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. While the internet is obviously used for many purposes other than pornography, it is notable that 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 previous laboratory studies, most of which 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 crucial to effective policymaking with respect to free speech and obscenity issues specifically, and to the regulation of private behavior more generally.[1] Previous studies on the relationship between pornography[2] 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, limitations in experimental design, and by the relative invariance in the price and availability of pornographic 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 market price of such materials, brought about by the growth of the world wide web, and of the graphical browsers used to access it, as an advantageous market experiment. However, unlike previous studies, I do not have direct measure of pornographic consumption. Instead I use state-level panel data on the rise of the internet as a proxy for the availability of pornography. I find that internet access appears to be a *substitute* for rape; in particular, 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%. Given the limitations in my measure of pornography consumption, plus the usual concerns regarding

[1] Recent important cases in the U.S. turning on this issue include *Farrell v. Burke*, 449 F.3d 470 (2d Cir. 2006) and *Mauro v. Arpaio*, 188 F.3d 1054 (9th Cir. 1999) on whether prison inmates or parollees' access to pornography can be restricted, and *Nitke v. Gonzales*, WL 3747954 (S.D.N.Y., July 25, 2005) on whether community standards can be used to restrict lewd imagery in cyberspace. Obscenity laws in Canada and other countries depend explicitly on the notion that some sexually-explicit materials may cause social harm to women (*R. v. Butler*, 1 S.C.R. 452, 89 D.L.R. (4th 1992)); thus, answering the question empirically is potentially even more important in these countries.

[2] 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.

omitted variables, functional form assumptions, and other confounding factors, such results by themselves may be unconvincing. Thus, I support this claim by showing that the internet has no apparent substitution effect on any of 25 other measured crimes, with the exception of the only other well-defined sex crime, prostitution. Moreover, I show that the effect on rape is concentrated among states with the highest male-to-female ratios, and that by age, the effect on rape is concentrated among teenage men, who are the prime consumers of pornography, and for whom the internet induced the largest change in availability. Considered as a whole, these results present a more compelling empirical case.

As stated above, the results in this paper are inconsistent with some previous empirical literature on the question, particularly controlled lab experiments; 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. Substitutability effects like these are very difficult to measure effectively in laboratory settings because sexual activity is usually not allowed there, and because market consumers of pornography are much more likely to be already aroused and seeking relief than randomly selected experimental subjects.

Before introducing the formal analysis and results below, two notes of caution are in order. First, serious underreporting is widely believed to afflict data on sexual assault[3] and unreported rapes are believed to differ in important aspects from reported ones.[4] To the extent

[3] FBI survey data find that 58% of rapes are unreported to police. 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.
[4] They seem to be more likely to be "acquaintance" or "date" rapes (Koss, 1985), as opposed to "stranger" rapes, and they are less likely to involve physical force and injury than reported rapes (DuMont, et al, 2003, Bownes, et al, 1991). However, other evidence suggests that the victim's psychological trauma from rape is similar across all rapes (Schwartz and Leggett, 1999).

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. Also, my methodological design allows me to test the relatively immediate (within-year) effects of pornography on rape; however, some effects may be cumulative, or have very long lags in their effects, and so would not be perceptible in these results.

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 and other media on society[5], and speaks to the advantages of complementing controlled laboratory experiments with market data.[6] Interestingly, this is not the only recent research to find effects of the media on social outcomes contrary to those found in controlled experiments. In a similar vein, 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 may improve test scores.

II. The Effects of the Internet on the Pornography Market

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".[7] 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

[5] For example, 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.
[6] See List and Levitt (2005) for further comparisons of these methods.
[7] 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 (Lane, 2000).

time have slowly lowered pecuniary prices, while changes in social mores have generally trended towards lower non-pecuniary prices.[8]

However, these trends have generally been quite slow, and for most of the last two millennia, there has been no systematized recording of rape victimizations. These facts have stymied many attempts to use population-level data to estimate the effects of pornography consumption on rape (though see the literature review below for some isolated examples).

By comparison, the arrival of the internet offered a rapid, quantum leap in pornography distribution.[9] While bulletin board systems in the 1980s offered some distribution of erotic stories, the invention of the World Wide Web in 1993 and the first graphical browser, Mosaic, in 1995, allowed large numbers of technologically unsophisticated 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, leading to a substantial increase in supply.

Due to its decentralized nature, definitive statistics on internet content are necessarily error-prone. However, there is little 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

[8] 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. Nevertheless, falling pecuniary prices have generally overwhelmed all such efforts in the long run.

[9] The invention of the VCR by Sony in 1975 allowed for much greater privacy in the consumption of pornographic moving images than was previously available. 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).

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 pornographic films. Moreover, 12% of all internet websites, 25% of all search engine requests, and 35% of all peer-to-peer downloads are pornographic (Ropelato, 2006).[10]

This technological innovation has not gone unnoticed by statutory authorities. Major provisions of the Communications Decency Act of 1996 attempted to strictly regulate internet pornography, although many of these provisions were later ruled unconstitutional. Currently, it is still unclear precisely how the "community standards" of decency upon which pre-internet obscenity laws were based will be interpreted and enforced in cyberspace, and there has been very little enforcement of obscenity regulations online.[11]

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

[10] In a recent prominent government study, Stark (2006) finds that only 1.1% of websites catalogued by major search engines are sexually explicit, although this excludes a large number of sites in which the user must "click through" to another page, or perform some other action in order to receive the content. Moreover, pornographic websites receive a disproportionate number of hits in comparison to other sites. In any case, as the study itself states, "[t]he number of sexually explicit websites is huge."

[11] However, significant law enforcement resources have gone into combating sexual images of children on the web, and there are many prosecutions of individuals who trade such images. Penalties in such cases are usually significant.

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.[12]

III. The Effects of Pornography on Rape

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 incentives. 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;[13] therefore, there is a *prima facie* case that potential rapists may respond to price variation in complementary and substitute goods.

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.[14] 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 lower 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 lower women's self-esteem, a well-known risk factor

[12] Naturally, these prohibitions are 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.
[13] 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. Thus, many sexual violence awareness campaigns include the statement "rapists are mentally ill" as a "rape myth" to be combated.
[14] The Meese Commission Report (Attorney General's Commission on Pornography, 1986) presents a number of such cases.

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).

On the other hand, consumption of pornography may reduce rape if they are economic substitutes. Consumers of pornography are often already aroused, and seek to use the material to relieve arousal. Thus, Posner (1994) theorizes that if pornography is a complement for masturbation or consensual sex, then pornography consumption could also deter rapes.[15]

IV. Previous Literature

The lengthy literature on the relationship between pornography and rape may be classified into three branches: surveys of sex offenders, psychological laboratory studies, and population-level correlations.

In the first group, a number of studies have measured pornographic exposure among the population of convicted rapists (e.g., Abel, et al, 1985, Goldstein and Kant, 1973), generally finding that these criminals report very high rates of exposure. However, these self-reports may simply reflect *ex post* blame-shifting on the part of criminals, and moreover, it may be that rape proclivities and 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 second 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)

[15] Naturally, this argument predates 1994. In the 1954 oral arguments before the Supreme Court in *Roth v. U.S.*, the counsel for the pornographer in question (Roth), made a similar argument, referring to pornography's potential for "Aristotelian catharsis" among potential criminals.

find a generally small positive effect of exposure to violent pornography on acceptance of rape stereotypes and aggressive behavior.[16] However, as these are laboratory studies, only attitudes towards rape – or at best, physiological arousal – can be measured, not actual rapes.[17] Also, because actual sex following pornographic exposure is not usually allowed in research labs, these studies simply do not allow for pornography's potential relieve sexual tension. Moreover, in actual market consumption, pornography is disproportionately consumed by people who are specifically seeking sexual release, not randomly assigned to typically unaroused people as in a laboratory.[18]

In the category of population-level correlations, Court (1976) analyzed rape victimization rates and the availability of pornography in seven countries, finding a positive correlation between the two. 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 may generate an upwards bias in the estimated relationship between pornography and rape. Moreover, as discussed in Section II above, the price of pornography in the time

[16] Similarly, 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, while Zillmann and Bryant (1984) find exposure to pornography reduces subjects' desire for society to punish actual rape offenders.

[17] 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. See Gross (1991) for a fuller survey and methodological critique.

[18] Although it is average treatment effect, not treatment on the treated, which seems to be implied in the typical U.S. statutory definition of obscenity, based on the "*Miller* test", which specifies that work is considered obscene if "the average person…would find that the work, taken as a whole, appeals to the prurient interest."

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, and some forms of sexual violence actually decreased. Most similar to my research is Wongsurawat (2006), who focuses on a different privacy technology for transmitting pornography – post office boxes – and also finds that rape and pornography are net substitutes as well.[19]

V. Data

The only subnational data on forcible rape[20] is that provided by the FBI's Uniform Crime Reports. 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 effect would raise standard errors but 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

[19] See also Peterson and Bailey (1988), Winich and Evans (1996), and Diamond and Uchiyama (1999) for other studies that find loosening of pornography restrictions either having no effect or reducing violence.
[20] FBI data on rape incidence only include forcible rapes of females; therefore, these data do not include most prison rapes, or other rapes of men. Moreover, non-forcible events such as statutory rape or incest are also not included.

in Gaspar and Glaeser (1998), this could mean more opportunities for rape.[21] Therefore, since the results below support a negative correlation between internet access and rape, they may actually underestimate the true substitutability of pornography and rape.

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 this could be an independent deterrent to potential rapists. 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 sample selection issues, such as the notion that new technology adopters may have unmeasured 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)".[22] Despite the statistics presented in the previous section, there are obviously many other non-pornographic uses of the internet, and not all internet users regularly access pornography.[23] Thus, there may also be significant measurement error in the independent variable of interest.[24]

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[21] Raphael and Winter-Ebmer (2001) find that the number of face-to-face interactions between men and women in a state is an important determinant of rape victimization there.

[22] 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.

[23] 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).

[24] 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. I also considered other data, such as measurements of the use of computers for non-internet purposes,

Despite all of these potential problems, the results presented in the following section are 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, 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.[25] 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 local 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.

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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.

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

Using the data in Table 2, which ranks states by rapidity of growth in internet usage over the 1998-2003 period, I divided the states into two groups: a "Quick Adopters" group, composed of the 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 reported rape incidence per 100,000 residents in 1995, when home internet access was quite rare, and in 2003.[26] 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).[27] Therefore, a differences-in-differences estimate of the effect of faster internet adoption on rape is -2.2 rapes per 100,000 residents. While the division into two groups may seem arbitrary, these results are robust to excluding the middle 10 internet growth states – those near the potentially arbitrary cut-off.[28]

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.[29]

Of course, it is possible other important factors are changing differentially between these two groups of states, causing a spurious correlation between crime rates and internet growth. Therefore, as one simple check on these results, the lower panel in Table 3 performs the exact same analysis for murder incidence per 100,000 residents. It can be seen that homicide actually

[26] The implicit assumption is that states which grew quickly over 1998-2003 also grew quickly over 1995-2003. In the more sophisticated regression analysis below, I will focus on the 1998-2003 period exclusively, since internet data before 1998 is not available, but this analysis suggests that the results hold over the longer period as well.
[27] These results are generally robust to selecting different "before" and "after" years. The 2003-1995 result presented corresponds to -0.28 on a "per-year" basis. A 2003-1994 design also generates a -0.28 change per year, while a 2003-1996 design implies a -0.24 change per year, and 2002-1995 generates a -0.13 per-year result.
[28] Comparing the fastest growing 21 states with the slowest growing 20 states generates a differences-in-differences effect of -1.8.
[29] If anything, the results present a reversal of previous trends, since the difference in rape victimization rates for between the fast-growing and slow-growing states in 1985 was -10.0, and in 1980, -11.6.

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 for rape is not likely to be due to omitted variables that affect crime generally, such as income or law enforcement resources.[30]

On the other hand, other factors that affect each crime may be varying independently between the groups of states, so these results, while suggestive, do not by themselves prove a causal relationship. The rest of this paper considers the robustness of these results, plus some auxiliary tests that point to (though of course cannot definitely prove) a causal interpretation of the results.

For instance, 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 to females, aged 15-24, in 2003. If internet pornography is being used as a substitute for rape, then states where the supply of potential mates is low should see a stronger substitution effect. I focus on ages 15-24 because this is the highest-risk age group both for victimization and offense. 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).[31] Figures 2 and 3 perform the same analysis for the 17 states with the mid-range, and low 15-24 year old male-to-

[30] See the discussion below on pages 19-20 for more details on the usefulness of murder and other crimes as baseline control groups for rape.
[31] The standard error is 0.457.

female ratios, respectively. In each of these cases, the estimated effects are statistically insignificant.[32]

Comparing the results in these Figures, the potential substitutability between pornography and rape appears to be concentrated in those states in which such a substitution effect is most important under the theory considered in the previous section.[33]

Simple estimators like those presented so far are suggestive of the theory, and 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:

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

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.[34] The standard errors, presented in parentheses below each coefficient, are

[32] 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 standard errors are 0.939 and 1.016, respectively).

[33] 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. Moreover, these results seem to be robust to a less arbitrary division of states into groups: see the regression results in Table 5, e.g.

[34] The variable of interest, internet access, is based on a survey of 50,000 households. Therefore, the number of households used to predict the state-level rate may be quite small in some sparsely populated states. Weighting by

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.[35] 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 these ages because they encompass most of the age distribution of rape victims and offenders.[36] State and year-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 rates[37]; and economic variables such as poverty, unemployment, per capita income, and human capital measures[38]. 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 urbanization 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.[39] Finally, to

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population uses the information available from the survey efficiently. Moreover, internet access is not a state policy or other "regime"-level variable, so there is no reason to consider the state the appropriate level of aggregation; the use of weights makes the individual household the implicit level of observation. Since rape is a crime primarily perpetrated by young people, and young people are also the most frequent victims, it might be argued that using the state population for ages 15-24 as weights would be more appropriate. The results below do not change substantially when the youth population is used to weight. However, as would be predicted based on this discussion, the standard errors in the results below are substantially higher if weights are excluded entirely, although the point estimates are similar.

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

[36] 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.

[37] 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. Data on executions from Espy and Smykla (2004).

[38] See Baier, et al (2004) for details on the construction of the human capital variables.

[39] 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

emphasize that it is internet usage specifically implicated in the measured effects, and not any factor associated with technology generally, such as specific forms of human capital, police technology, or characteristics of technology adopters, I also include the percentage of households owning home computers as a covariate.

The coefficient on internet access in column 1 implies that an increase in home internet access of 10 percentage points is associated with a 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, 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 were 50%, then the number of deterred rapes could be higher by a factor of 2.

The results in column 1 are for a particular specification of equation [1], which may be thought of as a "kitchen sink"-style specification, with all years, all states, and a large number of covariates included. Given that the results are similar in sign to those in the very simple, parsimonious analysis of Table 3, however, it seems likely these results are fairly robust to the specification used. Nevertheless, given the relatively small number of data points, one may be concerned that the results could be driven by a few outlier observations by year or state. In the first four rows of Table 5, I present the results of a specification identical to that in column 1 of Table 4, but I allow the coefficient on internet to vary across the four U.S. census regions.[40] While there is some variation in the effects of the internet on different parts of the country, the fact that the effect of the internet seems to be negative and statistically significant in each region

Donohue and Levitt (2001) for details on the construction of this variable, and see Joyce (2003) for criticisms of its use.

[40] Alternatively, simply excluding from the regression potential outlier states, such as D.C., California, Washington, or New York does not change the results appreciably either.

suggests that the results are not driven by a small number of state observations, but are broadly consistent throughout the country.[41]

Similarly, in the next four rows of Table 5, I allow the effect of internet to vary by year. Again, while there is some variation over time, in general the internet seems to reduce rape victimization in each year, although the effect is not statistically significant for 1998. Finally, as a check on the differences estimates by male-female ratio presented earlier, I ran a specification of equation [1] with the internet variable interacted with the state male-female ratio. Using these results, the lowest three rows of Table 5 show the estimated effect of the internet on rape victimization at the 25th, 50th, and 75th percentiles of the male-female ratio distribution.[42] As in the simple differences estimates, it appears that states with higher male-to-female ratios appear to see stronger substitution effects between the internet and rape victimization.

The inclusion of as many covariates as possible in column 1 may be criticized as well. In general, the inclusion of more control variables is likely to provide a better statistical test of a given hypothesis, since if these variables were omitted, they could covary with both internet access and rape victimization, and thus generate spurious correlations. However, given the potentially significant measurement error in both the internet and the rape victimization variables, the inclusion of too many covariates, especially those collinear with internet access, such as income or computer penetration, may reduce substantially the signal-to-noise ratio in the regression. If the noise in these variables were independently distributed, this would tend to bias

[41] Region 2's effect is different from those of the other regions in a statistically significant way; also region 1 is statistically different from region 3. All other differences in coefficients are statistically insignificant. These differences may be due to differences in pre-internet social stigma against pornography: in unreported analysis, I show that the states with the highest percentages of church-goers see a larger negative effect of the internet on rape.

[42] The regression coefficient on the internet variable is 5.49 (1.67), and that on the interacted (internet x m-f ratio) variable is -12.03 (1.84). The two variables are jointly significant at the 99%+ level. The 75th, 50th, and 25th percentiles of the m-f ratio distribution are: 0.51872, 0.51357, and 0.51057. While the male-female ratio does not vary a tremendous amount across states, since many crimes are concentrated among a small number of criminals (Marvell and Moody, 1994), small changes in demographic variables can have substantial effects on crime.

the results towards zero and raise the standard errors – thus, a bias against the findings here. On the other hand, if the measurement error in the internet variable were for some reason negatively correlated with that in the rape victimization variable, a reduction in the signal-to-noise ratio could bias the results in favor of the hypothesis.

As a check on this potential problem, I separated out thirteen of the right-hand-side variables in column 1, leaving only the internet variable, the age distribution variables, and the state and year fixed effects. Then, in the style of Leamer's (1985) "extreme bounds analysis", I ran regressions for every possible specification of equation [1] including in the covariates *X* each subset of the thirteen variables – thus, I ran 2^{13} = 8,192 regressions. Such an analysis represents a completely "agnostic" view of whether each variable should be included in the regression. Given the lengthy literature, using many different datasets and methodologies, showing the importance for crime rates of such variables as imprisonment, police, per-capita income, unemployment rates, and human capital, such an agnostic view seems flawed.[43] Nevertheless, Figure 4 plots the distribution of the coefficients on the internet variable in these regressions. As can be seen, every one of the 8,192 regression specifications delivers a negative coefficient on the internet variable, although these coefficients do vary substantially in magnitude. The mean of this distribution is -0.31, with a standard deviation of 0.16.

Not all of the coefficients are statistically significant, however. 31% of the coefficients are significant at the 95% level, and 43% are significant at the 90% level. Thus, while it seems that the negative point estimate of the relationship between the internet and rape is very robust to the inclusion or exclusion of particular covariates, the statistical significance of the relationship is not quite as robust. Moreover, this specification-agnostic view presents a relationship between

[43] See also Sala-i-Martin (1997) for further criticisms of this approach.

the internet and rape victimization that is somewhat smaller in magnitude than that presented in column 1 of Table 4.

As discussed earlier, however, such a view probably pays too little attention to the substantial information contained in previous literature that points to the propriety of including many of the variables in column 1. Moreover, given the potential for measurement error in the variables, the fact that not every specification presents a statistically significant result may not be completely surprising. In a similar analysis, Levine and Renalt (1991) find that *no* explanatory variables robustly predict output growth rates in cross-country regressions; therefore, such tests may simply be too strict for reasonable policy analysis.

Even if the result in column 1 of Table 4 were perfectly robust, it could still be criticized on a number of other grounds. For instance, the inclusion of state and year-fixed effects control for many unmeasured variables; nevertheless, it is possible that internet access could be proxying for some internet-correlated state- and time-varying 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, one cannot claim that the results of column 1 are definitive.

To provide further evidence on the hypothesis, 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 state- and year-varying omitted factors or functional form issues are driving the results in column 1, these may be equally evident for crimes other than rape, presenting a spurious negative correlation in these results as well.

While it seems natural that many omitted variables correlated with rape would also be correlated with other crimes, a "ballpark" figure on how much correlation there is between crimes is necessary to evaluate the quality of this test. Using data from 1980-1989, years well

before the widespread introduction of the internet into U.S. homes, I calculated state-level correlation coefficients of rape victimization (in logarithm) with other crimes. For murder, violent crimes other than rape, and property crimes, the correlations are 0.64, 0.66, and 0.73, respectively. Differencing out year and state fixed effects naturally lowers the correlations, however, the same three correlation coefficients are still positive and substantial: 0.20, 0.12, and 0.11. Finally, controlling for year and state fixed effects, the gender-specific age distribution of the population, as well as all 13 covariates presented in Table 4, the correlation coefficients between rape and murder, all violent crimes except rape, and property crimes, are 0.13, 0.15, and 0.09, respectively.[44] Therefore, while some of the state- and year-varying omitted variables in this period may not be correlated across crimes, a substantial number of them do seem to be so correlated. If the internet seems to have a negative effect on these other crimes, it would cast doubt on the results presented so far.

Columns 2 and 3 of Table 4 present the results with the dependent variables being the overall violent crime rate and the property crime rate. In neither case is there a statistically significant relationship between internet access and the crime rate, and the magnitude of the coefficients are greatly diminished (and, in fact, of opposite sign). In unreported analysis, I show that there is no statistically significant relationship between internet access and any individual FBI index crime (other than rape), including murder, robbery, aggravated assault, robbery, larceny, and auto theft. Thus, while it is still possible some there is some omitted variable driving spurious results in column 1, it would have to be some variable apparently uncorrelated with other crimes.

The results presented so far are based on crime-incidence data. The FBI also collects arrest data, though not incidence data, on a number of other "part 2" crimes. While data quality

[44] These correlations are also statistically significant at the 95% level or higher.

issues generally make these data less reliable than the incidence data for "index" crimes, if the internet were correlated with many of the part 2 crimes, it might cast doubt on the results presented above. Table 6 presents the coefficients on the internet variable in regressions specified similarly to those in Table 4, with the only differences being that the dependent variable is the (natural log of the) arrest total[45] for the specified crime, and the effective abortion rates are excluded, since they are crime-specific and cannot be calculated for these crimes due to lack of a long time-series of data.

Of the 18 crimes listed in Table 6, the internet is not correlated in any statistically significant way with 16.[46] Again, this suggests that omitted variables correlated with these crimes are not driving the results for rape presented above. Notably, the only crime for which the internet is negatively correlated in a statistically significant manner is prostitution, another sex crime. It is possible that internet pornography is a substitute for prostitute services as well as rape, providing another piece of evidence consistent with the hypothesis in this paper, although admittedly there are other reasons why the internet might reduce prostitution arrests.[47] Interestingly, the internet seems to be positively correlated with the number of juvenile runaways.[48]

Potentially inconsistent with the earlier results is the fact that the internet does not seem to be correlated with arrests in the "other sex crimes" category, which includes statutory rape[49],

[45] Since it is not clear what is the relevant at-risk population for many of these crimes, the total number of arrests, as opposed to the per-capita rate, is used.
[46] Drunkenness, gambling, and "suspicion" are also included as part 2 crimes in FBI data; however, the fact that these are not crimes in some states, and are rarely enforced or unreported in many others makes the number of available data points too small for systematic analysis.
[47] For instance, the internet provides many message boards where prostitutes and "escorts" may advertise their services and provide contact information, perhaps providing a more discreet means of meeting customers than traditional streetwalking.
[48] Running away is not a criminal offense, but those taken into protective custody under the provisions of local statues are counted by police. Speculatively, it may be that the internet facilitates juveniles' planning for a runaway episode, or that the internet allows police to more quickly trace and apprehend runaways.
[49] That is, non-forcible sexual relations with a minor under the age of consent.

incest, sodomy, and indecent exposure, among other crimes. It may be that internet pornography is not a good substitute for these behaviors, or it may be that the hodge-podge of very different sex crimes summed in one category blurs the true effect. Moreover, some sex-related crimes are also included in the "crimes against the family" category, which includes child abuse arrests. The internet does seem to have a negative effect on this crime category, though it is not statistically significant.[50]

Another way of dealing with the potential for omitted variables bias is to test the implication in the model that internet-based pornography may affect potential teenage rapists more so than those of other ages. If state- and time-varying omitted variables are to blame for the results presented above, most of these variables should bias the effects of the internet on rape for all ages; on the other hand, if the effects of the internet are concentrated among teenagers, then this provides another piece of evidence in support of the substitution hypothesis.

The FBI's incidence 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 present the only way to empirically consider the effects of pornography by age, though see Levitt and Miles (2004) for caveats with respect to the use of arrest data.[51]

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.[52] I then divided through each estimate by the national age-specific male arrest rate over the sample period to

[50] The "all other crimes" category also includes a (very rare) sex-related offense, bigamy, among a variety of other unrelated crimes.
[51] Rape arrest data may be especially error-ridden, given some research that suggests a significant number of false rape allegations (Kanin, 1994).
[52] A similar pattern is evident if the data is logged, however, though the number of observations is significantly lower.

arrive at "normalized" coefficients, which are, to a first-order approximation, in percentage terms. These coefficients are reported in column 3 of Table 7. 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 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 effects for men aged 20-29 are also negative, consistent with the theory, although these effects are not statistically significant. The effects of the internet on all other ages are statistically insignificant, and in fact, positive.[53]

Besides providing a useful auxiliary test on the previous results, these age-specific findings also help to separate 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. On the other hand, more dating also means more opportunities for rape victimization, so the theoretical effects of such websites are ambiguous. In a survey of over 22,000 users of a major internet dating site, Hitsch, et al (2005) finds that only about 50% of users self-report ages under 25, and none are under age 18.[54] 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

[53] The substantial variance across age groups is likely due to the fact that there are very few rape arrests in the 10-14 and 45-49 age groups.

[54] Self-reporting likely leads to a bias towards younger ages as well. 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.

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. Nevertheless, without detailed information on which sites individual users access, it is difficult to fully distinguish the effects of pornography from the effects of other sexually-related web content.

In unreported results, I also ran a similar age-specific analysis for murder, but found no effect of the internet for any age group, nor any discernable pattern in the magnitudes of the point estimates across age groups. Again, it seems the effects measured in Table 7 are rape-specific, not an effect of some omitted factor that impacts arrests at different ages generally.

To summarize the empirical results, my analysis of the effects of the internet on rape victimization suggest that internet access is associated with substantial declines in rape victimization rates, on the order of a 7.3% decline in rape from a 10 percentage point increase in internet access. Given the limited amount of data, and the potential for substantial measurement error, these results cannot be treated as fully definitive. However, if these results are spurious, and are actually driven by some omitted variable, that variable must be uncorrelated with crime generally, specific to young people, and concentrated in areas with relatively high male-to-female sex ratios. While there may be a few such variables, the most likely interpretation of the results seems to be that internet pornography is substituting for sexual violence.

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 study, policy prescriptions based on these results must be made with extreme care. More research on other countries, other time periods, or using other methodologies or datasets is necessary before broad results can be stated with confidence. Nevertheless, the results of this simple study point to what may be important flaws in the previous literature, and suggest that liberalization of pornography access may not lead to increased sexual victimization of women.

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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
Murders 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), for rape	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	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)	State	1998	2003	Difference (2003 – 1998)
North Dakota	24.01	64.52	40.52	D.C.	24.36	55.28	30.92
Wyoming	28.36	65.89	37.53	Louisiana	19.19	49.97	30.78
Iowa	25.93	63.35	37.42	Nevada	28.74	59.32	30.59
Nebraska	26.16	63.01	36.85	Idaho	31.71	62.26	30.55
Minnesota	32.92	69.06	36.14	Kentucky	25.84	56.19	30.36
North Carolina	20.69	56.71	36.02	Montana	24.99	55.32	30.33
Wisconsin	28.80	63.79	34.99	Michigan	29.10	59.41	30.30
South Dakota	26.76	61.50	34.73	Tennessee	24.48	54.63	30.15
West Virginia	21.16	55.83	34.66	R. Island	33.34	63.39	30.06
Maine	30.86	65.43	34.57	Texas	24.78	54.54	29.76
Pennsylvania	29.48	63.35	33.86	Florida	30.97	60.44	29.47
New York	27.52	61.23	33.71	Hawaii	32.51	61.54	29.03
Virginia	32.56	66.18	33.62	New Hamp.	43.85	72.87	29.02
Kansas	29.78	62.60	32.82	Mississippi	14.75	43.34	28.59
Delaware	28.78	61.37	32.59	Utah	39.25	67.71	28.46
Oregon	33.23	65.80	32.56	Illinois	29.29	57.20	27.91
Connecticut	37.71	70.16	32.44	Alabama	24.05	51.91	27.86
New Jersey	35.73	68.14	32.41	Colorado	38.60	66.23	27.62
Ohio	28.47	60.43	31.96	S. Carolina	24.11	51.69	27.58
Massachusetts	33.69	65.31	31.63	Vermont	37.38	64.77	27.38
Oklahoma	23.01	54.57	31.56	Indiana	30.26	57.44	27.18
Missouri	27.49	58.79	31.30	Arizona	30.92	58.10	27.17
Georgia	25.79	57.07	31.28	Alaska	47.22	73.30	26.08
Arkansas	16.83	48.06	31.23	Washington	42.36	67.98	25.62
Maryland	36.36	67.52	31.15	New Mexico	27.53	47.23	19.70
California	30.87	61.81	30.94				

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

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

Rapes per 100,000 Residents

	1990	1995	2003	2003-1995
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

Murders per 100,000 Residents

	1990	1995	2003	2003-1995
26 Quick Adopting States	6.3	5.9	4.2	-1.7 (-29%)
25 Slow Adopting States	10.6	10.0	6.9	-3.1 (-31%)
Difference	-4.3	-4.1	-2.7	+1.4

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 murder 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 murder.

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

	ln(rapes per capita)	ln(violent crimes per capita)	ln(property crimes per capita)
Percent households accessing internet	-0.730	0.130	0.414
	(0.254)	(0.318)	(0.320)
ln(prisoners per capita) (t-1)	-0.018	0.037	0.124
	(0.038)	(0.049)	(0.031)
ln(police per capita) (t-1)	-0.109	-0.005	-0.109
	(0.043)	(0.035)	(0.041)
Shall-issue concealed weapons law	-1.625	-1.618	-4.238
	(3.517)	(2.220)	(1.144)
Executions per capita (t-1)	-0.040	-0.162	-0.090
	(0.118)	(0.159)	(0.057)
Poverty rate	-0.003	-0.008	0.005
	(0.004)	(0.004)	(0.004)
State unemployment rate	0.014	-0.021	0.001
	(0.009)	(0.011)	(0.006)
ln(state income per capita) ($2003)	1.19	0.070	0.154
	(0.482)	(0.340)	(0.294)
Human capital stock	0.073	-0.173	0.215
	(0.073)	(0.055)	(0.059)
% residents with education < 9 years (x 100)	0.602	-0.281	0.824
	(0.298)	(0.366)	(0.145)
Beer consumption per capita (gal.)	-0.014	-0.020	-0.010
	(0.013)	(0.009)	(0.008)
Population density (x 1000)	-0.358	0.137	-0.368
	(0.384)	(0.214)	(0.134)
“Effective” abortion rate (crime-specific) (x 100)	0.178	-0.017	-0.178
	(0.130)	(0.071)	(0.047)
Percent households owning computer	0.641	0.102	-0.243
	(0.205)	(0.336)	(0.265)
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 in parentheses below each coefficient are panel-data Prais-Winsten corrected for heteroskedasticity, cross-panel contemporaneous correlation, and within-panel AR(1) autocorrelation.

Table 5: Disaggregated Effects of the Internet on Rape Victimization

	Coefficient on Internet
By Census Region:	
Northeast	-0.764 (0.260)
Midwest	-0.647 (0.229)
South	-1.09 (0.281)
West	-0.962 (0.288)
By Year:	
1998	-0.322 (0.240)
2000	-0.482 (0.243)
2001	-0.661 (0.253)
2003	-0.877 (0.244)
By ages 15-24 male-to-female ratio	
Effect at m-f ratio 25th percentile	-0.659
Effect at m-f ratio 25th percentile	-0.596
Effect at m-f ratio 25th percentile	-0.757

Notes: Standard errors in parentheses.

Table 6: Estimated Effects of Internet on Arrests for Various Part 2 Crimes

	Estimated Effect of Internet		**Estimated Effect of Internet**
Arson	2.44 (1.69)	Other sex Crimes	0.32 (1.23)
Other assaults	0.97 (1.80)	Drug violations	0.79 (1.80)
Forgery	0.66 (3.30)	Crimes against the family	-2.18 (1.98)
Fraud	0.50 (1.72)	Driving under the influence	0.89 (1.31)
Embezzlement	-3.51 (5.24)	Liquor law Violations	1.27 (2.31)
Stolen property	-1.54 (2.17)	Disorderly Conduct	1.36 (1.89)
Vandalism	0.96 (2.00)	Curfew Violations	1.39 (2.53)
Weapons violations	0.59 (1.23)	Runaways	4.46 (1.53)
Prostitution	-6.66 (1.56)	All other crimes	-0.66 (1.35)

Notes: Standard errors in parentheses. Results reported are coefficients on internet variable in regression of equation [1], with the dependent variable being the natural log of state arrests for the crime listed in each row. All covariates included in Table 4 are also included here, but the results are suppressed for readability. See notes to Table 4 for further details.

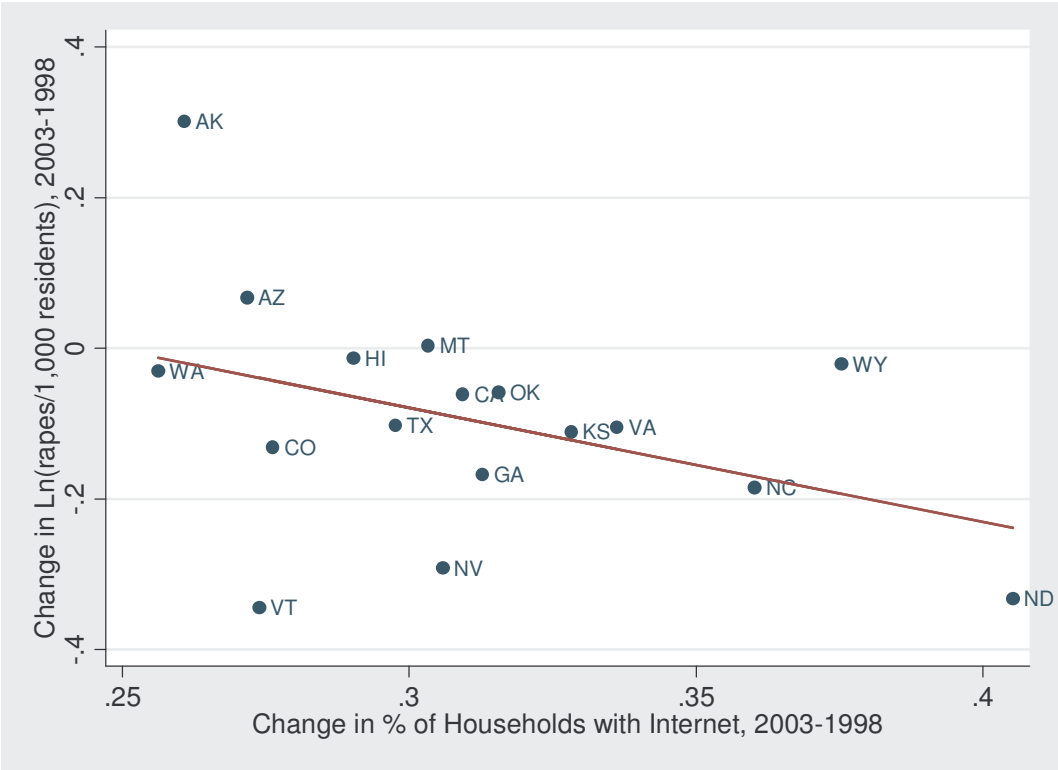
Table 7: The Impact of Internet Usage on Rape Arrests by Age
(All Values in the Table are Coefficients on the Percent of Households Accessing the Internet, Other Coefficients are Not Reported)

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	7.30 (10.84)	6.99	1.04
15-19	-69.30 (25.54)	23.88	-2.90
20-24	-39.10 (31.29)	23.32	-1.68
25-29	-11.72 (19.61)	16.42	-0.71
30-34	2.90 (19.29)	14.60	0.20
35-39	-17.57 (23.47)	12.41	-1.42
40-44	9.77 (10.56)	8.79	1.11
45-49	-14.32 (14.16)	5.34	-2.68

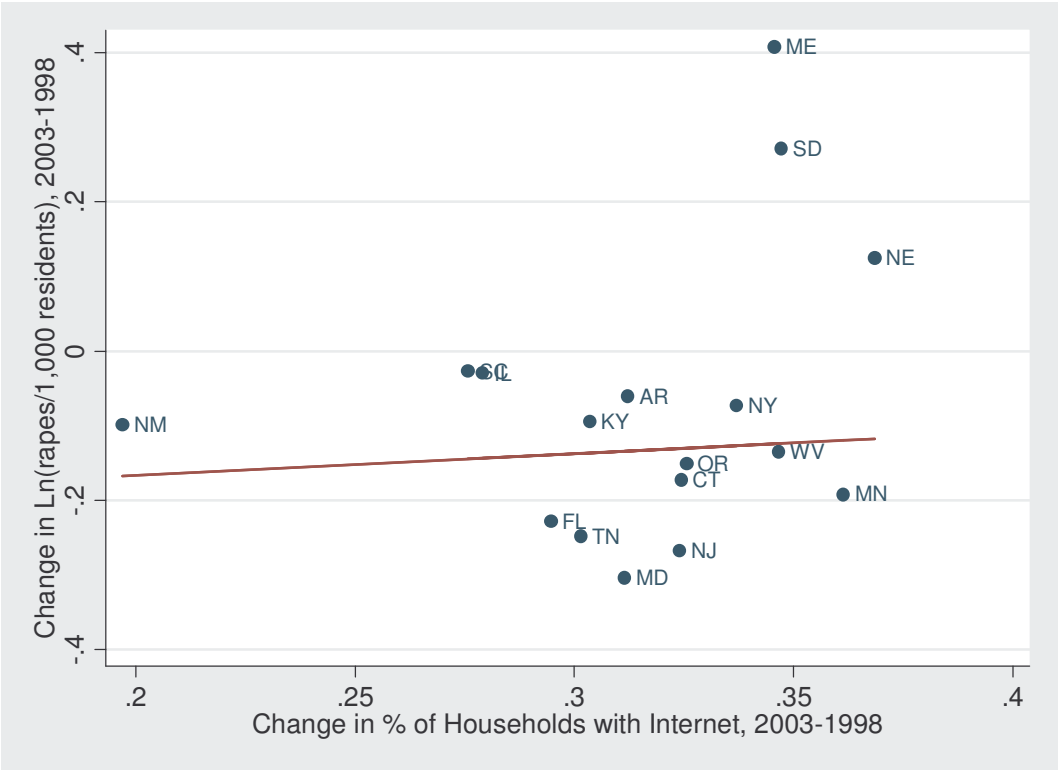
Notes: Standard errors in parentheses. Regressions are identical to those in Table 4, except that the dependent variables are arrest rates broken down by age category instead of overall crime rates. Covariates included are all those listed in Table 4, as well as state- and year-fixed effects, and the percentage of the gender-specific population in each 5-year age group, from 10-14 through 45-49. 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. 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.

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



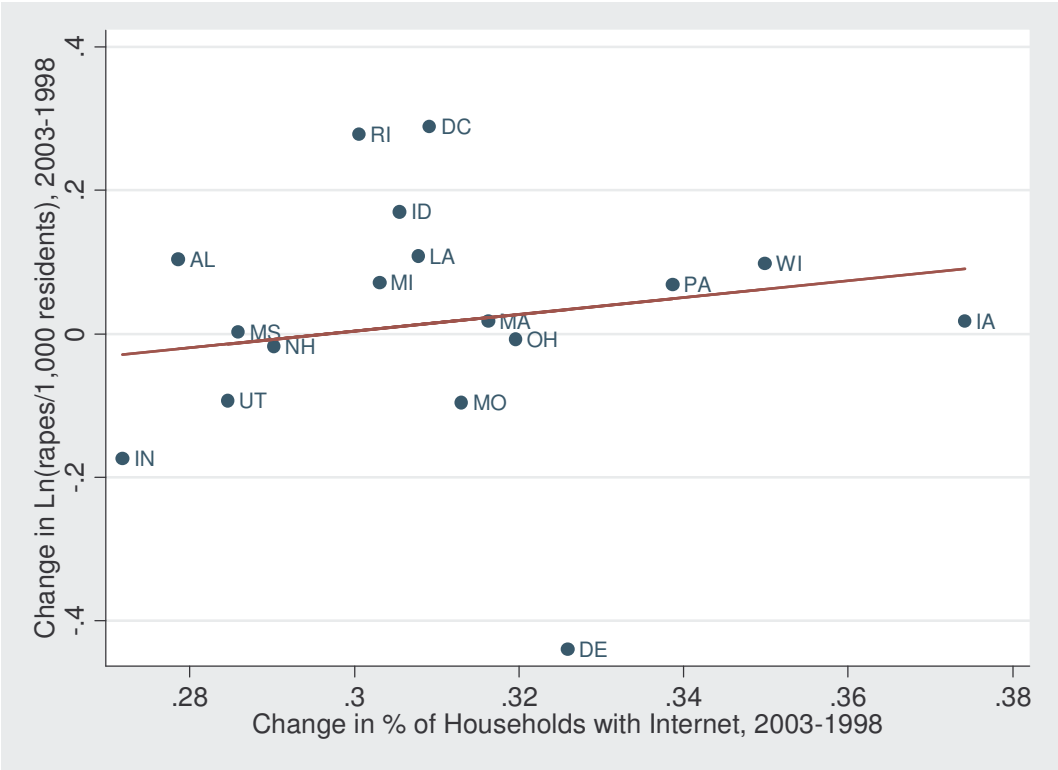
Notes: These 17 data points are states with the highest male-to-female ratios among the 15-24 year old population in 2003. The regression line indicated is a total-population weighted least squares estimate. The coefficient is -1.518, with a standard error of 0.457.

Figure 2: Rape Incidence Changes as a Function of Internet Access Growth, 1998-2003
17 States with Medium15-24 year-old Male-to-Female Ratios



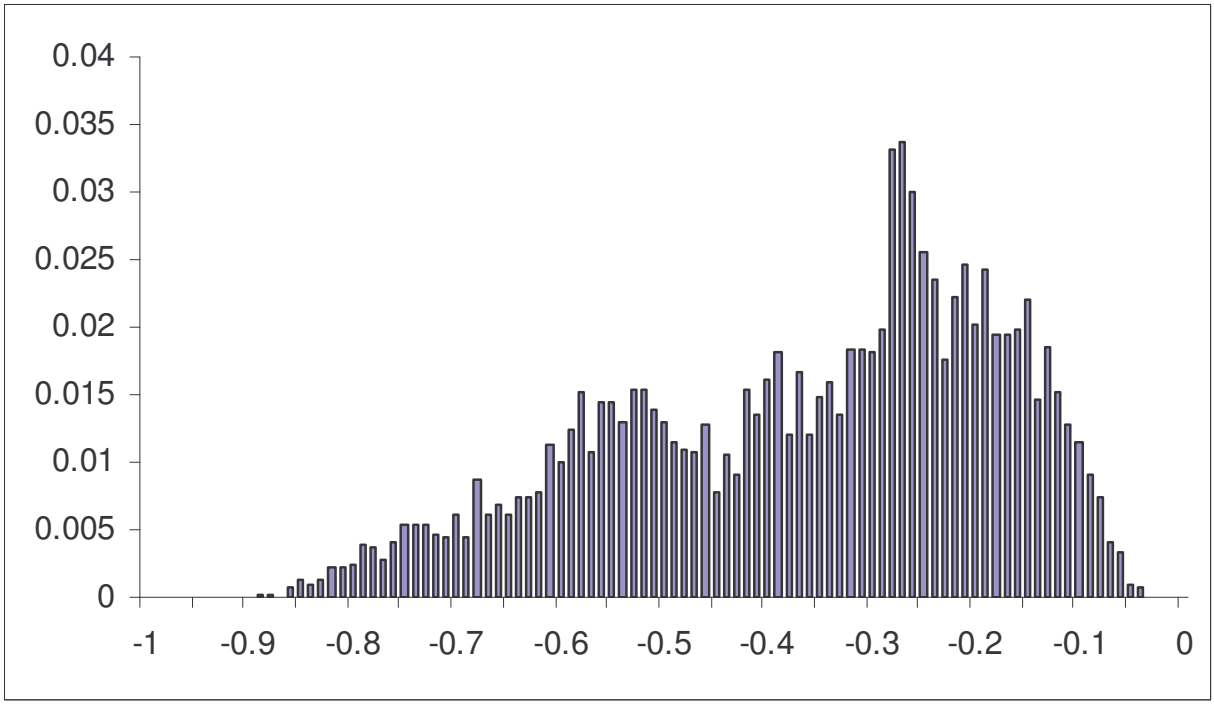
Notes: These 17 data points are states with medium male-to-female ratios among the 15-24 year old population in 2003. The regression line indicated is a total-population weighted least squares estimate. The coefficient is 0.291, with a standard error of 0.939.

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 standard error of 1.016.

Figure 4: Extreme Bounds Distribution of Coefficient on Internet



Notes: Histogram of estimates of the effect of internet on ln(rapes per capita) from equation [1], using all possible subsets of 13 covariates listed in Table 4. This represents the results of 2^{13} = 8,192 regressions. Each histogram bar is 0.01 wide.