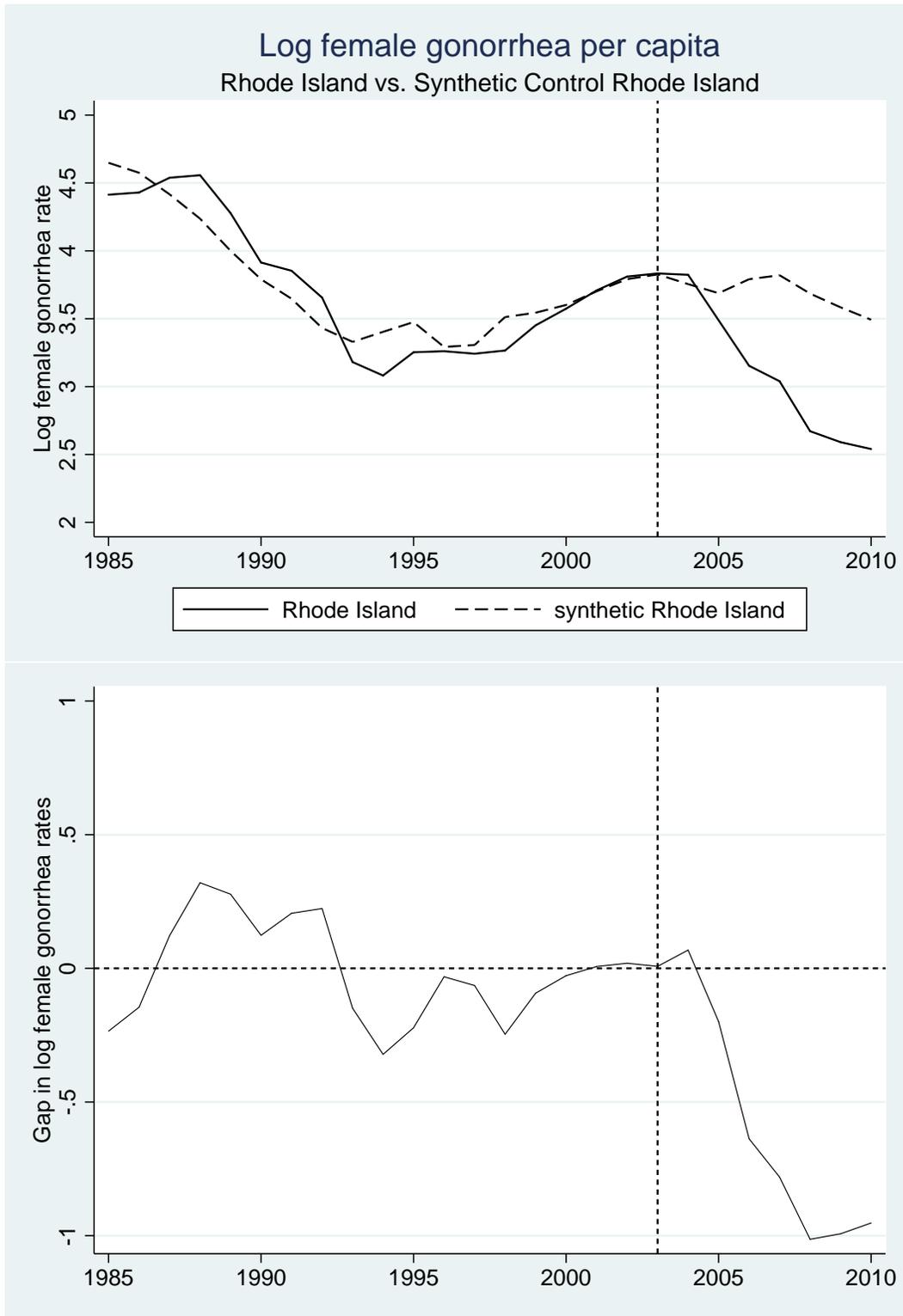
Figure 8 Top panel: Trends in per capita female gonorrhea: RI and synthetic RI
Bottom panel: Per capita gonorrhea gap between RI and synthetic RI
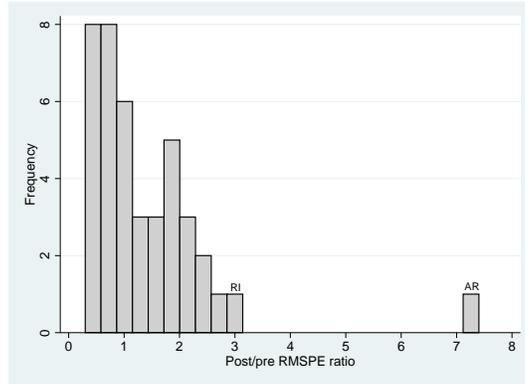
Figure 9 Ratio of post–decriminalization and pre-decriminalization RMSPE for per capita rape: Rhode Island and 41 control states
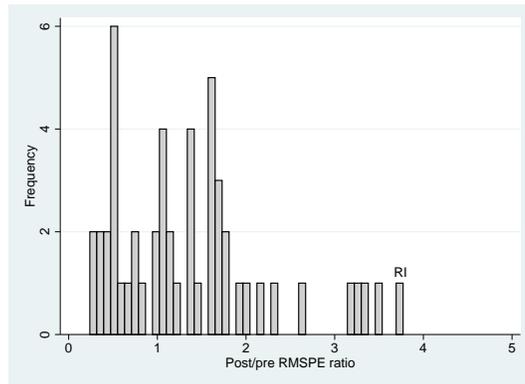
Figure 10 Ratio of post–decriminalization and pre-decriminalization RMSPE for per capita gonorrhea: Rhode Island and 51 control states
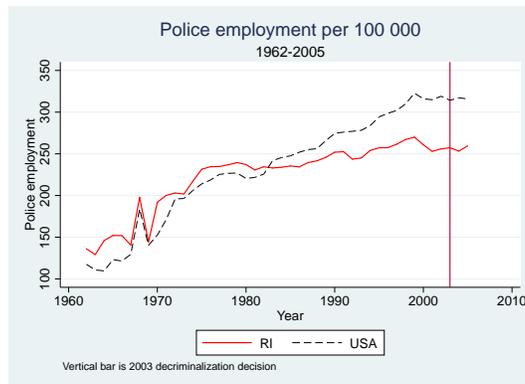
Figure 11 Police employment does not change post–decriminalization

A   Appendix Tables and Figures—For Online Publication

Table A1 Does Decriminalization Impact Public Health Outcomes?

Dependent variable:	ln(Male gonorrhea per capita)		
Panel A: Clustered Standard Errors			
RI effect post-decriminalization	-0.065	-0.128	-0.460***
	(0.097)	(0.079)	(0.054)
Panel B: Placebo-based Confidence Intervals			
RI effect post-decriminalization	-0.065	-0.128	-0.460
5th percentile	-0.473	-0.459	-0.511
95th percentile	0.785	0.771	0.364
N	1203	1203	1203
Mean of dependent variable	4.96	4.96	4.96
State and year FE	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 where the dependent variable is ln gonorrhea incidence per capita for males. 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 A2 Does Decriminalization Impact Rape Offenses? (City Level)

Dependent variable:	Rape offenses per capita		
Panel A: Clustered Standard Errors			
Providence effect post-decriminalization	-10.75***	-23.78***	-23.31***
	(2.402)	(1.131)	(1.158)
Panel B: Placebo-based Confidence Intervals			
Providence effect post-decriminalization	-10.75	-23.78	-23.31
5th percentile	-27.64	-32.61	-24.43
95th percentile	28.96	33.51	18.68
N	2975	2975	2975
Mean of dependent variable	51.11	51.11	51.11
State and year FE	Yes	Yes	Yes
State linear trends	No	Yes	Yes
State quadratic trends	No	No	Yes

These are OLS regressions using UCR city level data, 1985-2009. City 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 A3 Does Decriminalization Impact Rape Offenses? (City Level, 14 Northeastern states only)

Dependent variable:	Rape offenses per capita		
Panel A: Clustered Standard Errors			
Providence effect post-decriminalization	-12.39*	-22.91***	-21.30***
	(4.198)	(1.444)	(1.370)
Panel B: Placebo-based Confidence Intervals			
Providence effect post-decriminalization	-12.39	-22.91	-21.30
5th percentile	-20.78	-29.36	-23.66
95th percentile	19.77	20.87	26.03
N	350	350	350
Mean of dependent variable	35.52	35.52	35.52
State and year FE	Yes	Yes	Yes
State linear trends	No	Yes	No
City linear trends	No	No	Yes

These are OLS regressions using UCR city level data, 1985-2009. City 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 A4 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 A5 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

Placebo Rape Rate Sampling Distribution

Full model

Solid vertical bar is RI DD estimate of -19.42 and vertical dashed bars are 5th and 95th percentile
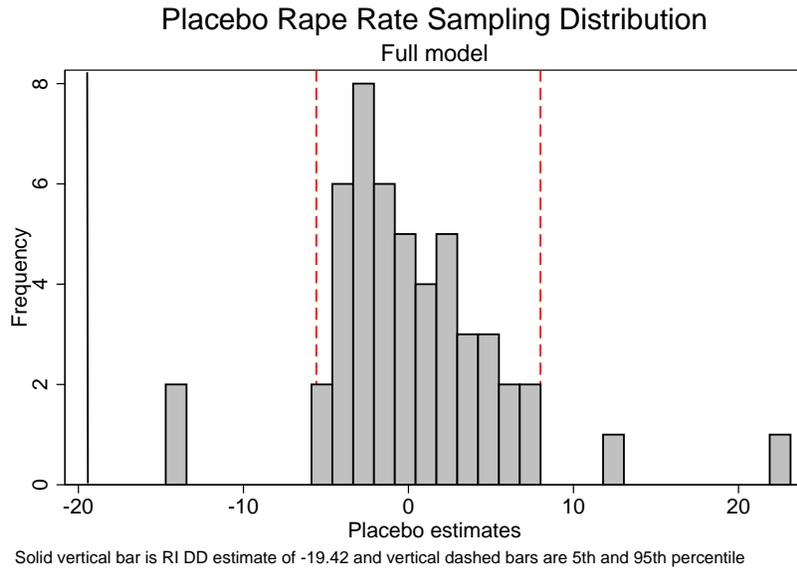
Figure 12 State Effects from Placebo Tests (Rape, Col 3 Table 6)

Placebo Log Female Gonorrhea Rate Sampling Distribution

Full model

Solid vertical bar is RI DD estimate of -0.62 and vertical dashed bars are 5th and 95th percentile
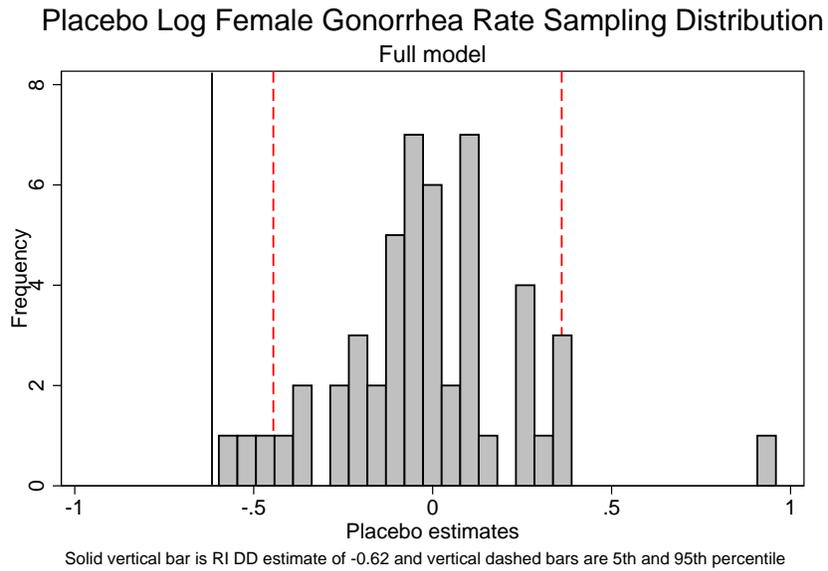
**Figure 13** State Effects from Placebo Tests (Female Gonorrhea, Col 3 Table 7)
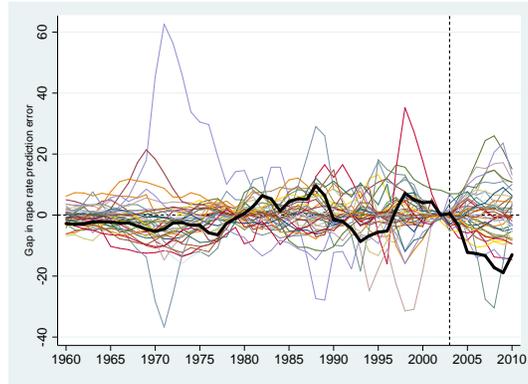
Figure 14 Per capita rape gaps in Rhode Island and placebo gaps in all 41 control states
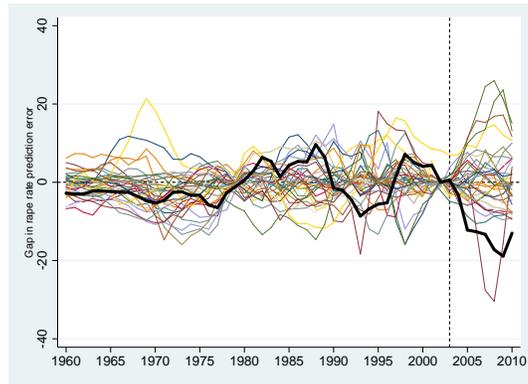
Figure 15 Per capita rape gaps in Rhode Island and placebo gaps in all 41 control states (discards states with pre-decriminalization RMSPE 2 times higher than RI's)
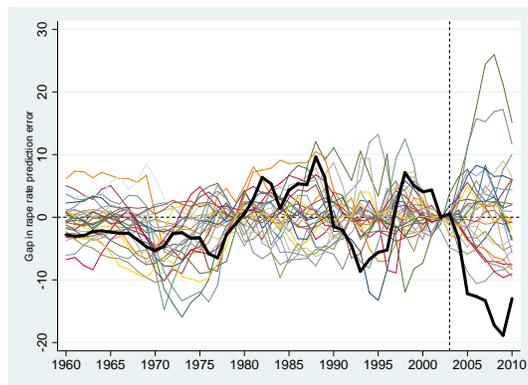
Figure 16 Per capita rape gaps in Rhode Island and placebo gaps in all 41 control states (discards states with pre-decriminalization RMSPE 1.5 times higher than RI's)
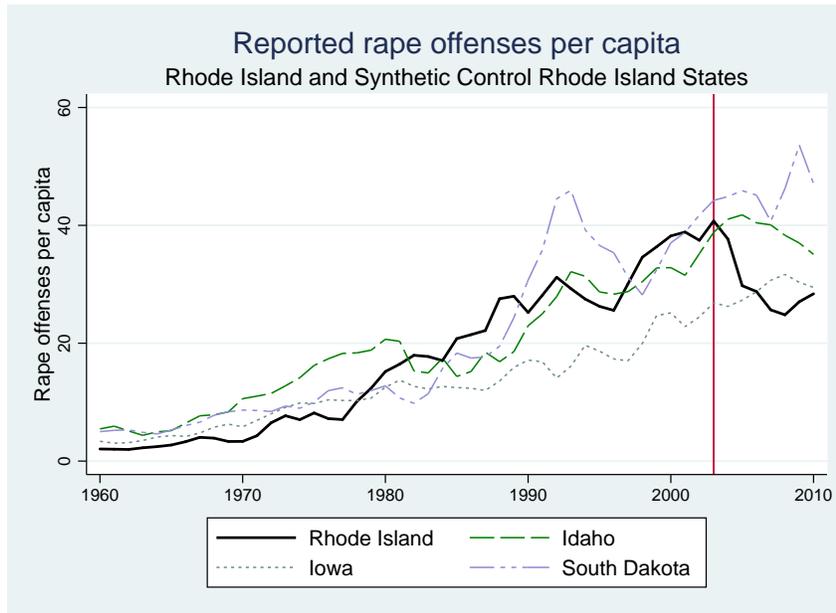
Figure 17 Per capita rape for Rhode Island and synthetic control Rhode Island states
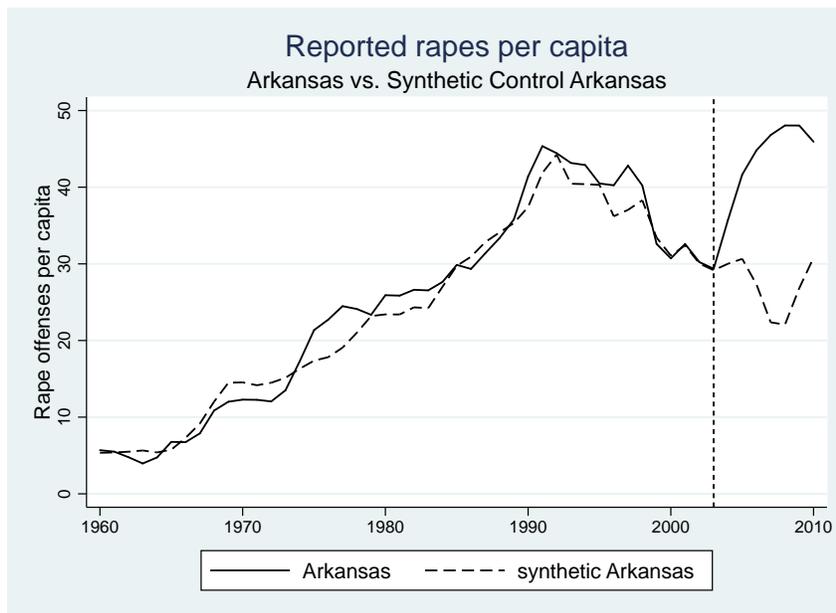
Figure 18 Per capita rape offenses for Arkansas and synthetic control Arkansas
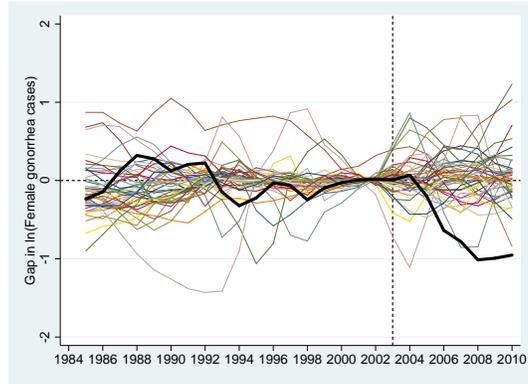
Figure 19 Per capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states
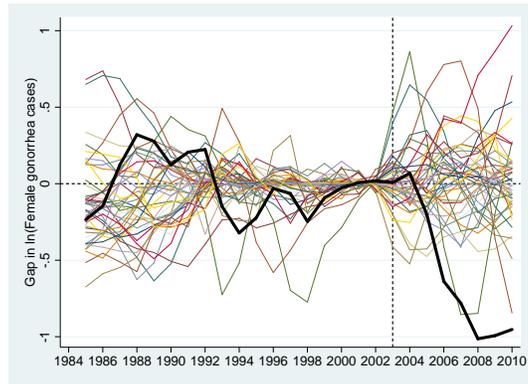

Figure 20 Per capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states (discards states with pre-decriminalization RMSPE 2 times higher than RI's)
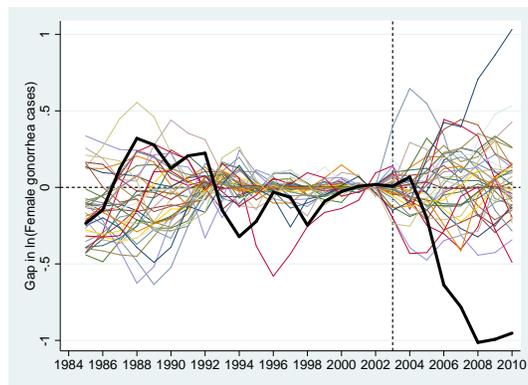

Figure 21 Per capita gonorrhea gaps in Rhode Island and placebo gaps in all 51 control states (discards states with pre-decriminalization RMSPE 1.5 times higher than RI's)
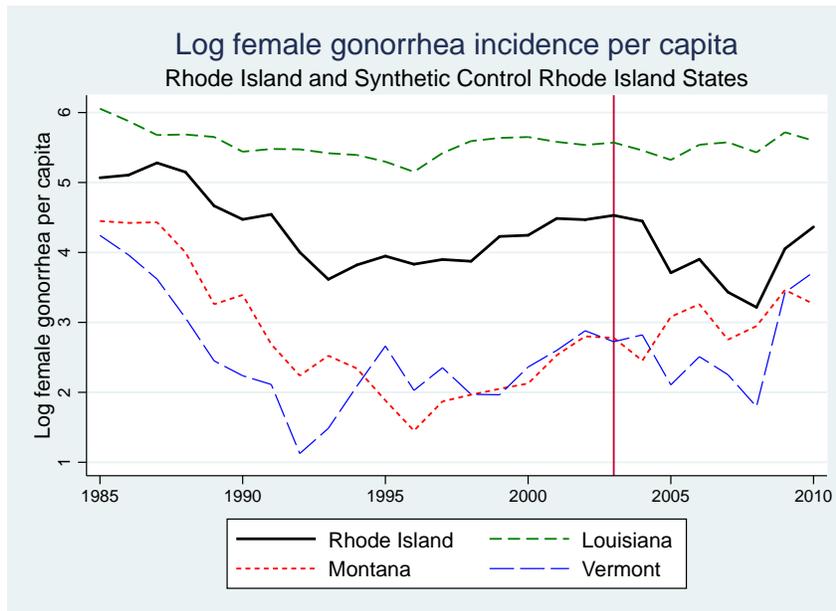
**Figure 22** Per capita gonorrhea for Rhode Island and synthetic control Rhode Island States
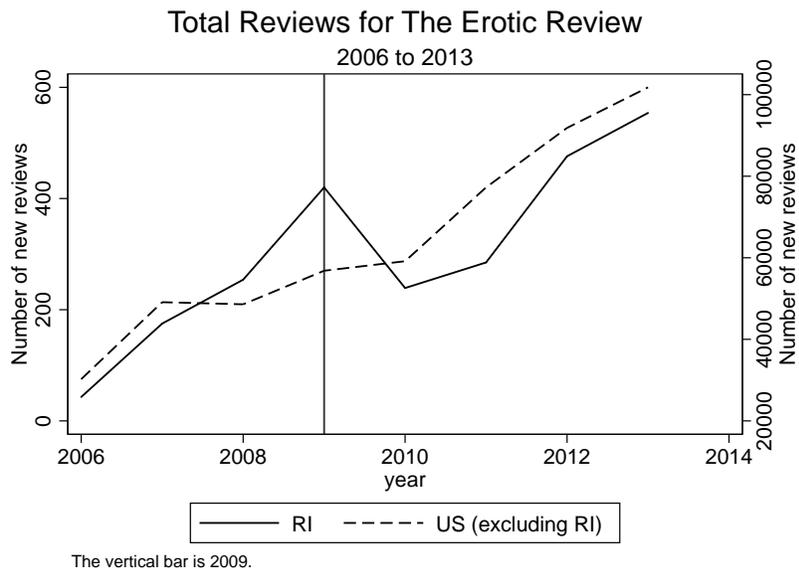
Figure 23 Total Erotic Review Data after Re-criminalization