

Pornography, Rape, and the Internet

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The arrival of the internet caused a large decline in both the pecuniary and non-pecuniary costs of accessing pornography. Using state-level panel data from 1998-2003, I find that the arrival of the internet was associated with a reduction in rape incidence. However, growth in internet usage had no apparent effect on other crimes. Moreover, when I disaggregate the rape data by offender age, I find that the effect of the internet on rape is concentrated among those for whom the internet-induced fall in the non-pecuniary price of pornography was the largest – men ages 15-19, who typically live with their parents. These results, which suggest that pornography and rape are substitutes, are in contrast with most previous literature. However, earlier population-level studies do not control adequately for many omitted variables, including the age distribution of the population, and most laboratory studies simply do not allow for potential substitutability between pornography and rape.

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I. Introduction

A long-standing question in the social sciences concerns the relationship between exposure to sexually-explicit materials and various anti-social behaviors, among the most grave of which is the propensity to commit rape. Understanding the nature of this relationship is clearly crucial to effective policymaking and judicial decision-making with respect to free speech and obscenity issues specifically, and to the regulation of private behavior more generally. Previous studies on the relationship between pornography and sexual violence, some of which are reviewed in a following section, have been limited in a variety of ways, including the inability to control for relevant confounding factors and by the relative invariance in the price and availability of pornographic¹ materials over time and across locations during the relatively recent period over which rape statistics are available.

In contrast, this paper considers a major decline in the price of such materials, brought about by the growth of the world wide web, and of the graphical browsers used to access it. Using state-level panel data on the rise of the internet, I find that internet access appears to be a *substitute* for rape. Specifically, the results suggest that a 10 percentage point increase in internet access is associated with a decline in reported rape victimization of around 7.3%. While admitting that data quality, omitted variables, functional form assumptions, and other confounding factors could potentially cause bias, I support this claim with six separate pieces of evidence. When considered as a whole, the empirical case is more compelling.

¹ In this paper, I do not attempt to distinguish between different content-types of sexually-explicit materials. Although some scholars make a distinction between “erotica” and “pornography”, the former of which is perceived more positively, I lump all sexually explicit materials under the term “pornography” due to limitations of the data. Moreover, these distinctions are often subjective, making empirical identification of each infeasible even with improved content data.

First, I use a simple differences-in-differences approach to show that states that adopted the internet quickly saw larger declines in rape incidence than other states (while no similar effect is evident for homicide). Second, I show that this effect is most concentrated among states with a high ratio of male to female population, suggesting that men are substituting pornography for rape most when potential mates are in low supply. Thirdly, I use regression analysis with fixed state and year effects to show a negative correlation between internet access and rape, even controlling for a wide variety of other factors. Fourth, I show that a similar analysis evidences neither a statistical nor economically significant effect of internet usage on any other violent or property crime for which reliable state-level data is available. Fifth, using data on arrests, I am able to separate the effects of internet access on rape across different age groups. I find a significant negative effect of internet access on rape arrest rates among men ages 15-19 – a group for whom pornography was most restricted before the internet, while the estimated effects on arrest rates for other age groups are statistically insignificant and smaller in magnitude. Again, by contrast, I show that no similar pattern exists for homicide arrests. Finally, I also provide evidence on the correlations between internet adoption and several other measures of sexuality, including teen birth rates, prostitution arrests, marriage and divorce rates, and HIV transmission. The results generally imply that internet usage has had significant effects on sexual behavior more generally, and thus they lend credibility to the claim that the internet may impact sexual assault to the degree claimed.

As stated above, the results in this paper are inconsistent with much previous empirical literature on the question; however, they are consistent with Posner's (1994)

economic theory in which the potential complementarities of rape with the use of pornography for sexual arousal are swamped by the potential substitutability of rape with consensual and masturbatory sex, for which pornography may be a complement. Thus, pornography may be a net substitute for rape.

Before introducing the formal analysis and results below, a few notes of caution are in order.

First, serious underreporting is widely believed to afflict data on sexual assault. FBI survey data find that 58% of self-reported rapes are unreported to police.² If these rapes were a random selection of all rapes, there would be little cause for concern in interpreting the results below. However, much evidence suggests that unreported rapes differ in important characteristics: they are more likely to be “acquaintance” or “date” rapes (Koss, 1985), as opposed to “stranger” rapes,³ and they are less likely to involve physical force and injury than reported rapes (DuMont, et al, 2003, Bownes, et al, 1991).⁴ To the extent that the effect of pornography on rape might differ across these categories of rape, one should be extremely careful in extrapolating the results reported here to understanding rape generally. Issues related to underreporting will be discussed in more detail in Section V.

Second, a significant number of recent popular books and articles have associated the rise of internet pornography with a coarsening and “raunch-ifying” of American culture (Levy, 2005, Paul, 2005, e.g.). The results of this study should not be

² A wide range of estimates from different surveys, varying between 20% and 90% non-reporting rates, may be found in the literature. The FBI’s “National Crime Victimization Survey”, from which the 58% figure is derived, presents the largest nationally-representative sample.

³ And, in fact, acquaintance rapes appear to be the most common form of rape (67% of all rapes in FBI survey data, and up to 84% in surveys of college women (Koss, et al, 1987)).

⁴ However, other evidence suggests that the victim’s psychological trauma from rape is similar across all rapes (Schwartz and Leggett, 1999).

taken as rebuttal for these claims, though they do suggest avenues for further empirical research into the effects of the internet on other social indicators. More generally, these results should be taken as neither pragmatic nor ethical support for the consumption of pornography, as production and consumption of these materials may have other deleterious effects besides rape, both on the consumer and on society.

Thirdly, a very controversial element of rhetoric and academic research on rape concerns the question of whether rape is driven by sexual desire or not. Sociological and feminist scholarship over the last 25 years has typically treated rape as a crime of violence or “power”, not lust.⁵ Under this theory, therefore, consensual and masturbatory sex are not substitutable for rape. However, this view has been criticized by other scholars on empirical grounds (Ellis and Beattie, 1983), and through the arguments of evolutionary biology (Thornhill and Palmer, 2000). The findings of this paper are consistent with the possibility that at least some part of the cause for rape is sexual in nature, though the results could also be consistent with the “power” theory if viewing pornography on the internet satisfies cravings for power that otherwise would be acted out as rape. Therefore, these results cannot be fully conclusive on the question.

In addition to the literature on pornography and rape, discussed at length below, this paper also contributes more generally to a growing economic literature on the effects of the internet on society. Gaspar and Glaeser (1998) find that internet technology may be a complement for urbanization. Brown and Goolsbee (2002), Smith and Brynjolfsson (2001), Scott Morton, et al (2000), and Carlton and Chevalier (2001) consider the effect of the internet on the competitiveness of various industries. The data used in this paper is

⁵ See Brownmiller (1975) for a seminal statement of this argument. Other scholars argue that rape *is* a sexual crime, but only because sex, violence, and power are all equivalent in a patriarchal society, rendering moot the question of distinguishing between these as causes (MacKinnon, 1989).

also used by Kuhn and Skuterud (2004) and Stevenson (2003) to analyze the effect of the internet on job search and unemployment, Freeman (2002) to analyze union membership, and Fairlie (2004) to analyze school enrollment.

Interestingly, this is not the only recent research to find counter-intuitive effects of the media on social outcomes. In a similar vein to this paper, Dahl and DellaVigna (2006) find that film violence is a substitute for violent crime, and Gentzkow and Shapiro (2006) show that television viewing among children (mildly) improves test scores.

II. A Brief History of Pornography in America

The prefix porno- is derived from the Greek term for a prostitute; hence, it may be said that pornography is as old as the “world’s oldest profession”.⁶ Sexually explicit images were widespread in Classical Greek and Roman art (Hyde, 1964). However, the social stigma placed on sexually explicit materials associated with the rise of Christianity in the first millennium A.D. led to prohibitively high increases in the non-pecuniary price of pornography for most individuals. Since then, improvements in communication and transportation technology over time have slowly lowered pecuniary prices, while changes in social mores have generally trended towards lower non-pecuniary prices. On the other hand, technologically-driven declines in price have often met with attempts to, at least temporarily, increase the non-pecuniary costs of consumption. For instance, it was not long after the invention of the printing press by Gutenberg in 1440, that a declaration of Pope Paul IV in 1563 included erotic books in the *Index Librorum Prohibitorum*, a list of censored texts. In 1711, the first anti-pornography statute in the United States was passed

⁶ The “Venus of Willendorf” figurine, found in Austria, dates to as early as 24,000 B.C.E., and is believed to have served a pornographic purpose. See Lane (2000).

in the Massachusetts Bay Colony. Nevertheless, falling pecuniary prices have generally overwhelmed all such efforts in the long run.

Widely considered the first erotic novel, *Fanny Hill, or the Memoirs of a Woman of Pleasure*, was penned by an English debtor's prison inmate in 1749. *Fanny Hill* was first printed in the United States in 1810, where it met with significant, though largely illicit, demand. William Hayes, an early American publisher of erotic fiction, was said to have approached annual sales of over \$100,000 by the 1870's, despite (or perhaps because of) significant opposition from federal and state censors. Ostensible books of "advice" that nonetheless contained sexual content, such as William Alcott's *Young Man's Guide* (1833) or Alice Stockham's *Tokology: A Book for Every Woman* (1883), achieved substantial circulation. It was not until the 20th century, however, that sexually explicit *images* were widely circulated in the U.S.

Postcards or playing cards with nude images gained some clandestine popularity in the early decades of the 20th century. "Tijuana Bibles" (pornographic comic books) were illicitly circulated among schoolboys during the Great Depression. However, the Comstock Act of 1873, which prohibited the use of the U.S. Post Office to distribute sexual materials⁷ kept the costs of widespread production high, and the 1922 "Hays Code" for motion pictures deeply restricted the degree to which sexualized images could be presented in mainstream films. A number of independent "stag" films did achieve some covert distribution, the number of which increased with the invention of the automobile and improvements in the highway system, by which these films could be illicitly transported, despite the Comstock Act.

⁷ The Comstock Act applied to sexual materials other than pornography, including, e.g., contraception.

The large-scale deployments of American men abroad during World War II raised the demand for sexually explicit materials including early nude magazines (often skirting obscenity regulations by presenting themselves as reading material for sunbathing enthusiasts or as art appreciation magazines). In 1941, an issue of the widely circulated magazine *Life* portrayed film star Rita Hayworth kneeling on a bed wearing only a satin slip on its cover. Other popular magazines followed suit with similar “soft-core” images throughout the 1940’s and 1950’s.

A major milestone in the rise of the pornography industry was the first issue of *Playboy* magazine, printed by Hugh Hefner, in 1953. While it was by no means the first pornographic magazine⁸, somewhat surprisingly it met no significant legal opposition⁹, and its immediate success swamped the demand for all other pornographic magazines for many years to follow. *Playboy* sold 50,000 copies in its first two weeks, reaching a circulation of 175,000 after 1 year, and 400,000 after two years. *Playboy*’s subscription base peaked at around 7,000,000 in 1972.

Playboy’s format, though widely copied, was unmatched in circulation until the early 1970’s, with the introduction of *Hustler* magazine in 1974, founded by Larry Flynt. *Hustler* offered much more explicit images than those in *Playboy*, and the magazine had 2,000,000 subscribers by 1975.

Shortly after the founding of *Playboy*, the U.S. Supreme Court first attempted to distinguish between “obscene” and “pornographic” materials, the latter of which was to be protected under the First Amendment. In *Roth v. United States* (1957), the Court’s

⁸ *Esquire* and other men’s magazines had been slowly increasing sexual content in their pages during this period.

⁹ Apparently surprising to Hefner himself, as he chose not to sign or date the first issue of *Playboy*, fearing there might not be a second issue.

relatively lax definition of obscenity as only that which is “utterly without redeeming social importance” opened the way for legal distribution of a wide variety of previously banned material, including Henry Miller’s novel *Tropic of Cancer*, the aforementioned *Fanny Hill*, and the comedy of Lenny Bruce (Lane, 2000). The Court later attempted to enforce a more restrictive definition in *Miller v. California* (1973), proscribing materials that “taken as a whole, [lack] serious literary, artistic, political or scientific value”, and emphasizing “contemporary community standards” in defining obscenity.

In 1969, *Midnight Cowboy*, an X-rated film, won an Academy award for Best Picture, the first such film to do so. The popularity of films with explicit sexuality continued with 1970’s *A Clockwork Orange*, and *Last Tango in Paris* (1973). These films were not “ pornos”, however, since the sexuality portrayed in them was not the main focus of the plot.

The first true porno film to achieve mainstream success was *Deep Throat* (1973), although its producers and actors were later prosecuted under the new obscenity standards defined by the *Miller* case, and since then, no porno film has achieved such widespread viewership, nor has any film rated beyond R won another Academy Award for Best Picture. Nevertheless, by 1980 there were nationally around 1,000 adult film houses dedicated to showing pornos.

The next major technological invention to lower the price of pornography was the videocassette recorder (VCR), introduced by Sony in 1975. Although both VCRs and tapes were initially quite expensive,¹⁰ they allowed for much greater privacy in the consumption of pornographic moving images than was previously available. Tapes could be purchased or borrowed from many video rental shops, acquired by mail, or ordered

¹⁰ The U.S. ownership rate was only 28% as late as 1986 (Osanka and Johann, 1989)

and viewed privately in hotel rooms. However, the embarrassment of being seen in the “blue” section of a video store, or having a family member, spouse, or friend find a tape in one’s home still involved a significant non-pecuniary cost of consumption.

Nevertheless, by 1992, videocassette pornography was a \$490 million dollar sales industry (Barron and Kimmel, 2000).

In comparison with previous technology, the arrival of the internet offered a quantum leap in pornography distribution. While bulletin board systems in the 1980’s offered some distribution of erotic stories, the invention of the World Wide Web in 1993 and the first graphical browser, Mosaic, in 1995, allowed users to quickly download, view, and discreetly store pornographic photos and moving images on their home computers (Sherman, 2003). Moreover, electronic distribution involves significantly lower marginal costs of production in comparison to paper or videotape copies.

By many accounts, pornography was crucial in the development of the internet, fueling demand for streaming video and credit card acceptance applications. Due to the decentralized nature of the internet, definitive statistics on internet content are necessarily error-prone. However, there is no doubt that the rise of the internet has led to significant increases in the consumption of pornography in the U.S. By October, 2003, Nielsen Net Ratings surveys indicated that one in four internet users admitted to accessing an adult web site within the month, spending an average of 74 minutes on such sites, and these figures do not include time spent on “amateur” porn sites nor downloads from peer-to-peer services, such as Kazaa, on which 73% of all movie searches in a recent survey were for porno films. According to Ropelato (2006), 12% of all internet websites, 25% of all search engine requests, and 35% of all peer-to-peer downloads are pornographic.

The Communications Decency Act of 1996 prohibited the display of “indecent” materials to minors on the internet. This law was subsequently struck down by the Supreme Court. Previous Court definitions of pornography, such as that in the *Miller* case, focused on local community standards. As the internet is inherently non-local, there has been very little enforcement of obscenity online, although significant law enforcement resources have gone into combating sexual images of children on the web, and there are many prosecutions of individuals who download or distribute erotic images of minors. Penalties in such cases are usually significant.

While the fall in the pecuniary price of pornography due to the internet may have been constant across all groups of users, the fall in the non-pecuniary price has likely been highest among the young, who typically live with their parents. Before the arrival of the internet, these consumers’ access to, and ability to discreetly store, sexually explicit materials was thus highly restricted. The privacy in consumption and storage allowed by electronic distribution increased the availability of pornography to younger age groups significantly. According to the internet traffic measuring service comScore, 70% of 18 to 24 year-old men visit adult sites each month. Statistics from Ropelato (2006) find that the 12-17 age group is the largest demographic consumer of internet pornography, and that 80% of 15-17 year olds admit to multiple exposures to hard-core pornography on the internet. By comparison, in most states, children under age 18 are prohibited from entering adult film houses or renting pornographic videos.¹¹

¹¹ Naturally, these prohibitions have been difficult to fully enforce; nevertheless, fake IDs, bribes to video store owners or over-age persons, etc., constituted an additional cost for accessing pornography pre-internet.

III. Theory

Crime in general has long stood as a challenge to economic analysis, given the view that many criminals are psychologically disturbed, and thus, potentially irresponsive to price variation (Becker, 1968). Rapists in particular are commonly believed to be “sick” or lunatics. However, a large body of psychological and sociological research has generally concluded that this view is false – so much so that many sexual violence awareness campaigns include the statement “rapists are mentally ill” as a “rape myth” to be combated.¹²

Pornography may affect an individual’s propensity to commit rape for a variety of reasons. The production of pornography may be directly associated with sexual violence if the actors or other participants are involved without their consent, or are abused during production.¹³ However, the number of individuals producing pornography is much smaller than the number consuming it, so that if a significant effect exists, it seems more likely to arise from the “demand” than the “supply” side.

Since pornography is used to sexually arouse its consumer, this arousal may increase the demand for sex and/or for particular experiences associated with rape. Thus, pornography and rape may be economic complements. Moreover, repeated experiences with pornography can lead to conditioning, habituation, and desensitization that lowers the inhibitions or psychic costs of rape to perpetrators (Russell, 2000). Pornography consumption may also have effects on cultural norms that lead to higher levels of rape, or

¹² Many studies have found little psychological difference between rapists and other men (Fisher and Rivlin, 1971). Moreover, in a large survey of college-aged men, Malamuth, Haber, and Fishback (1986) found that 51% of respondents agreed they would commit rape if they were assured there would be no punishment.

¹³ The Meese Commission Report (Attorney General’s Commission on Pornography, 1986) presents a number of such cases.

lower women's self-esteem, a well-known risk factor for rape (Parrot, 1989). For instance, the rise of internet pornography has been blamed for coarsening culture by Paul (2005) and Levy (2005), and some feminist scholars have claimed that pornography enforces a male-dominated social hierarchy in which rape is more socially acceptable (see, e.g., Dworkin and MacKinnon, 1988, or Brownmiller, 1975, who writes, "Pornography represents hatred of women, that pornography's intent is to humiliate, degrade and dehumanize the female body for the purpose of erotic stimulation and pleasure"). Finally, pornography consumption by parents may consume time that would otherwise be spent monitoring children, leading to greater victimization risks for the children (Dornbusch, et al, 1987).

On the other hand, consumption of pornography may reduce rape if they are economic substitutes. Posner (1994) theorizes that if pornography is a complement for rape, it is likely also to be a complement for masturbation and consensual sex. If masturbation and consensual sex satisfy a potential rapist's sexual desire sufficiently, then pornography consumption could also deter rapes. If this effect is large, it might outweigh the direct complementarity, making pornography a net *substitute* for rape. Alternatively, some feminist scholars believe that certain forms of pornography are "empowering" for women, and may lead to social changes that make rape socially unacceptable. For instance, Gloria Steinem (1980) distinguishes between "erotica" and "pornography", the former of which she defines as that which presents female sexuality in a positive light, while the latter is degrading and harmful. By this theory, if internet access increases consumption of "erotica" to a large degree, this may outweigh the deleterious effects of increased pornography consumption.

It is worth noting that the internet is a relatively new technology. If the temporal effects of the internet differ from the long-run steady-state effects, then the use of extant data may err in predicting future trends.¹⁴

IV. Previous Literature on Pornography and Rape

Discussions of the relationship between pornography and rape were first addressed in a substantial way by the U.S. Commission on Obscenity and Pornography (1970). The rise of feminist studies in academia and feminism in society during the 1970's and 1980's, along with the associated popularization of slogans such as “Pornography is the theory—rape is the practice” (Morgan, 1980) led to a lengthy literature on the subject, which may be classified into three branches: population-level correlation analyses, surveys of sex offenders, and psychological laboratory studies.

In the first category, Court (1976) analyzed rape victimization rates and the availability of pornography in seven countries, finding a positive correlation between the two. Posner (1994), however, finds mixed cross-country evidence. Baron and Straus (1984) and Jaffee and Straus (1987) used state-level circulation numbers on soft-core pornographic magazines, also finding a positive relationship with rape victimization. These studies, however, are generally cross-sectional and so cannot control for unmeasured location-specific effects, nor do they fully control for some important factors, such as the age distribution of the population. Since young people are the prime consumers of pornographic materials, and also constitute a disproportionate fraction of rape offenders, this generates an upwards bias in the estimated relationship between

¹⁴ Mulligan (1995) argues that the internet may drive down profits in the production of older pornographic media, and so while consumption may be high during the early years of the internet, the long-run effect could be a decline.

pornography and rape. Moreover, as discussed in Section II above, the price of pornography in the time periods considered by these studies (1960's-1980's) did not vary much over time or across locations in comparison with the post-internet era.

Kutchinsky (1973) does consider a potentially exogenous and significant event – pornography legalization in Denmark in 1965 – and finds that rape did not increase subsequently, in comparison to other crimes.¹⁵ While this result mirrors those found in my analysis below, the Kutchinsky study lacks cross-sectional variation, and so has been criticized by Giglio (1985) and others for its inability to distinguish the effect of the legalization from other temporal factors. Most similar to my research is Wongsurawat (2006), who focuses on a different privacy technology for transmitting pornography – post office boxes. When he instruments the subscription rate to pornographic magazines with the availability of post office boxes in an area, he finds that rape and pornography are net substitutes as well. In a related, though different, vein, Dahl and DellaVigna (2006) find that movie violence is a substitute for violent crime, though the separate effects of sexual content in film is less clear.

A number of studies have correlated pornographic exposure among the population of convicted rapists and other violent offenders. Famously, several notorious serial killers, including Ted Bundy, owned extensive pornographic collections. In a sample of 256 convicted sexual offenders, Abel, et al (1985) found that 56% of rapists implicated pornography in their crimes, while Goldstein and Kant (1973) found that convicted rapists reported significantly earlier childhood exposure to pornography than a control sample of non-offenders. However, these results may simply reflect *ex post* blame-shifting on the part of criminals, and moreover, it may be that rape proclivities and

¹⁵ In fact, Kutchinsky argues that child molestation actually decreased as a result of the liberalization.

consumption of pornography are simultaneously driven by some unmeasured factor, such as the inability to attract a mate, rendering the causal nature of these correlations questionable.

In the third category of literature are a variety of laboratory studies in which, typically, male college student volunteers are exposed to pornographic content, and then tested in some way for attitudes towards women or rape. In a meta-analysis of such studies, Allen, et al (1995) find a generally small positive effect of exposure to violent pornography on acceptance of rape stereotypes and aggressive behavior. Marshall, et al (1991) find that exposure to videos of simulated rapes led to greater sexual arousal in men when exposed a second time to such materials. Zillmann and Bryant (1984) find exposure to pornography reduces subjects' desire for society to punish actual rape offenders. However, as these are laboratory studies, only attitudes towards rape – or at best, physiological arousal – can be measured, not actual rapes. Moreover, when privately consumed, pornography is often associated with masturbation or consensual sex, and thus, laboratory settings may be quite dissimilar to the typical experience with pornography. In fact, by attempting to simply *arouse* subjects, such studies allow only for complementarity between pornography and rape, ignoring completely the potential substitutability with rape derived from the use of pornography to *release* sexual tension.¹⁶

V. Data

The only subnational data on rape is that provided by the FBI's Uniform Crime Reports, which receive data from individual police agencies in all 50 states on a

¹⁶ These studies also suffer from the usual problematic elements of all laboratory research. For instance, Fisher and Greiner (1994) find that attrition from the volunteer sample among men who do not wish to view pornography biases the results of many studies.

voluntary basis. These data do not, unfortunately, provide information on victim or perpetrator characteristics, nor report the relationship between them. Moreover, rape is believed to be underreported to a greater extent than other crimes for a variety of reasons, including the social stigma associated with victimization and the difficulty of proving a lack of consent in court. To the extent that the severity of the underreporting problem is orthogonal to internet access, this will serve to raise standard errors, but will not bias the regression results. It is plausible, however, that internet access could be correlated with rape reporting, separate from its direct effect on the crime, if the internet facilitates apprehension of rapists or documentation of threats, for example. This effect would tend to bias the results towards a positive correlation between internet access and rape. Moreover, if the internet facilitates more dating and other face-to-face interactions, as in Gaspar and Glaeser (1998), this could mean more opportunities for rape. Therefore, since the results below support a *negative* correlation between internet access and rape, these results may actually underestimate the true substitutability of pornography and rape.¹⁷

On the other hand, if internet access in a state is correlated with the general state of computer technology, including forensic technology used by law enforcement to prosecute rapists, then internet access could be negatively correlated with rape reporting. In an attempt to attenuate this problem, I include household ownership of computers as a separate covariate intended to capture the state of technology in the regression analysis below. Inclusion of this control also helps to separate the proposed effect from many

¹⁷ Alternatively, though less plausibly, if internet access to pornography significantly coarsens society quickly enough, it could lower the perceived social standards for rape, leading to less victim reporting.

sample selection issues, such as the notion that computer users may have psychological characteristics that are undesirable in the marriage market.

Data on internet access is derived from the Current Population Survey's Internet and Computer Usage Supplement, which was implemented in 1998, 2000, 2001, and 2003. The survey asked, "Does anyone in this household connect to the internet from home? (yes or no)".¹⁸ Despite the statistics presented in the previous section, it goes without saying that there are many other non-pornographic uses of the internet, and not all internet users regularly access pornography. Thus, there may also be significant measurement error in the independent variable of interest.¹⁹ A different approach to such measurement issues is the use of an instrumental variable. Data on various instruments for internet access, including the state sales tax rate (following Goolsbee, 2000) and subscriptions to pornographic magazines were collected, but all turned out to be weak instruments. In the latter case, magazine subscriptions may proxy for underlying tastes for pornography, but these magazines are also substitutes for internet pornography.²⁰

Despite all of these potential problems, the results presented in the following section are highly suggestive of a relationship between pornography and rape. Nevertheless, it must be admitted that from this analysis one cannot fully distinguish between the effect of pornography and that of other content available online. Moreover,

¹⁸ In two of these years, questions were asked about internet usage at work. However, there is not enough data to perform any substantial analysis; moreover, access to sexually explicit materials at work is usually restricted by employers.

¹⁹ Another source of state-level data on internet usage exists, collected by the market research firm Forrester Research. These data have been used in other studies (e.g., Goolsbee, 2000), but are inappropriate for use in this survey because they consistently undersample lower income and occupational class households, among which rapists are particularly concentrated (Amir, 1971).

²⁰ I also considered other data, such as measurements of the use of computers for non-internet purposes, such as word processing. Ideally, one could run a falsification test to see whether word processing has a similar effect on rape as internet use appears to have. However, the CPS data does not consistently survey for word processing or other computer uses over different survey years.

distinctions between different types of pornography, particularly “violent” and “non-violent” content, which has been an important distinction in previous literature, are problematic.

Table 1 provides some summary statistics. Nationally, the percent of households reporting internet usage at home rose from 29% in 1998 to 60% in 2003. Table 2 shows that the internet expanded much more quickly in some states than in others.²¹ Between 1998 and 2003, the percent of households connecting to the internet more than doubled from 24% to over 64% in North Dakota; by contrast, in New Mexico internet usage only grew from 28% to 47%. The reasons for differential growth rates are varied. Goolsbee (2000) finds that state sales taxes can explain much of the rise in internet commerce, while the results of Goolsbee and Klenow (2002) suggest that peer effects are important in the diffusion of the internet. Undoubtedly there are many other factors that also determine the differential rates of internet usage across states; many of these I attempt to control for in the analysis below.

VI. Results

I first present two simple “differences-in-differences” experiments that illustrate the main results of the paper. These analyses do not control for many important factors, and so later I will present a more formal regression analysis; nevertheless, the basic results will remain unchanged.

Using the data in Table 2, which ranks states by rapidity of growth in internet usage, I divided the states into two groups: a “Quick Adopters” group, composed of the

²¹ Stevenson (2003), who uses a different dataset, also finds significant cross-state variation in the diffusion of the internet.

first 26 states in the table, and a “Slow Adopters” group, composed of the other 25 states (including the District of Columbia). The top panel of Table 3 gives within-group means of rape incidence per 100,000 residents in 1995, when home internet access was quite rare, and in 2003. Taking the 2003 – 1995 difference in each group, the results show that rape incidence rates fell by 4.7 rapes per 100,000 in the Quick Adopters group, but only by 2.5 rapes per 100,000 in the Slow Adopters group (this difference is even larger when considered in percentage terms). Therefore, a differences-in-differences estimate of the effect of internet adoption on rape is -2.2 rapes per 100,000 residents. A back-of-the-envelope calculation using this number implies that a 10 percentage point increase in internet access is associated with a 11.7% decline in reported rape.²² This figure is slightly larger than the estimate I find in the regression analysis below which controls for a number of other factors, but not unreasonably so. It is also notable that a similar analysis of the 1990 to 1995 period shows practically no differences between the two groups’ rape victimization rates; thus, the results do not seem to be driven simply by the continuation of previous time trends.

As another check on these results, the lower panel in Table 3 performs the exact same analysis for homicide incidence per 100,000 residents. It can be seen that homicide actually fell more slowly between 1995 and 2003 in the Quick Adopter states than in the Slow Adopter states. Thus, this analysis suggests that the measured effect is not simply due to omitted variables that may affect crime generally, such as income or law enforcement resources.

²² Since the internet grew on average in the Quick Adopter states by 33.79 percentage points between 1998 and 2003, versus 28.50 percent for the Slow Adopters, the experiment suggests that a state in which the internet grew 5.29 percentage points more would have 2.2 fewer rapes per 100,000 residents. Given a national average of 35.66 rapes per 100,000 in 1998, this is roughly an 11.7% decline.

Figures 1, 2, and 3 provide a different approach to the data that looks specifically at the hypothesis of substitutability between pornography and rape. Here, I separate the 51 states (including D.C.) into three groups, categorized by the ratio of males, aged 15-24, to females, aged 15-24, in 2003. If internet pornography is being used as a sexual substitute for rape, then states where the supply of potential mates is low should see a stronger substitution effect.²³ I focus on ages 15-24 because these are the highest-risk ages for victimization and offense rates. Figure 1 illustrates the relationship between the change in rape incidence, 1998 – 2003 and the change in household internet usage over the same time period for the 17 states with the highest 15-24 year old male-to-female ratios. The estimated effect, illustrated by the least-squares regression line, implies that a 10 percentage point increase in internet usage is associated with a 15% lower rape incidence rate (and this effect is statistically significant at the 1% level).²⁴ Figures 2 and 3 perform the same analysis for the 17 states with the mid-range, and low 15-24 year old male-to-female ratios, respectively. In each of these cases, the estimated effects are statistically insignificant.²⁵

Comparing the results in these Figures, the potential substitutability between pornography and rape appears to be concentrated in those states in which such a substitute is most attractive under the theory considered in the previous section.²⁶

²³ Males constitute over 99% of all rape arrestees, according to FBI survey data, although admittedly, victims of female rapists may be less likely to report.

²⁴ The t-statistic is 3.32.

²⁵ The regression line in Figure 2 implies that a 10 percentage point increase in internet usage is associated with a 2.9% increase in rape incidence. In Figure 3, the estimated effect implies that a 10 percentage point increase in internet usage is associated with an 11.5% increase in rape incidence. In neither case, however, is the effect statistically distinguishable from zero (the t-statistics are 0.31 and 1.15, respectively).

²⁶ While male-female ratios do not differ very much across states, most crimes are committed by a relatively small group of people, so it is plausible that the extant variation is the most relevant variation.

Simple estimators like those presented so far illustrate plainly the results of the paper; however, it may be argued that they fail to fully control for the many omitted variables that potentially affect both pornography consumption and rape simultaneously. A more sophisticated regression analysis which attempts to control for these factors follows.

I seek to estimate a relationship between internet activity and rape of the following form:

$$[1] \quad \ln(\text{rapes per capita})_{it} = \beta[\text{internet usage}]_{it} + \alpha X_{it} + \eta_i + \gamma_t + \varepsilon_{it}$$

where i indexes U.S. states, t indexes years, X_{it} is a vector of covariates, and η_i and γ_t represent state and year fixed effects, respectively. As in the previous analyses, internet usage is measured as the fraction of households reporting home internet access.

Column 1 of Table 4 presents the results from estimating equation [1]. The regression coefficients are derived from a weighted least squares technique, with the weights determined by state populations. The t-statistics, presented in parentheses below each coefficient, are derived from a panel-data Prais-Winsten approach that adjusts for heteroskedasticity, temporal correlation across states, and an AR(1) process for within-state autocorrelation.²⁷ The regression includes a number of covariates identified as relevant in empirical studies of crime, as well as variables identifying gender-specific age distributions – in particular, there are 16 variables specifying the fraction of the population in each five-year gender-age group between 10-14 and 45-49. I focus on

²⁷ Donohue and Levitt (2001) and DellaVigna and Pollet (2006) use very similar empirical strategies to approach aggregated data.

these ages because they encompass most of the age distribution of rape victims and offenders.²⁸ State and year-level fixed effects are also included. Other covariates include legal variables, such as prison populations, police force size, a dummy for the existence of a concealed handgun law (Lott and Mustard, 1997), and capital punishment rates²⁹; and economic variables such as poverty, unemployment, per capita income, and human capital measures. I also include a measure of alcohol consumption, since this is known to be an important risk factor in rape victimization (Koss 1985), and the population density to control for urban/rural differences across states. Also, following Donohue and Levitt (2001), I include what those authors refer to as the “effective” abortion ratio, a measure of the lagged effect of abortion on crime.³⁰ Finally, to emphasize that it is internet usage specifically implicated in the measured effects, and not any factor associated with technology generally, I include the percentage of households owning home computers as a covariate in all regressions.

The coefficient on internet access in column 1 implies that an increase in home internet access of 10 percentage points is associated with an 7.3% decline in rape. Since there were 93,433 rapes reported in the U.S. in 2003, a back-of-the-envelope calculation implies that a 10 point increase in the percent of the population with internet access is associated with a reduction on the order of 6,800 reported rapes. As discussed earlier,

²⁸ Inclusion of variables for other age groups does not change the results much, but does reduce the degrees of freedom in the regression. Given the maximum of 204 data points (51 states x 4 years) in these analyses, there is a tradeoff involved with inclusion of more covariates. Inclusion of the 0-4 and 5-9 age groups generally increases the size of the internet coefficient, while inclusion of age groups beyond age 50 tends to diminish the size of the coefficient, although none of these effects are large.

²⁹ While the death penalty is not usually relevant in rape cases, this factor, as well as the concealed handgun law variable, may be thought of as proxies for general attitudes towards criminal punishment in a state.

³⁰ The effective abortion rate is a crime-specific weighted average of lagged (abortions/1,000 live births) ratios, with weights determined by the age-structure of the contemporaneous arrestee population. Loosely speaking, it is an attempt to measure the fraction of potential criminals in a given year who are “missing” due to abortion. See Donohue and Levitt (2001) for details on the construction of this variable, and see Joyce (2003) for criticisms of its use.

trepidation is in order for extrapolation of these results to unreported rapes, which have different characteristics than reported rapes, but if the non-reporting rate is 50-80%, then the number of deterred rapes could be higher by a factor of 2 or 3. Estimates on covariates in column [1] are generally of expected sign, although collinearity between variables may explain some counter-intuitive results, making these coefficients less reliable.³¹

The regression in column 1 may be criticized on a number of grounds. Despite attempts to include a number of relevant covariates, it is possible that internet access could be proxying for some correlated omitted variable. Functional form, causality, and econometric technique issues may also be problematic. Hence, while providing more evidence than the simple differences estimates explored earlier, I still do not claim that the results of column 1 are definitive.

As another test of the hypothesis that pornography is a substitute for rape, I ran regressions of precisely the same form as in column 1, changing only the dependent variable from the rape incidence rate to the incidence rates for other crimes. If omitted variables or functional form issues are driving the results in column 1, these are likely to be equally evident for crimes other than rape. Columns 2 and 3 of Table 4 present the results with the dependent variables being the violent crime rate (including murder, rape, robbery, and assault) and the property crime rate (including larceny, burglary, and auto theft). In neither case is there a statistically significant relationship between internet

³¹ The fact that the estimated coefficient on the effective abortion rate is insignificant for rape, and rarely significant for other crimes in Table 4 should not be taken as a refutation of the results in Donohue and Levitt (2001), since my sample period is much shorter than theirs and the abortion variable does not vary much. Moreover, most individuals in high crime risk cohorts in 1998-2003 were born after the national legalization of abortion in 1973, so that the crime-reducing effects of abortion are mostly complete before the start of the sample.

access and the crime rate, and the magnitude of the coefficient is greatly diminished (and, in fact, of opposite sign).

Columns 4, 5, and 6 in Table 4 present results for each non-rape violent crime separately. Again, there is no evident relationship between internet access and the murder, robbery, or assault rates.³²

Next, I separated out the data by age group. The FBI's offense data cannot be separated by age; however, data on arrests can be so separated. While not all those arrested for rape are convicted, nor are all guilty rapists ever arrested, arrest data presents the only way to empirically consider the effects of pornography by age.³³

Again, regressions identical to those in equation [1] were run, but with the crime rate replaced by the state-level age-specific male arrest rates for rape. Since there are a significant number of states with zero arrests in some age cohorts (especially the under 15 and over 40 cohorts), I ran these regressions in levels instead of in natural logarithms.³⁴ I then divided through each estimate by the national age-specific male arrest rate over the sample period to arrive at "normalized" coefficients, which are, to a first-order approximation, in percentage terms. These coefficients are reported in column 3 of Table 5. Coefficients on other variables are suppressed for readability.

These results show that the substitution effect of internet access on rape is statistically significant only for men in the 15-19 age group, and, moreover, that the magnitude of the coefficient is highest for this group as well. This is further evidence

³² Since rape is a violent crime, I only separate out other violent crimes in table 3; however, unreported analysis shows there is no relationship between internet access and any measured property crime either.

³³ See Levitt and Miles (2004) for caveats with respect to the use of arrest data. Rape arrest data may be especially error-ridden, given some research that suggests a significant number of false rape allegations (Kanin, 1994).

³⁴ A similar pattern is evident if the data is logged, however, though the number of observations is significantly lower.

consistent with the hypothesis that pornography is a substitute for rape, since as discussed in Section II, the internet lowered the non-pecuniary price of pornography most among those for whom privacy concerns made pornography relatively unavailable before the internet (e.g., men living at home with their parents). The effect for men aged 20-29 is also negative, consistent with the theory, although these effects are not statistically significant. The smaller measured effect of the internet on rape arrests, relative to the measured effect on reported rapes in Table 3 is not surprising, given that most crime is concentrated among a small number of offenders – thus, one fewer rapist may be associated with many fewer reported rapes (Marvell and Moody, 1994).

These age-specific results also help to separate out the effect of internet pornography on rape from the potential effect of internet dating sites or chatrooms where singles meet. These sites might also reduce rape by lowering the cost of matching individuals into consensual relationships, which could also serve as substitutes for rape.³⁵ In a survey of over 22,000 users of a major internet dating site, Hortacsu, et al (2004) finds that only about 50% of users self-report ages under 25, and none are under age 18.³⁶ Since at least half of the users of these sites are over 25, one would expect to see a similar substitution effect of internet access on rape for older men if it were internet dating sites, not pornography, driving the results. By contrast, the prime consumers of pornography are teenagers and men in their early twenties, a fact that *is* consistent with the age-specific analysis here.

³⁵ On the other hand, as discussed earlier, more dating also means more opportunities for date rape.

³⁶ Self-reporting could lead to a bias towards younger ages. This site, like most dating sites, is not available to those under age 18, although it probably would not be difficult for a teenager to report his age as 18 in order to use the site.

Table 6 is identical to Table 5, but again considers homicide in lieu of rape. The results in Table 6 show that the age-specific results evident for rape in Table 5 are not evident in Table 6. In fact, there seems to be no discernible age trend whatsoever, with most estimates clustered around zero.³⁷ Table 6 therefore buttresses the results of Table 5 by suggesting that the effect measured is rape-specific, not an effect of some omitted factor that impacts crime generally.

Finally, the results in Table 7, while not providing direct support for the hypothesis of substitution between pornography and rape, do speak to its general plausibility. In particular, by the theory presented in this paper, pornography is a substitute for rape because it is a complement for other means of sexual release, such as masturbation or consensual sex. If the internet is indeed having a significant effect on sexual assault, one would expect to also see significant effects of internet usage on other measures of sexual behavior. As a test of this hypothesis, Table 7 considers the relationship between internet usage and five other measures of sexuality: teen birth rates, prostitution arrest rates, marriage rates, divorce rates, and HIV infection rates. Again, I use the same functional form from equation [1], although eliminating the law enforcement variables, except in the case of prostitution.

The results of this analysis show that internet access is negatively correlated with teen births and prostitution arrests, and positively correlated with new marriages, divorce, and HIV transmission. The first two effects are clearly consistent with the hypothesis of this paper, since if internet pornography is a complement for masturbation, fewer births (especially among teenagers, who access pornography at higher rates) and less

³⁷ The apparently large (though statistically indistinguishable from zero) effects in the 10-14 and 45-49 age groups may be due to small sample size, given the very low number of homicide arrests in these age groups.

prostitution should result.³⁸ The effect on HIV transmission could be interpreted as inconsistent with the theory presented here, although if pornography is a complement for consensual sex, higher HIV transmission rates could still result. The apparently positive effects of internet access on new marriages and divorce, suggesting more “turnover” in the marriage market where the internet is popular, do not have obvious implications for the results presented above, but as with the other results in Table 7, they buttress the major results presented above by showing that the internet is having significant effects on many types of sexual behavior, not just sexual assault.

VII. Conclusion

The results above suggest that potential rapists perceive pornography as a substitute for rape. With the mass market introduction of the world wide web in the late-1990’s, both pecuniary and non-pecuniary prices for pornography fell. The associated decline in rape illustrated in the analysis here is consistent with a theory, such as that in Posner (1994), in which pornography is a complement for masturbation or consensual sex, which are themselves substitutes for rape, making pornography a net substitute for rape.

Given the limitations of the data, policy prescriptions based on these results must be made with extreme care. Nevertheless, the results suggest that, in contrast to previous theories to the contrary, liberalization of pornography access may lead to declines in sexual victimization of women. The results in Table 7 suggest that the internet has had

³⁸ These results are also consistent with other hypotheses, of course. For instance, teenagers may be using the internet to gain access to information on contraception, and the internet may help to more discreetly match prostitutes and “johns”, lowering the probability of arrest. A more complete analysis is necessary to fully separate these effects; nevertheless, the reduced-form result is consistent with the theory presented in this paper.

large effects on important social behaviors; further exploration of these effects is necessary to fully understand these results, however.

Data Appendix

Arrests by Age

From Federal Bureau of Investigation, produced and distributed by Inter-university Consortium for Political and Social Research, University of Michigan-Ann Arbor.

Beer Consumption

Consumption of malt beverages from the Beer Institute's Brewer's Almanac [annual], in gallons consumed per capita.

Computer and Internet

Percentage of households with computers and with internet access at home, respectively, as measured by Current Population Surveys performed by Bureau of Labor Statistics in October, 2003, September, 2001, August, 2000, and December, 1998. Accessible from BLS website:

<http://www.bls.census.gov/cps/computer/computer.htm>.

Crime and Police

All crime and police data used in the analysis are from Federal Bureau of Investigation Crime in the United States [annual].

Density

Resident population per square mile, from Bureau of the Census, United States Statistical Abstract [annual].

Divorces

Counts of divorces by state of occurrence from National Center for Health Statistics, Division of Vital Statistics, National Vital Statistics Reports [annual].

Effective abortion rate

An estimate of abortion prevalence among criminals, calculated by Donohue and Levitt (2001) as a weighted average of abortions per 1,000 live births, with weights determined by the size of the cohort in the age distribution of arrests for a particular crime in the contemporaneous year.

$$Eff. Abortion Rate_{itc} = \sum_{a=8}^{\infty} \left[\frac{arrests_{act}}{arrests_{ct}} \right] [abortion ratio_{i,t-a}]$$

Unlike Donohue and Levitt (2001), I allow the age distribution of arrests to differ across years, and use linear interpolation to better approximate the age distribution of arrests. Abortion data is from annual surveys conducted by the Alan Guttmacher Institute, and is published in Bureau of the Census United States Statistical Abstract.

Executions

Criminal executions by state from Espy and Smykla (2004).

HIV

HIV Infection Rate from Centers for Disease Control HIV/AIDS Surveillance Reports [annual].

Human Capital Stock

Stock of human capital in the labor force from Baier, et al (2004), measured by the following formula:

$$Human Capital = \exp(0.134 \min(4, Y) + 0.101 \min(4, \max(0, Y - 4)) + 0.068 \max(0, Y - 8) + 0.0495(A - 6 - Y) - 0.007(A - 6 - Y)^2$$

where Y is average years of schooling in the state, and A is the average age in the state. See the entry under “Percent with Less than 9 Years of Schooling” for details on how average years of schooling were calculated. The rate of return on years of schooling is allowed to be non-linear. Specifically, the first four years of schooling have a 13.4% rate of return, the next four years have a 10.1% rate of return, and years after 8 have a 6.8% rate of return. On-the-job experience is related to human capital in a quadratic form. This method follows Hall and Jones (1999) and Klenow and Rodriguez-Clare (1997), who derive their rates of return from cross-country Mincerian earnings equations.

Income

Per capita state personal income, converted to 2003 dollars using the Consumer Price Index, from Bureau of the Census, United States Statistical Abstract [annual].

Low Human Capital Population

Percent of state labor force members with fewer than 9 years of schooling, adjusted for migration, from Baier, et al (2004). Following Barro and Lee (1993), a “perpetual inventory” method is employed, with a law of motion for the percent of persons with each schooling level, and initial conditions based on state-level census data from 19th century censuses.

Marriages

Yearly counts of new marriages performed from U.S. Census Bureau, Statistical Abstract of the United States [annual].

Population by Age and Gender

From Estimates for the United States, Regions, Divisions, and States by 5 Year Age Groups and Sex: Annual Time Series Estimates, U.S. Census Bureau [annual].

Poverty

Persons below poverty level, by state, taken from Bureau of the Census United States Statistical Abstract [annual]

Prisoners

Data on number of prisoners is from Correctional Populations in the United States, published annually by the Bureau of Justice Statistics. Washington, D.C. ceased holding prisoners in 2001. Data for 2003 in DC is linearly interpolated.

Shall-Issue Concealed Handgun Law

Dummy variable for whether the state had enacted a law requiring local law enforcement authorities to grant concealed weapons permits to anyone meeting certain pre-established criteria. Data come from Lott and Mustard (1997).

Teen Births

Birth rates for female teenagers ages 15-19 from National Center for Health Statistics, Division of Vital Statistics, National Vital Statistics Reports [annual].

Unemployment

Figures used represent the percent unemployed among civilian non-institutional population 16 years and older, with total unemployment estimates based on the Current Population Survey, taken from Bureau of the Census United States Statistical Abstract [annual].

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Table 1: Summary Statistics

	Mean	Standard deviation (overall)	Standard deviation (within state)
Rapes per 100,000 residents	34.28	11.56	3.16
Homicides per 100,000 residents	5.66	6.07	0.83
Percentage households accessing internet	0.48	0.14	0.12
Percentage households owning computer	0.60	0.10	0.07
“Effective” abortion rate (per 1,000 live births), from Donohue & Levitt (2001)	188.03	108.58	14.96
Prisoners per 1,000 residents	1.32	0.48	0.11
Police per 1,000 residents	1.12	0.30	0.15
Beer consumption per capita (gal.)	22.86	3.72	0.54
Executions per 100,000 residents	0.02	0.06	0.03
Poverty rate	11.04	3.37	1.43
Unemployment rate	4.65	1.21	0.84
Personal income per capita (\$2003)	27,222.74	5,235.56	2,979.05
Human capital stock from Baier, et al, (2004)	8.28	0.26	0.14
Percent of residents with less than 9 years of education	7.78	4.57	2.97
Population density (per mi ²)	356.54	1263.74	46.56

Notes: All values reported are means of annual, state-level observations for the years 1998, 2000, 2001, and 2003, with the following exceptions. The police, prisons, and executions data are lagged one year, and thus correspond to the years 1997, 1999, 2000, and 2002. The “effective” abortion rate is a weighted average of the abortion ratio per 1,000 live births for each cohort born in a state, with weights determined by the fraction of rape arrests by age in the cohort’s birth year. The human capital variables are calculated using Mincerian earnings equations estimates of the rate of return to schooling and experience. All statistics are based on 204 observations.

Table 2: Percentage Households Accessing Internet, 1998 and 2003, by State

State	1998	2003	Difference (2003 – 1998)
North Dakota	24.01	64.52	40.52
Wyoming	28.36	65.89	37.53
Iowa	25.93	63.35	37.42
Nebraska	26.16	63.01	36.85
Minnesota	32.92	69.06	36.14
North Carolina	20.69	56.71	36.02
Wisconsin	28.80	63.79	34.99
South Dakota	26.76	61.50	34.73
West Virginia	21.16	55.83	34.66
Maine	30.86	65.43	34.57
Pennsylvania	29.48	63.35	33.86
New York	27.52	61.23	33.71
Virginia	32.56	66.18	33.62
Kansas	29.78	62.60	32.82
Delaware	28.78	61.37	32.59
Oregon	33.23	65.80	32.56
Connecticut	37.71	70.16	32.44
New Jersey	35.73	68.14	32.41
Ohio	28.47	60.43	31.96
Massachusetts	33.69	65.31	31.63
Oklahoma	23.01	54.57	31.56
Missouri	27.49	58.79	31.30
Georgia	25.79	57.07	31.28
Arkansas	16.83	48.06	31.23
Maryland	36.36	67.52	31.15
California	30.87	61.81	30.94
D.C.	24.36	55.28	30.92
Louisiana	19.19	49.97	30.78
Nevada	28.74	59.32	30.59
Idaho	31.71	62.26	30.55
Kentucky	25.84	56.19	30.36
Montana	24.99	55.32	30.33
Michigan	29.10	59.41	30.30
Tennessee	24.48	54.63	30.15
Rhode Island	33.34	63.39	30.06
Texas	24.78	54.54	29.76
Florida	30.97	60.44	29.47
Hawaii	32.51	61.54	29.03
New Hampshire	43.85	72.87	29.02
Mississippi	14.75	43.34	28.59

Table 2: Percentage Households Accessing Internet, 1998 and 2003, by State (Continued)

Utah	39.25	67.71	28.46
Illinois	29.29	57.20	27.91
Alabama	24.05	51.91	27.86
Colorado	38.60	66.23	27.62
South Carolina	24.11	51.69	27.58
Vermont	37.38	64.77	27.38
Indiana	30.26	57.44	27.18
Arizona	30.92	58.10	27.17
Alaska	47.22	73.30	26.08
Washington	42.36	67.98	25.62
New Mexico	27.53	47.23	19.70

Notes: Data are from Current Population Surveys, Computer Usage Supplements

Table 3: Changes in Rape and Homicide Incidence as a Function of Internet Growth, 1998-2003

Rapes per 100,000 Residents				
	<u>1990</u>	<u>1995</u>	<u>2003</u>	<u>2003-1995</u>
26 Quick Adopting States	35.6	33.6	28.9	-4.7 (-14%)
25 Slow Adopting States	44.0	42.3	39.8	-2.5 (-5.9%)
Difference	-8.4	-8.7	-10.9	-2.2

Homicides per 100,000 Residents				
	<u>1990</u>	<u>1995</u>	<u>2003</u>	<u>2003-1995</u>
26 Quick Adopting States	6.31	5.89	4.16	-1.73 (-29.4%)
25 Slow Adopting States	10.62	9.96	6.92	-3.04 (-30.4%)
Difference	-4.31	-4.07	-2.76	+1.31

Notes: States are classified by the ranking in Table 2 above into the 26 states with the fastest growth in internet usage, and the other 25 states. The difference in rape and homicide incidence between the two groups is similar in 1990 and 1995, before widespread home access to the internet. However, by 2003, the Quick Adopting states' rape incidence rate fell significantly more than the Slow Adopting states. Such a pattern is not, however, evident for homicide.

Table 4: Panel-data Estimates of the Relationship between
Internet Usage and Various FBI Index Crimes

	ln(rapes per capita)	ln(violent crimes per capita)	ln(property crimes per capita)
Percent households accessing internet	-0.730 (2.86)	0.130 (0.41)	0.414 (1.30)
ln(prisoners per capita) (t-1)	-0.018 (0.46)	0.037 (0.75)	0.124 (4.03)
ln(police per capita) (t-1)	-0.109 (2.52)	-0.005 (0.15)	-0.109 (2.69)
Shall-issue concealed weapons law	-1.625 (0.46)	-1.618 (0.73)	-4.238 (3.70)
Executions per capita (t-1)	-0.040 (0.34)	-0.162 (1.02)	-0.090 (1.58)
Poverty rate	-0.003 (0.074)	-0.008 (2.35)	0.005 (1.47)
State unemployment rate	0.014 (1.57)	-0.021 (1.86)	0.001 (0.14)
ln(state income per capita) (\$2003)	1.19 (2.47)	0.070 (0.21)	0.154 (0.52)
Human capital stock	0.073 (0.080)	-0.173 (3.14)	0.215 (3.66)
% residents with education < 9 years (x 100)	0.602 (2.02)	-0.281 (0.77)	0.824 (5.67)
Beer consumption per capita (gal.)	-0.014 (1.57)	-0.020 (2.25)	-0.010 (1.28)
Population density (x 1000)	-0.358 (0.93)	0.137 (0.64)	-0.368 (2.74)
“Effective” abortion rate (crime-specific) (x 100)	0.178 (1.37)	-0.017 (0.23)	-0.178 (3.78)
Percent households owning computer	0.641 (3.13)	0.102 (0.30)	-0.243 (0.92)
Male population distribution (in 5-year age groups)	YES	YES	YES
Female population distribution (in 5-year age groups)	YES	YES	YES

State fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Obs.	204	204	204

Notes: The dependent variable is the log in the per capita crime rate named at the top of each column. The data set is comprised of state-level (including District of Columbia) observations for 1998, 2000, 2001, and 2003. State and year fixed effects are included in all specifications, as are variables for the percentage of the gender-specific population in each five year age group, from 10-14 through 45-49. Estimation is performed by weighted least squares, with weights determined by state populations, and standard errors are panel-data Prais-Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation.

Table 4: Panel-data Estimates of the Relationship between Internet Usage and Seven FBI Index Crimes (Cont.)

	Ln(murders per capita)	Ln(robberies per capita)	Ln(assaults per capita)
Percent households accessing internet	-0.206 (0.43)	0.299 (0.80)	-0.032 (0.07)
Ln(prisoners per capita) (t-1)	-0.192 (1.40)	-0.233 (2.63)	0.166 (3.15)
Ln(police per capita) (t-1)	-0.066 (0.68)	-0.151 (2.12)	0.031 (0.71)
Shall-issue concealed weapons law	-5.709 (0.69)	-2.964 (2.32)	-1.209 (0.44)
Executions per capita (t-1)	-0.039 (0.39)	-0.139 (0.86)	-0.299 (1.27)
Poverty rate	-0.008 (1.65)	0.000 (0.03)	-0.016 (3.15)
State unemployment rate	0.023 (1.28)	-0.003 (0.23)	-0.029 (2.42)
Ln(state income per capita) (\$2003)	0.868 (0.98)	0.644 (0.83)	-0.084 (0.32)
Human capital stock	-0.343 (2.06)	-0.052 (0.45)	-0.303 (4.12)
% residents with education < 9 years (x 100)	-1.275 (4.24)	0.313 (0.98)	-0.009 (1.82)
Beer consumption per capita (gal.)	-0.005 (0.21)	-0.034 (3.53)	-0.017 (1.52)
Population density (x 1000)	-0.592 (2.33)	0.047 (0.33)	-0.032 (0.10)
“Effective” abortion rate (crime-specific) (x 100)	0.199 (2.23)	-0.372 (4.77)	0.164 (1.24)
Percent households owning computer	0.529 (0.89)	-0.412 (1.58)	0.290 (0.69)
Male population distribution (in 5-year age groups)	YES	YES	YES
Female population distribution	YES	YES	YES

(in 5-year age groups)			
State fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Obs.	204	204	204

Notes: The dependent variable is the log in the per capita crime rate named at the top of each column. The data set is comprised of state-level (including District of Columbia) observations for 1998, 2000, 2001, and 2003. State and year fixed effects are included in all specifications, as are variables for the percentage of the gender-specific population in each five year age group, from 10-14 through 45-49. Estimation is performed by weighted least squares, with weights determined by state populations, and standard errors are panel-data Prais-Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation.

Table 5: The Impact of Internet Usage on Rape Arrests by Age
 (All Values in the Table are Coefficients on the Percent of Households
 Accessing the Internet, Other Coefficients are Not Reported)

Dependent Variable: Rape arrests per 100,000 male residents in specified age group

	[1]	[2]	[3]
Age Group:	Coefficient	National Rape Arrest Rate per 100,000 Males	Normalized Coefficient =[1]/[2]
10-14	7.300 (0.67)	6.99	1.04
15-19	-69.294 (2.82)	23.88	-2.90
20-24	-39.100 (1.25)	23.32	-1.68
25-29	-11.72 (0.60)	16.42	-0.71
30-34	2.903 (0.15)	14.60	0.20
35-39	-17.57 (0.75)	12.41	1.42
40-44	9.76 (0.93)	8.79	1.11
45-49	-14.32 (1.01)	5.34	2.68

Notes: Regressions are identical to those in Table 4, except that the dependent variables are arrest rates broken down by age category instead of overall crime rates. Covariates included are state- and year-fixed effects, the percentage of the gender-specific population in each 5-year age group, from 10-14 through 45-49, the “effective” abortion rate, once-lagged police and prisoners per capita in logs, once-logged executions per capita, state unemployment rate, logged state income per capita, the poverty rate, shall-issue concealed weapons law, beer consumption per capita, the human capital stock, the percentage of population with less than 9 years of schooling, and population density. The regressions use state-level data for 1998, 2000, 2001, and 2003. Because of missing data from some states, the regressions have only 188 observations out of a theoretical total of 204 observations. Estimation is performed by weighted least squares, with weights

determined by state populations, and standard errors are panel-data Prais-Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation. Zeros in the data make a log-linear specification infeasible; hence, column 2 supplies the national means for arrests per 100,000 male residents, and column 3 normalizes the coefficients in column 1 by these means.

Table 6: The Impact of Internet Usage on Homicide Arrests by Age
 (All Values in the Table are Coefficients on the Percent of Households
 Accessing the Internet, Other Coefficients are Not Reported)

Dependent Variable: Homicide arrests per 100,000 male residents in specified age group

	[1]	[2]	[3]
Age Group:	Coefficient	National Arrest Rate per 100,000 Males	Normalized Coefficient =[1]/[2]
10-14	-2.748 (1.14)	0.706	-3.89
15-19	2.595 (0.10)	14.53	0.18
20-24	-9.374 (0.29)	18.69	-0.50
25-29	15.780 (0.72)	10.93	1.44
30-34	10.289 (0.83)	6.28	1.64
35-39	-7.141 (0.48)	4.69	-1.52
40-44	-0.330 (0.03)	3.54	-0.09
45-49	-13.57 (1.88)	2.37	5.73

Notes: Regressions are identical to those in Table 4, except that the dependent variables are homicide arrest rates broken down by age category instead of overall crime rates. Covariates included are state- and year-fixed effects, the percentage of the gender-specific population in each 5-year age group, from 10-14 through 45-49, the “effective” abortion rate, once-lagged police and prisoners per capita in logs, once-logged executions per capita, state unemployment rate, logged state income per capita, the poverty rate, shall-issue concealed weapons law, beer consumption per capita, the human capital stock, the percentage of population with less than 9 years of schooling, and population density. The regressions use state-level data for 1998, 2000, 2001, and 2003. Because of missing data from some states, the regressions have only 188 observations out of a theoretical total of 204 observations. Estimation is performed by weighted least squares, with weights determined by state populations, and standard errors are panel-data Prais-

Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation. Zeros in the data make a log-linear specification infeasible; hence, column 2 supplies the national means for arrests per 100,000 male residents, and column 3 normalizes the coefficients in column 1 by these means.

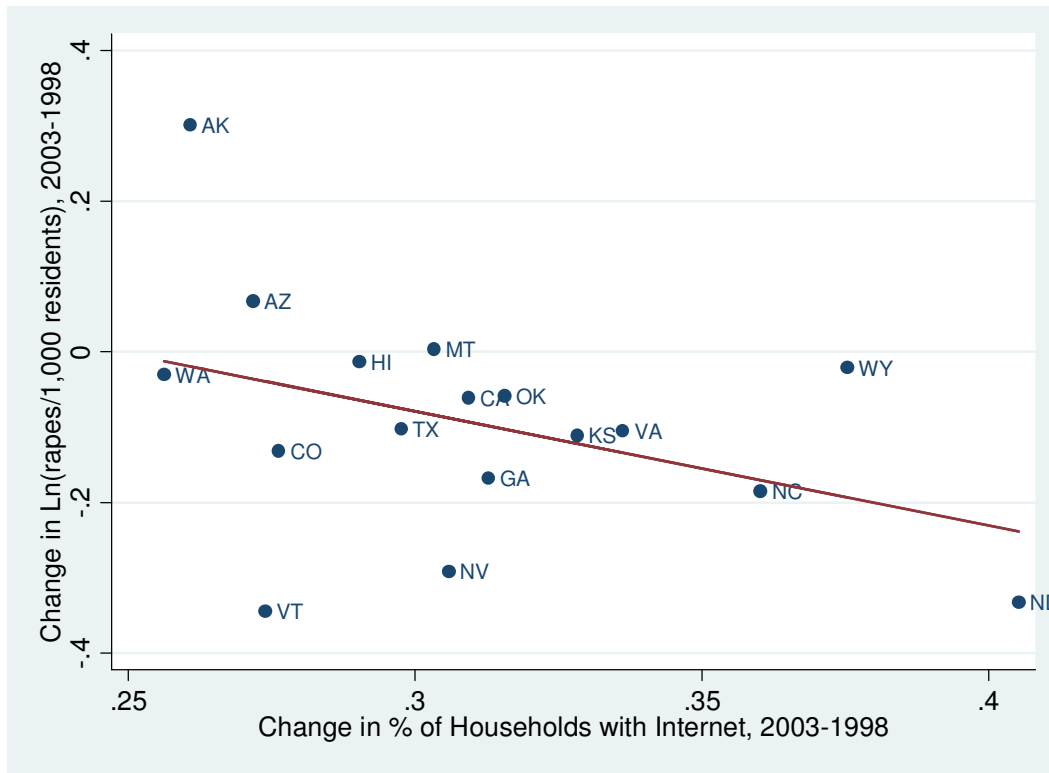
Table 7: Impact of Internet Usage on Other Measures of Sexuality

	Dependent Variables:				
	ln (teen birth rate) (t+1)	ln (prostitution arrest rate)	ln (marriages per capita)	ln (divorces per capita)	ln (HIV infection rate)
Percent households accessing internet	-0.307 (2.53)	-6.855 (4.89)	0.641 (3.06)	0.941 (3.07)	8.480 (1.80)
Poverty rate	-0.002 (0.93)	0.059 (1.67)	-0.010 (2.56)	-0.003 (0.62)	0.813 (1.61)
State unemployment rate	-0.003 (0.93)	-0.046 (0.70)	-0.041 (5.82)	-0.007 (0.60)	0.231 (1.57)
ln(state income per capita) (\$2003)	0.599 (2.76)	-2.256 (0.59)	-1.187 (3.67)	0.414 (1.16)	7.168 (1.52)
Human capital stock	-0.369 (11.97)	0.715 (0.85)	-0.096 (0.56)	0.449 (4.16)	2.086 (1.45)
% residents with education < 9 years (x 100)	-1.220 (14.98)	0.301 (0.37)	-0.419 (0.96)	0.784 (2.75)	6.491 (1.58)
Population density (x 1000)	0.038 (0.78)	13.090 (1.69)	-0.161 (1.16)	-0.432 (2.16)	-42.031 (2.56)
Percent households owning computer	0.215 (1.37)	6.512 (4.91)	-0.753 (2.18)	-0.495 (1.26)	-2.276 (0.49)
ln(prisoners per capita) (t-1)	---	-0.144 (0.34)	---	---	---
ln(police per capita) (t-1)	---	0.560 (7.54)	---	---	---
Shall-issue concealed weapons law	---	11.920 (1.21)	---	---	---

Executions per capita (t-1)	---	-0.292 (0.31)	---	---	---
Beer consumption per capita (gal.)	---	0.187 (4.46)	---	---	---
Male pop. dist. (5-year age groups)	YES	YES	YES	YES	YES
Female pop. dist. (5-year age groups)	YES	YES	YES	YES	YES
State fixed effects	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES
Obs.	153	182	192	176	124

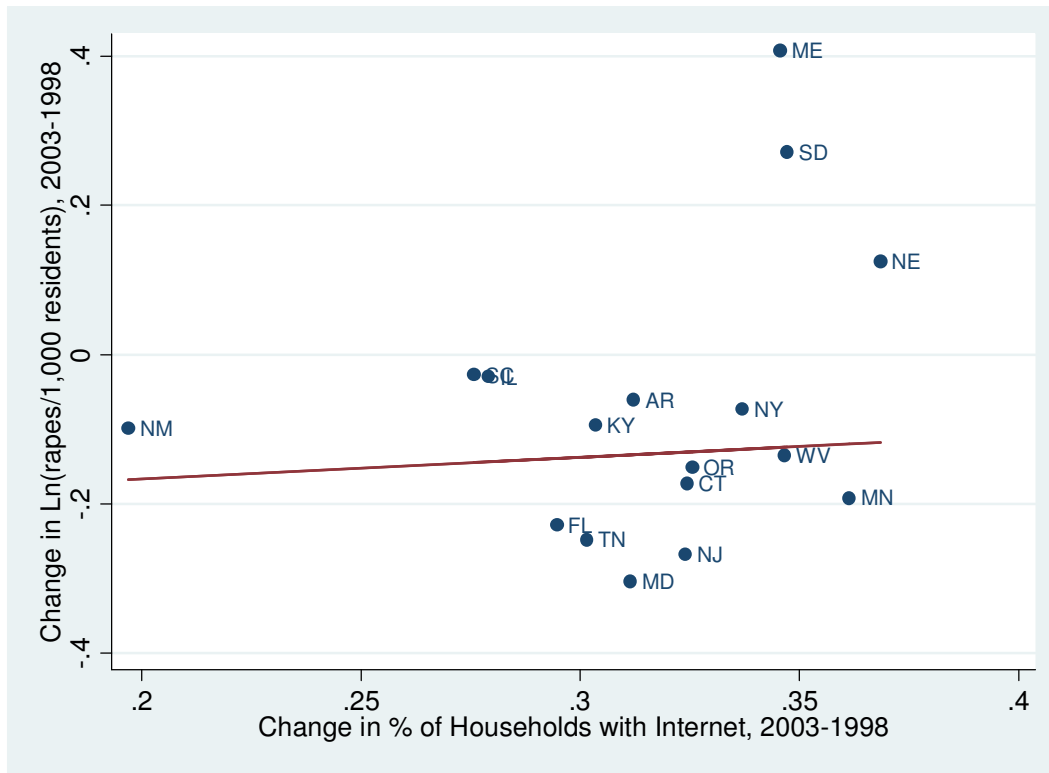
Notes: The data set is comprised of state-level (including District of Columbia) observations for 1998, 2000, 2001, and 2003. Missing data for some dependent variables reduces the number of observations from the theoretical maximum of 204 in some cases. State and year fixed effects are included in all specifications, as are variables for the percentage of the gender-specific population in each five year age group, from 10-14 through 45-49. Estimation is performed by weighted least squares, with weights determined by state populations, and standard errors are panel-data Prais-Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation.

Figure 1: Rape Incidence Changes as a Function of Internet Access Growth, 1998-2003
 17 States with High 15-24 year-old Male-to-Female Ratios



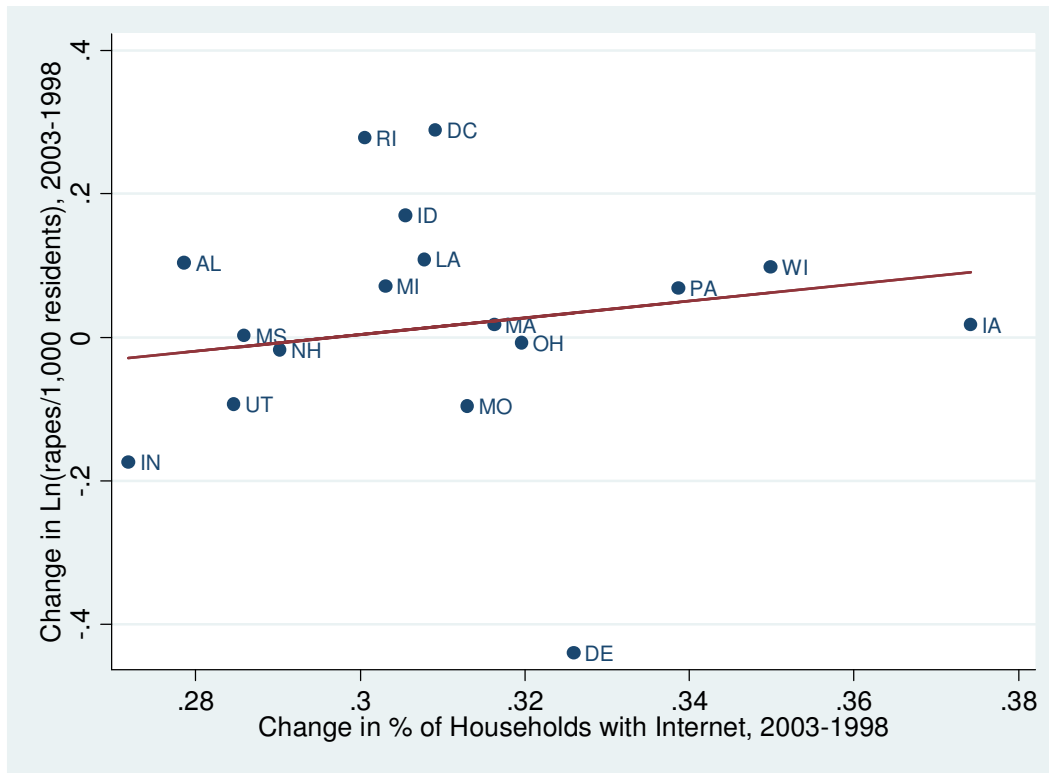
Notes: These 17 data points are states with the highest male-to-female ratios among the 15-24 year old population in 2003. The regression line indicated is a total-population weighted least squares estimate. The coefficient is -1.518, with a t-statistic of 3.32.

Figure 2: Rape Incidence Changes as a Function of Internet Access Growth, 1998-2003
 17 States with Medium 15-24 year-old Male-to-Female Ratios



Notes: These 17 data points are states with medium male-to-female ratios among the 15-24 year old population in 2003. The regression line indicated is a total-population weighted least squares estimate. The coefficient is 0.291, with a t-statistic of 0.31.

Figure 3: Rape Incidence Changes as a Function of Internet Access Growth, 1998-2003
 17 States with Low 15-24 year-old Male-to-Female Ratios



Notes: These 17 data points are states with the lowest male-to-female ratios among the 15-24 year old population in 2003. The regression line indicated is a total-population weighted least squares estimate. The coefficient is 1.168, with a t-statistic of 1.15.