

# Craigslist's Effect on Violence Against Women\*

Scott Cunningham

Gregory DeAngelo

John Tripp

Baylor University

West Virginia University

Baylor University

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## Abstract

Female prostitution is both illegal in most American cities and extremely dangerous, as prostitutes face risks of violence from the environment and clients. Previous studies suggest that prostitution has the highest homicide rate of any female intensive occupation in the United States by several orders of magnitude. Policies that can efficiently minimize these hazards are therefore of *prima facie* importance. Between 2002 and 2010, Craigslist provided an “erotic services” section on its front page which was used almost exclusively by prostitutes to advertise illegal sex services. The company opened this service in different cities at different points in time. We use a differences-in-differences strategy to identify its causal effect on female safety and find that Craigslist erotic services reduced the female homicide rate by 17.4 percent. We also find modest evidence that erotic services reduced female rape offenses. Our analysis suggests that this reduction in female violence was the result of street prostitutes moving indoors and matching more efficiently with safer clients.

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*“Marketplaces need to provide thickness, . . . overcome the congestion that thickness can bring . . . and make it safe to participate in the market as simply as possible . . . but some kinds of transactions are repugnant, and this can be an important constraint on market design.” (Roth, 2009)*

## 1 Introduction

Illegal sex work is a dangerous occupation with a high homicide rate. While the exact number of sex workers in the United States is difficult to establish, the number of yearly full-time female prostitutes is estimated to be 23 per 100,000 (Potterat et al., 1990). Potterat et al. (2004) estimate that the workplace homicide rate for female prostitutes is 204 per 100,000.<sup>1</sup> Segmentation in sex markets (e.g. indoor vs. outdoor work) present different levels of risk to participants. Outdoor solicitation (i.e., street prostitution) is considered the most dangerous market segment for sex services (Church et al., 2001), and has a death by homicide rate over 13 times higher than the general population (Lowman and Fraser, 1995; Potterat et al., 2004). This high level of risk has been historically addressed through economic mechanisms such as compensating wage differentials (Rao et al., 2003; Gertler, Shah and Bertozzi, 2005; DeAngelo et al., 2017), the use of lower-risk, indoor segments (Church et al., 2001), and/or the use of intermediaries such as agencies, brothels and pimps (Reynolds, 1986; Levitt and Venkatesh, 2007), which provide screening and protection to sex workers for a percentage of revenue.

However, the ubiquity of internet services has caused a profound reorganization of the underground prostitution market by creating new institutions, new practices, and new mediums of exchange (Cunningham and Kendall, 2011a). Perhaps the most important change was the introduction of centralized clearinghouses for online classified advertising (e.g., Craigslist, Backpage), and searchable review databases (e.g., The Erotic Review). Some observers claim these changes made the underground market safer (Bass, 2015a,b) while others argue the opposite (Hughes, 2004).

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<sup>1</sup>By comparison, the second most dangerous occupation for females is the liquor store employee which has a workplace homicide rate of 4 per 100,000 (Castillo and Jenkins, 1994).

On the one hand, in legal labor markets clearinghouses considerably improve markets through market thickening, reduced search and screening costs, and safer market participation (Roth, 2008). In the context of prostitution, online clearinghouses have the potential to improve safety by redirecting exchange through the clearinghouse, replacing outdoor, face-to-face transactions and/or intermediaries with indoor transactions (Bass, 2015*a,b*). Matching through the clearinghouse enables both sides of the market to discern the quality of the match *ex ante*, through such activities as informal screening, circulated black and white lists, and online reviews (Cunningham and Kendall, 2011*b*; Grant, 2009).<sup>2</sup> This may provide the ability for sex workers to identify and screen out violent clients, law enforcement, and scammers. On the other hand, while clearinghouses and better matching may have the capacity to improve the safety of sex service providers, these mechanisms will also thicken the market, assuming that sex markets react in a similar manner as legal markets (Roth, 2008). Because sex markets are characterized by a high level of violence, if the size of the market merely increases, while other transaction characteristics remain unchanged (e.g., capacity to screen out violent clients), it would potentially result in increased violence (Schapiro and Alpert, 2011). However, this might not be the case if the market thickening is accompanied by additional structural reorganization, such as the movement of the market away from outdoor prostitution interactions, or increased capacity for screening. We seek to better understand this complex phenomenon by investigating the research question: *What are the impacts of online clearinghouses on female safety through their reshaping of prostitution markets?*

The importance of clearinghouses has been shown in legal markets (Roth, 2008). However, in more dangerous, illicit markets, such as sex work, the value of clearinghouses in promoting safe and efficient exchange has not yet been explored. In this study, we provide the first evidence that the introduction of an online clearinghouse dramatically reduced the female homicide rate. From 2002 to 2010, Craigslist provided a section on its front page for matching buyers and sellers of *erotic services* (ERS). ERS did not exist when Craigslist was initially launched. Once launched, ERS was added as one of a bundle of

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<sup>2</sup>Examples of informal screening include calling a client at his workplace, conducting extensive background checks online, and requiring letters of reference (Cunningham and DeAngelo, 2017).

14 unrelated “services” offered by the website (e.g., legal, events, lessons, financial, real estate). See Figures 1 and 2 for images showing the Craigslist front page before and after erotic services was an option. Figure 2 shows the 14 services offered, including erotic services, in the updated front page. We use the updating of the Craigslist front page with an ERS section in different cities at different points in time to identify the causal effect of ERS on violence against females. While we cannot conclusively show that ERS openings were exogenous, we note several stylized facts about ERS that suggest it is orthogonal to the unobserved determinants of female violence. While Craigslist offered multiple services, ERS was added to the platform after initial launch. In some markets, ERS was introduced long after the Craigslist platform launched, while in other markets it was included at launch. As such, it was not an endogenous selection of ERS only. Second, Craigslist’s opening of ERS was completely unpublicized. Finally, we examine the pre-treatment trends between treatment and control cities and show that both sets of cities followed, on average, the same time path with regards to rapes and female homicides.

Online clearinghouses also have practical policy relevance. Prior studies have shown that decriminalization made women safer by reducing the number of rapes (Cunningham and Shah, 2017). But decriminalization often involves state-level statutory changes (Posner and Silbaugh, 1996). Rhode Island, for instance, decriminalized its indoor market by pure accident, and Nevada ultimately only legalized licensed brothels in its small rural counties. States have, so far, not been willing to experiment with statutory reforms such as decriminalization. And given the repugnance associated with prostitution, municipalities face difficult tradeoffs between public safety and voter sentiments. Online erotic services clearinghouses, on the other hand, are protected by the Communications Decency Act (Knibbs, 2016), and as such there are much lower transaction costs associated with its adoption. Craigslist, and ultimately Backpage, provided erotic services to nearly every market of the United States, in addition to several other countries. One could therefore argue that online clearinghouses have the most policy relevance when contemplating a solution to sex market violence.

We provide evidence that the introduction of the Craigslist ERS thickened the internet-mediated market and reduced search costs — reviews at The Erotic Review increased by

43 percent after the introduction of ERS. Rather than simply increasing the size of the online market, the introduction of ERS caused additional structural changes, evidenced by the increase in the use of Craigslist emails by 200 percent, and the shift in the composition of the online market from predominantly agency-based transactions to prostitutes working independently. Most importantly, we find evidence that ERS significantly reduced female homicide rates by as much as 17.4 percent. We do not find evidence that this was a more general reduction in homicide, as ERS is unrelated to male murder, females killed by an acquaintance, or manslaughter rates. We also find no effect of Craigslist entry on female murders and rape offenses; our results are tied only to the addition of ERS to the website. This strengthens our assessment that ERS-driven changes in sex markets were the primary driver of the reduction in female murders. Finally, we also find some modest evidence that the introduction of ERS led to a reduction in forcible female rapes over time, providing an additional piece of evidence in a growing body of literature indicating that reductions in street prostitution and liberalized indoor prostitution can reduce rape offenses (Cunningham and Shah, 2017; Bisschop, Kastoryano and van der Klaauw, 2017; Cameron, Muz and Shah, 2016; Ciacchi and Sviatschi, 2016).

We propose four mechanisms that could explain our results. First, the introduction of ERS may have caused outdoor street-based prostitution to transition to the safer, indoor channel. If so, then we would expect the composition of prostitutes online to shift towards the marginal prostitute who would more likely be a former street prostitute. Second, the growth of the market, combined with more efficient matching may lead to repeat business with low-risk clients, thereby making the market lower risk to sellers. Third, ERS may have enabled more screening, such as the use of references when seeing new clients or background checks. And fourth, ERS may have led to greater deterrence of client violence through the creation of a digital fingerprint that made detection of criminal offenses more likely (Gash, 2016). We conclude that more efficient matching, growth in repeat business, and transitioning indoors are responsible for the decline in murders. An alternative explanation is that the creation of the digital fingerprint, once solicitation moved online, led to the dramatic increase in safety that we observe in our data.

The remainder of this article is organized as follows. In sections two and three, we

discuss ERS, opposition to the introduction and presence of ERS, as well as our theoretical basis for causal effects. In section four, we describe the four unique data sets used in this study. In section five, we present evidence on the influence of ERS on providers reviewed at The Erotic Review. In section six, we present evidence of the mechanism that links ERS to reductions in female homicides and rape offenses. In section seven, we explore the mechanisms that caused the decline in female violence. Finally, in section eight, we conclude and discuss the implications of our study for market participants and law enforcement in the sex services space.

## 2 Craigslist, ERS, and Associated Opposition

The classified advertising platform Craigslist (<http://www.craigslist.org>) is one of the most commonly visited websites in the world.<sup>3</sup> Craigslist is a generic classified-advertising website that facilitates multiple unrelated matching markets on a single, consolidated platform. Matching market interactions that take place on the Craigslist platform include job and resume posting, real estate/rental markets, general goods and services transactions, and dating/personal ads. Craigslist was founded in 1995 in San Francisco, began expansion in 2000, and then accelerated expansion across the US between 2004-2010 (Wolf, 2009). Craigslist’s expansion focused initially on large cities, but by 2010 covered most US cities and, as of 2017, the platform had a presence in over 700 locations, including multiple markets outside of the US.<sup>4</sup>

After the initial launch, Craigslist repeatedly updated its site, each time unannounced. Most of these updates took the form of subtle changes to its front page, including the addition of a services section. This section was expanded over time to include fourteen services, one of which was ERS. See Figure 1 for an example of the Craigslist front page before ERS. Notice in Figure 2 that the front page had been changed to include several additional sections, including the services section which included ERS. Further, Craigslist phased ERS into its front page in different markets over time, as illustrated in Figures

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<sup>3</sup>Alexa, a commercial web traffic data company owned by Amazon (<http://www.alexa.com/siteinfo/craigslist.org>), ranks Craigslist the 15th most popular website in the United States.

<sup>4</sup>Dates and locations of Craigslist expansion are listed here: <http://www.craigslist.org/about/expansion>.

3-5. The introduction of ERS followed a heterogenous path, hitting the West Coast first, selecting larger cities next, and then moving away from the west coast gradually.

Clearinghouses like Craigslist reduce market inefficiencies by lowering search costs (Brynjolfsson and Smith, 2000), thickening the market, and improving market participant safety (e.g., Li and Hitt, 2008; Roth, 2008). The impact of Craigslist on markets, both online and offline, is significant. For example, Craigslist’s market entry is associated with reduced classified advertising rates, increased subscription prices, and reduced circulation for print newspapers (Seamans and Zhu, 2014). Craigslist’s entry also led to reduced online traffic and posting fees for competing job posting websites (Brenčič, 2016), reduced real estate vacancy rates (Kroft and Pope, 2014), reduced solid waste added to landfills (Fremstad, 2017), and increased price dispersion of secondary concert ticket markets (Bennett, Seamans and Zhu, 2015). With regard to public health, Craigslist’s entry has been associated with increased HIV incidence rates (Chan and Ghose, 2014; Greenwood and Agarwal, 2016), and an increase in online prostitution trends (Mojumder, Chan and Ghose, 2016).<sup>5</sup> But the effects of ERS have not been as extensively studied; what little we do know suggests that different effects were associated with ERS than Craigslist entry. For example, while Craigslist entry is positively associated with HIV incidence, ERS has negative effects on HIV incidence (Chan and Ghose, 2014).

In response to the growth of prostitution advertising on the site, as well as other concerns (e.g., increased human trafficking), Craigslist ultimately shut down ERS amid mounting legal pressure from federal and state government agencies (Miller, 2010). Law enforcement and activists had mixed responses to government shutdowns of online ERS. There were three primary arguments justifying the shut down. First, critics argued that Craigslist both facilitated prostitution transactions through ERS (Delateur, 2016), and made enforcement more difficult.<sup>6</sup> Second, critics argued that the the use of ERS was

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<sup>5</sup>Our paper differs substantially from the conference paper published by Mojumder et al. (2016). We investigate the impact of Craigslist on the structure of the prostitution market at the market level, and focus on this as a mechanism for investigating associated impacts on women’s safety. In contrast, Mojumder et al. (2016) focus primarily on prostitution trends at the county level.

<sup>6</sup>Thomas Dart, sheriff of Cook county, sued Craigslist because he estimated that between January and November 2008 his department devoted 3,120 man-hours and approximately \$105,081.00 to make 156 arrests (*Thomas Dart, Sheriff of Cook County v. Craigslist, Inc.*, No. 09 C 1385 [Northern District of Illinois Eastern Division District Court, 2009]).

dangerous for the individuals involved. This argument was based primarily on a few famous cases in which serial killers and murderers targeted prostitutes on Craigslist.<sup>7</sup> Third, there was a widespread belief that online platforms were captured by human traffickers, and their growth and importance were therefore supporting the infrastructure of human trafficking networks (Delateur, 2016). Alternatively, it could be that all or most opposition to internet-mediated sexual transactions is the result of moral repugnance (Roth, 2007).

However, these points have been disputed by both law enforcement and prostitutes. Some law enforcement officials have suggested that shutting down online ERS made law enforcement more, not less, difficult by dispersing trafficking through more clandestine channels (Mehta, 2017; AP, 2017). Furthermore, prostitutes and journalists have argued that ERS shutdowns made sex work more dangerous (Bass, 2014, 2015a).

### **3 ERS and Market Participant Safety**

Prostitutes face multiple sources of risk, including risk of arrest, violence from clients and serial killers, and general environmental violence.<sup>8</sup> This high level of risk has led to the emergence of an extensive set of mechanisms (primarily related to screening, and the location of solicitation and delivery of services) that market participants use to increase safety. There are multiple segments in prostitution markets, ranging from the primarily higher priced independent “call girl,” to escort agency workers, to street walking prostitutes (Reynolds, 1986; Weitzer, 2011).<sup>9</sup> Segments differ in regards to levels of risk, as well as along numerous dimensions such as the quality of the workers, prices charged, services rendered, and location where services are performed.

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<sup>7</sup>At the time of this writing, there is a still-at-large serial killer of Craigslist prostitutes operating out of Long Island, New York (Kolker, 2013, 2014). In addition, there are several serial killers currently active who appear to target prostitutes, but it is not clear that all of them used Craigslist or Backpage to target the victims (Henry, 2016).

<sup>8</sup>In addition, sex workers are easy prey for sadistic individuals (Warren, Hazelwood and Dietz, 1996), as more than half of all serial killers’ victims have been prostitutes (Egger, 2003) and fully one third of all prostitute deaths are due to murder by serial killers (Brewer et al., 2006). The presence of psychopathic homicidal behavior poses a policy problem insofar as these groups of people are not easily deterred.

<sup>9</sup>Some prostitutes report working simultaneously across these different segments (Moran, 2015). See Reynolds (1986) for a detailed taxonomy of the tiers within the market.



Prior to ERS, prostitutes had several ways in which to identify, screen, and transact with potential clients. An independent worker could advertise in the back pages of alternative local print publications (e.g., *The Providence Phoenix*), develop reputation through online “review” websites, such as The Erotic Review,<sup>10</sup> or utilize paid online advertising. As an alternative to working independently, escort agencies provided advertising, screening, and matching services at a monetary cost to the worker. Independent and agency-affiliated workers screen potential customers before agreeing to meet, whereas, in contrast, a street walker has significantly less opportunity to screen before contracting. For this reason, so-called “indoor” prostitution has the potential to be less risky than streetwalking (Weitzer, 2011).

Although opponents argued that ERS made prostitutes less safe, violence against prostitutes was not unique to Craigslist ERS transactions. Lowman and Fraser (1995) estimated that a female street prostitute is 60 to 120 times more likely to be murdered than a female nonprostitute. Brewer et al. (2006) explains, “Lone perpetrators accounted for the overwhelming majority of prostitute and client homicides. In these data sets, clients committed 57-100 percent of prostitute homicides, prostitutes committed 86-94 percent of client homicides, and pimps committed 40-67 percent of pimp homicides. Serial killers accounted for more than one-third of prostitute victims, and nearly all such serial killers were clients.” Further, the modal victim of a serial killer is a female prostitute, as these make up more than 50 percent of all serial killer victims (Egger, 2003).<sup>11</sup> In light of these risks, careful investigation of whether this technological shock significantly impacted female safety is of *prima facie* importance.

## 4 Description of Data

We investigate the effects of ERS on market participant safety using four unique datasets. First we collected data on the date on which ERS began operating in each city. We used the Wayback Machine to construct this dataset.<sup>12</sup>

<sup>10</sup><https://www.theeroticreview.com/>

<sup>11</sup>For a detailed review of the trends in prostitutes as victims of serial homicides, see Quinet (2011).

<sup>12</sup>The Wayback Machine first started archiving in 1996. It can be accessed at <https://archive.org>.

Our second dataset utilizes reviews from The Erotic Review, which is a reputation website (similar to Yelp.com), and one of the largest prostitution websites in the United States (Cunningham and Kendall, 2016). Clients use The Erotic Review to share detailed reviews of prostitutes. We use these data to measure whether a prostitute worked for an agency or independently, whether the provider provided an incall,<sup>13</sup> the average hourly price,<sup>14</sup> ratings on performance and appearance, and unstructured textual data provided by reviewers. We collected 344,561 unique reviews of 68,450 unique providers reviewed between 1998-2009 from across the United States. Our data contains information on reviews of providers from 185 cities in the United States.<sup>15</sup>

Our third set of data was the FBI’s Supplemental Homicide Reports (SHR) for the years 1995-2009. These data contain information on the number of homicides, the gender of the victim and of the murderer, the circumstances of the murder, the weapon used and the relationship between the victim and the murderer (Fox and Swatt, 2014). However, Brewer et al. (2006) notes that prostitute homicides are grossly underascertained in the SHR.<sup>16</sup> This appears to be a by-product of the way in which information about the homicide is reported in the SHR. The monthly reporting schedule for participating agencies “requires agencies to report homicides in the month that they are *discovered*, even if that is not the month in which they occurred or if the social context of the homicide is not yet known. Prostitute homicides often go undetected for weeks, months, or years, so the SHR procedures have a built-in bias toward under ascertainment of many prostitute homicides” (Brewer et al., 2006, emphasis added). Thus, we focus on total female homicides for most of our analysis so as to avoid this biased underascertainment problem. Our

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<sup>13</sup>Outcalls are instances where the prostitute travels to meet the client. Incalls are instances where the client travels to meet the prostitute.

<sup>14</sup>Price is based on a bundle of female characteristics and sex acts. We look only at the aggregate hourly price for simplicity.

<sup>15</sup>Reviews reflect an individual client’s self-reported experience with a specific escort. Reviewers are assumed to be clients who had visited the prostitute and later left a review of her on the website. Reviews remain on the website unless a complaint is made, at which point the offensive review may be removed by administrators. We utilized the calendar date of each review to determine whether the review was posted before or after ERS existed in the market. As reviews are the self-reported statements by individual clients about a specific escort, they are therefore subject to all caveats, such as hindsight bias and so forth.

<sup>16</sup>For instance, there are only 49 such instances of a murder offense named as a prostitution death out of 31,250 observations.

proxy for female safety is the number of female victim homicides per 100,000 population. We also measure the number of male homicides and the number of females murdered by an acquaintance per 100,000 for our falsification exercise. These data use a total of 402 cities.

Finally, given the growing evidence that shifting prostitution indoors reduces rape, we collected data on forcible female rape offenses from the FBI’s Summary Uniform Crime Reports Part I, and used jurisdiction-level files from Chalfin and McCrary (2017). We measure rapes as the number of female rape offenses per 100,000 population. We also collected data on the number of manslaughter offenses per 100,000 for our falsification exercise. These data contain information on 365 cities. Summary statistics for our data are shown in Table 1.

## 5 Did Craigslist Affect Prostitution Reviews?

We do not observe the universe of sex services because a representative survey or census of sex workers in the United States does not exist. Review websites have been used in previous studies both as an alternative because these sites provide an interesting window into the online sex market in their own right (Cunningham and Shah, 2017). We examine the influence of Craigslist on the sex services market by examining its effect on reviews at The Erotic Review. Our identification strategy uses the staggered introduction of ERS in different cities over time. Depending on the city, ERS may have been present on the day Craigslist entered the market, while in other cities, ERS may have opened months or even years later. Our approach is similar to the one taken by Kroft and Pope (2014), Seamans and Zhu (2014) and Greenwood and Agarwal (2016), though in each they use the Craigslist platform entry for identification; in contrast, we look at the opening of ERS, similar to Mojmunder, Chan and Ghose (2016). Key to our identification strategy is that both Craigslist’s entry into markets, as well as the entry of its ERS section, was *ex ante* unannounced.<sup>17</sup> Assuming the evolution of the prostitution markets in treatment cities would have followed a similar path as control cities, then we are able to identify the

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<sup>17</sup>Craigslist, in fact, does not advertising, so entry into markets, as well as the addition of sections, has always occurred unannounced.

causal effect of ERS.

We first focused on outcomes associated with growth in the size of the internet-mediated market, specifically the effect that ERS had on total reviews, total number of providers, and whether a prostitute is reviewed with a Craigslist email. The first and second outcomes are aggregate market-level regressions, whereas the third outcome is an individual level regression. We empirically investigated all using the following linear regression model:

$$Y_{mt} = \delta_1 D_{<10,mt} + \delta_2 D_{\geq 10,mt} + \beta X_{mt} + \varepsilon_{mt} \quad (1)$$

where  $Y$  is the outcome of interest expressed as a count per 100,000 by market  $m$  and month  $t$ ,  $D_{<10}$  is a dummy indicating 0-9 months after erotic services has opened in the market,  $D_{\geq 10}$  is a dummy indicating 10+ months post-entry,  $X$  is a matrix of market and month-by-year fixed effects (e.g., January 2001 dummy), and  $\varepsilon$  is an error term. All models are clustered at the market level to account for within-market serial correlation. Our model attempts to capture both short and long-run effects through the inclusion of two staggered treatment indicators.<sup>18</sup>

One may question whether our dataset has sufficient mass for the post-treatment period given the staggered introduction of ERS by market and month. We represent the number of cities by date before and after the treatment that are contained in our data in Figure 6. The x-axis depicts the number of months until or after the introduction of ERS and the y-axis presents the number of cities that appear in our panel with the recentered treatment value of the x-axis. We believe that there exists sufficient mass for identification for the number of pre- and post-treatment dates in our estimation.

To calculate the aggregate number of reviews, we summed all reviews at the city/month/year level. Columns 1 and 2 for Table 2 report the results from estimating equation (1). We find that in the first ten months, the number of reviews increased 41 percent over the mean, and 67 percent over the mean beyond that point. We also find that the number of unique providers reviewed increased by 29 percent (by market/month) in the first ten

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<sup>18</sup>In addition to using typical cluster robust standard errors, we also constructed empirical p-values using randomization inference. We randomly assigned treatment dates using 1,000 permutations and estimated the probability that chance produced our coefficients. The effects were significant at the 5-10% level.

months, and then 43 percent beyond that.

While we do observe when Craigslist introduced ERS in a market, we do not observe whether sex workers used the platform for advertising and solicitation. As such, our treatment parameters may simply be intent-to-treatment parameters. We investigate this more carefully using the email addresses of prostitutes. When posting an advertisement on Craigslist, sellers are given a temporary pseudonymized Craigslist-specific email address (e.g., jdzt7-5899208383@sale.craigslist.org). If prostitutes became more reliant on Craigslist for meeting clients, it is plausible that clients would record the temporary Craigslist email in their review. The pseudonymized email address provides an additional level of identity protection for the worker at the point of solicitation.<sup>19</sup> Investigation of the The Erotic Review data shows that there were 129 unique providers whose profile contained a Craigslist email address. Therefore, we created a dummy variable equaling 1 if the provider has a Craigslist-specific email address, and estimated equation (1). Those results are presented in column 3 of Table 2. The effect of ERS opening on the probability of a Craigslist email is statistically significant at the 1-5 percent level. After the 10th month the probability a review contained a Craigslist email had doubled. We also explored this effect visually in the upper left panel of Figure 7. As can be seen, the probability a prostitute had a Craigslist email prior to the introduction of ERS was zero, but increased substantially afterwards. Note also that there was about a ten month delay before Craigslist emails showed up at The Erotic Review.

Next we examine the effect that ERS had on intermediary composition. We have two measures of firm intermediary in The Erotic Review: whether a provider works through an agency and whether they are independent, or self-employed. We find robust evidence that ERS led to a change in the employment characteristics of prostitutes reviewed at The Erotic Review. In the first 10 months, the probability a prostitute was independent rose 6.5 percent, which is 12 percent of the mean. This effect persisted in the long run, as evidenced by the positive and statistically significant 10+ month coefficient. This increase in the probability of being independent is associated with a declining probability

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<sup>19</sup>As these are temporary emails, it is equally plausible that clients use the provider's real email address when interviewing after initial contact and not the temporary Craigslist email. This biases our estimates toward zero, and thus our estimates represent a lower bound.

of agency employment. We suspect that this flip is coming both from agency workers becoming independent, but maybe more importantly, a transition of women moving indoors who are otherwise unaffiliated with agencies. One can see this transition with graphical evidence in Figure 7. The introduction of ERS into markets had a profoundly negative effect on the vertical integration of workers with agencies suggesting that ERS reduced transaction costs (Williamson, 2002) or simply led to an introduction of prostitutes who were unaffiliated with agencies.

## 6 Did Craigslist Increase Market Participant Safety?

Prostitutes have claimed that prostitution became safer after ERS, but some activists and law enforcement make the opposite claim. Knowing whether ERS negatively or positively affected female safety is therefore an empirical question. In this section we examine the effect of ERS on female homicide rates and female rape rates. Both female homicide and rape offenses are infrequent at the city/month level, therefore we estimate equation (1) using a Poisson specification. Our Poisson model becomes:

$$E[Y_{mt}|D_{<10,mt}, D_{\geq 10,mt}, X_{mt}] = \exp(\delta_1 D_{<10,mt} + \delta_2 D_{\geq 10,mt} + \beta X_{mt}) \quad (2)$$

where all variables are defined the same as equation (1). All analyses allow errors to be correlated within cities over time when estimating standard errors (Bertrand, Duflo and Mullainathan, 2004).

We also estimate a version of equation (1) using OLS, which is presented in columns 2-4 of Table 3. Our three OLS specifications differ with regards to how we handle the number of zero counts in the data. In columns 2, we estimate the effect of ERS on the homicide (rape) cases per 100,000. Thus, the interpretation of our coefficient is as a marginal effect, and therefore is not directly comparable to the coefficient in column 1, which is a semi-elasticity. In column 3, we transform the outcome variable using the quartic root (Ashraf et al., 2015; Tarozzi et al., 2014). The advantage of this transformation is that the variable is defined at zero and mimics the natural log. The interpretation of our treatment variables in column 3 is as a marginal effect, and therefore must be transformed

into a percentage change by  $4 \times \widehat{\delta}_i(\bar{Y}^{0.75})$  where  $\bar{Y}$  is the mean of the non-transformed outcome variable and  $\widehat{\delta}_i$  is the specific treatment effect coefficient. Finally, we use the inverse hyperbolic sine (Pence, 2006; Black et al., 2015). The inverse hyperbolic sine is  $\ln(Y^2 + (Y^2 + 1)^{\frac{1}{2}})$  and is interpreted as a semi-elasticity. We present all four to test for the sensitivity of our results to alternative specifications and methodologies.

## 6.1 Impact on Female Homicides

ERS would have increased violence against women if Craigslist was either more dangerous than the alternative, or the incidence of violence was simply a function of the size of the market (Schapiro and Alpert, 2011). But, the fact that prostitutes voluntarily selected into the Craigslist clearinghouse suggests that there was some reduction in cost. This reduction in cost may be the perceived reduction in risk and increased safety. Many prostitutes claim that Craigslist enabled them to better screen new clients which could have reduced prostitute violence (Grant, 2009). But prior to this study, such claims were purely anecdotal.

We estimate equation (2) where the dependent variable is the number of female homicides per 100,000. Our data is structured at the city/month level for all cities with an average population above 100,000 over the sample period. Many jurisdictions report no female homicides in a given month. Therefore, we calculate the number of female homicides per 100,000, and estimate equation (2) using Poisson maximum likelihood.<sup>20</sup> We cluster the standard errors at the city level because of overdispersion. Using the Poisson specification we find that after the first 10 months of the introduction of ERS, the number of female homicides decreased by 17.4 percent (Table 3).<sup>21</sup>

In columns 2-4, we present estimates using our OLS specifications. Columns 2-4 are all estimated using OLS but differ with regards to the specification of the outcome variable itself. Column 2 uses the level (rate) as the outcome, column 3 uses the quartic root, and column 4 uses the inverse hyperbolic sine. In all three, the effect of the post-10

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<sup>20</sup>In unreported analysis, we also estimated the effect of erotic services on female homicides using Poisson limiting our analysis only to those dates in which Craigslist entered a market *with* erotic services simultaneously. The effects remained negative and statistically significant.

<sup>21</sup> $1 - \exp(-0.192) = 0.174$

month treatment variable is negative and significant at the 5-10 percent level, though the magnitudes differ from our Poisson model. The OLS model using the rate as the outcome is -0.019, which is 14.6 percent of the sample mean. The quartic root is -0.016, which is equivalent to a 1.3 percent reduction in female homicide rates. And the inverse hyperbolic sine is -0.011, which is a 1.1 percent reduction.<sup>22</sup>

The underlying model behind equation (2) is differences-in-differences. The key identifying assumption for a differences-in-differences strategy is the claim that absent the intervention, female homicides would have evolved similarly in treatment and control units across the point of the intervention itself. This is fundamentally an untestable assumption because we do not have data on the counterfactual post-treatment period for treatment units. We do not, in other words, observe the evolution of the outcome in treatment units if there had not been any treatment. But we can evaluate whether such a dynamic existed in the pre-treatment period. We examine this by estimating the following model:

$$E[Y_{mt} | \sum_{j=2}^6 L_{m,t-j}, \sum_{i=1}^8 D_{m,t+i}, X_{mt}] = \exp(\sum_{j=2}^6 \gamma_j L_{m,t-j} + \sum_{i=1}^8 \delta_i D_{m,t+i} + \beta X_{mt}) \quad (3)$$

where  $L_{mt}$  is five ten-month pre-treatment dummies and one pre-50 month dummy, and  $D_{mt}$  are seven post-treatment ten-month dummies<sup>23</sup> and one post-70 month dummy.<sup>24</sup> We present coefficient boxplots with 5th and 95th percentile confidence intervals from our Poisson regression in Figure 8 for easier interpretation given the large number of coefficients. As can be seen, the effect on female murders is a long-term negative effect starting at approximately the tenth month. Importantly, there is no statistical difference between

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<sup>22</sup>We also estimated all four models controlling for the date of Craigslist entry into the market, as opposed to just the introduction of ERS. There is no effect of Craigslist, and the marginal effect of ERS remains negative and significant in most models. We also estimated our models with state-specific linear time trends and the results are the same.

<sup>23</sup>We chose 10-month because it appears that the Craigslist email results suggest a 10-month lag (See Figure 7). We re-estimated our models using 6-month, 9-month, and 12-month dummies. The results do not change much. The significance is always on the lagged effect, and the precision is always p-values of 0.010 to 0.016. Shorter lag time is never significant: p-values range from 0.641 to 0.970. The effect sizes get larger with the lag.

<sup>24</sup>We combine the last dummy so that all coefficient plots can be seen on the same graph. The omitted variable is the ten months just prior to treatment.



the treatment units and the control units in the pre-treatment. Coefficient estimates are close to zero in several cases and always with large standard errors.<sup>25</sup>

We can calculate the number of saved female lives using a back-of-the-envelope calculation. Using the year prior to the introduction of ERS (2001) as our base year, we compute the number of total homicides. We then shrink the number of murders by 17.4 percent which gives us 268.83 fewer murders as a result of ERS. Multiplied by eight years, this is 2,150 fewer murders that resulted from the introduction of ERS.

Are these magnitudes plausible? It is difficult to answer this question given the true incidence of prostitution homicides is unknown. Most datasets do not record whether a female victim of a homicide was a prostitute, and those that do suffer from severe underascertainment biases built into the data collection methods themselves. There is only one study (Brewer et al., 2006) to our knowledge that has attempted to estimate the incidence of prostitution homicide as a share of female homicides. The authors concluded that 2.7 percent of all female homicides are prostitution deaths by clients. But this study has significant limitations. It is based on select data only from Chicago, St. Louis, Washington state, North Carolina, the SHR, 33 urban counties for one cross-section, and Colorado Springs. The issue of underascertainment bias would conceivably hold, and maybe more so, for this select sample. Thus we interpret their estimates to be, at best, a lower bound. Our estimate of a 17.4 percent reduction in female homicides does suggest, though, that ERS created an overwhelmingly safe environment for female prostitutes — perhaps the safest in history.

In a final robustness check, we conduct three falsification exercises related to lethal violence. We examine the effect of ERS on male homicides, females murdered by acquaintances and manslaughters — none of which should be affected by ERS. We present those results in Table 4. Although several coefficients are large, only two are negative and none are statistically significant. We present event study plots as well in Appendix Figure 9.

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<sup>25</sup>We also estimated event study plots for the alternative OLS specifications. Those are presented in Appendix Figure 10.

## 6.2 Impact on Rape Offenses

Craigslist could reduce rape offenses if quasi-legalized prostitution regimes create opportunities for substitution away from sexual violence (Cunningham and Shah, 2017; Bisschop, Kastoryano and van der Klaauw, 2017; Cameron, Muz and Shah, 2016; Ciacci and Sviatschi, 2016). We explore this possibility empirically by estimating equation (1) with the number of female rape offenses per 100,000 as a dependent variable. In column 1 of Panel B in Table 3, we present our Poisson results. While both coefficients are negative, neither is statistically significant. The effect in column 2 is negative but insignificant. Only the transformation models are significant at the 5 percent level.

We also estimated our event study in equation (2) with both Poisson and OLS and plotted these regression coefficients with confidence intervals in a boxplot graph (Figure 8 and 11). Here we see a negative effect, but only one of the coefficients is statistically significant at the 5 percent level in our Poisson model. The most significant effects come from our quartic root and inverse hyperbolic sine estimates (see the Appendix).

## 7 What is the mechanism linking ERS to decreased murders?

Given the robustness of our homicide result, we investigated The Erotic Review more carefully to determine whether there was any evidence for screening and shifting away from higher risk activities. We focus on several measures which we believe can help shed light on our results.

Before we present our results, we discuss the layout of Table 5. Panel A uses the same specification in equation (1). These estimates all represent changes in mean values associated with entry. In Panel B we estimate the effect of ERS on entrants only. Entrants were defined as providers whose first review was 0-10 months post-ERS opening in their city, 10-20 months, and so on. To estimate the marginal effect of ERS on marginal entrants, we estimated the following equation:

$$Y_{imt} = \sum_1^6 \delta_{t+\tau} E_{i,t+\tau} + \sum_1^6 \gamma_{t+\tau} D_{m,t+\tau} + \beta X_{mt} + \varepsilon_{imt} \quad (4)$$

where  $E_{it}$  is an indicator equaling one if the respondent appeared in our data after ERS (and in which band of months) and  $D_{mt}$  is an indicator equaling one for each of the time bands. We report estimates for  $\delta_t$  in Table 5 Panel B for each outcome.

We propose three main hypotheses linking ERS to declining violence. The first is increased screening. Screening is one of the main ways that a prostitute manages new clients. Screening methods including formal registrations, such as white lists, as well as informal methods such as calling new clients at work (Cunningham and DeAngelo, 2017).<sup>26</sup> We measure screening using textual analysis and search for language in the client reviews correlated with screening such as “refer,” “reference,” “screen,” “white list,” and the names of specific screening services (e.g., p411).<sup>27</sup> Roughly 5 percent of the reviews contained such language.

A second possibility is that screening is not increasing because of an increase in safer environments, either because street-oriented prostitutes are moving indoors, or because greater efficiency in the market leads to more repeat business (or both). The first effect, which we call the composition effect, speaks to changes in entry, while the second effect, which we call the efficiency effect, speaks to changes in the matching technology linking prostitutes with clients. We can evaluate both of these, albeit somewhat indirectly.

Before discussing our results, we note two caveats. It stands to reason that insofar as the marginal entrant into sex work was a former street prostitute, she had previously screened very little to none at all. This is because street solicitation requires quick decisions which leaves little time for collecting information about the client. Thus, if she screens at all, and is a former street prostitute, then it is likely that she was screening more than she would have had she remained on the street. Second, it is worth noting that we also do not observe clients who were screened, but rejected. If a sex worker had screened a client, and that client was deemed too risky such that she rejected him, he would not appear in our data. Our data only permit us to observe the mentioning of screening as a function of ERS existing in an area.

While it is intuitive to believe that ERS would increase screening, we ultimately find

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<sup>26</sup>See [https://www.theeroticreview.com/info\\_policies/whiteListFAQ.asp](https://www.theeroticreview.com/info_policies/whiteListFAQ.asp).

<sup>27</sup>We also modify this classification by building a classifier that accounts for negations and other potential confusion (e.g. *preference* instead of *reference*).

no effect for that in Table 5, Panel A, column 1. There’s no effect in the first ten months, and a slightly negative but insignificant effect for the 10+ month period. This suggests that ERS does not change the frequency with which screening occurred on the site.

When we evaluate the effect that ERS had on entrants’ screening choices, we find a very different pattern. Entrants were considerably less likely to screen when ERS entered, and this effect grew with time. This suggests that the women moving indoors and online were typically women with lower tendency to screen compared to incumbents. This does not mean that marginal entrants are decreasing their screening; only that they screen less than their incumbent counterparts. All that we can say is that screening as a practice did not increase on The Erotic Review when ERS was introduced to an area, and that entrants screened less than incumbents, comparatively speaking.

To evaluate the second efficiency hypothesis, we searched client reviews and classified a review as referring to “repeat” business if it contained the words “repeat” or “regular.” Approximately 15 percent of the sample were described by such reviews. Indeed, the introduction of ERS is associated with a higher probability that a review contains this sort of language — by 2 percent in the first ten months, and 2.7 percent thereafter. When we look at the effect that ERS had on entrants, though, we find very weak evidence that their behavior was noticeably different than incumbents. This suggests that ERS affected incumbents and entrants equally with regards to forming repeat liaisons with clients.

Evidence for women transitioning indoors and online is more difficult because we do not observe whether a woman is a street prostitute; only that she appears in the The Erotic Review database and at what point her first review occurred. But, we reason that if in fact there was an increase in street prostitution moving indoors and online, then we would expect the composition of The Erotic Review to present evidence of negative selection. This is because street prostitutes are believed to fall on a lower rung of the informal sex market and may perhaps be less attractive.<sup>28</sup> We look for evidence for this along several quality dimensions. First, we look at the effect that ERS had on appearance ratings, and find that it reduced the mean score slightly by 0.053 in the first ten months,

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<sup>28</sup>Scott (2002) notes that “street prostitutes have lower status than prostitutes who work indoors. They are often in some state of personal decline (e.g., running away from abusive situations, becoming drug dependent, deteriorating psychologically, and/or *getting less physically attractive*)” (emphasis added).

and 0.131 after ten months. This effect became even more pronounced over time when we focus only on the entrants. After the introduction of ERS, entrant appearance worsened relative to incumbents, suggesting that the marginal prostitute was being drawn from a less professionalized pool of women. We also evaluated the impact it had on performance ratings — like appearance, ERS reduced the ratings on performance given by clients at the mean, but particularly for the entrants. Customer satisfaction can also be measured using a question that asked clients to state whether the experience was “as promised.” This kind of *ex post* satisfaction measure is indicative of having one’s expectations met. Here we find no effect on the population as a whole, but we do find large, negative effects among the entrants. We also looked at whether the prostitute provided a real photo; while again we find no effect for the population as a whole, we do find large negative effects among entrants. We examine a myriad of measures for quality, such as, performance, and meeting expectations, and they all indicate that the marginal entrant is significantly worse than the existing population of sex service providers.

While we cannot measure street prostitution experience directly, we can measure whether the word “street” appeared in a review. Over 6,000 reviews contained the word “street,” and while not all of these appear to describe a street prostitute, a large number do. Such examples include a description that a woman appeared to be “street-like” or that they met at a motel room near some street. We find that the introduction of ERS is associated with a negative occurrence of street mentions in a review. This suggests that the incidence of reviews with street mentions began disappearing with ERS. But, an interesting pattern emerges when we examine the effect of ERS on the characteristics of marginal entrants. All of the coefficients on the entrant variables are positive, and two are significant, suggesting that while ERS is associated with a negative mention of streets in reviews, entrants receive these mentions more often. This is further evidence that the marginal entrants were street prostitutes.

Transitioning indoors could also show up as a change in the location that prostitutes meet with clients. We examine this by using a field where clients stipulated whether a meeting place occurred at his location (outcalls) or hers (incall). Outcalls have the potential for risk because the prostitute is in a foreign and unknown situation with a

potentially unknown male (Bass, 2015a). As ERS has the potential to improve worker safety, it could increase the number of outcalls made, because of this reduction in risk (Peltzman, 1975). But we find economically large and statistically significant effects of ERS on the likelihood a reviewed prostitute provided incall services. Incalls increased by 4.9 percent in the first ten months, and 8.7 percent after that. But interestingly, this positive effect does not hold for the entrants. Entrant incall probabilities fall slightly after about the 41st month relative to incumbents. This is evidence that the marginal streetwalker is moving indoors — these women are, incidentally, the same women that are more inclined to take on outcall services.

Finally, we examined the impact that ERS had on the prostitute’s hourly adjusted price. Insofar as Craigslist shifted supply, we may expect to find declines in price. But it’s also the case that if Craigslist led to a transitioning of outdoor prostitutes into the indoor online sector, then we would expect average prices to decline as the composition of the indoor market shifted towards former streetwalkers. We find strongly significant and economically meaningful declines in average prices per hour associated with ERS. The average hourly price fell by \$6.62 in the first ten months and then to \$14.82 after that. This effect is more pronounced among the entrants, though, whose prices are lower within 11-20 months after ERS opened.

For several of these outcomes, the effects are similar, suggesting that the main effect was driven by differences in the characteristics of entrants. For instance, we find that the marginal entrants were far less likely to screen (column 1), and that they scored worse on appearance, performance, meeting client expectations, and the use of real photos. These all suggest heterogeneity; ERS is associated with entrants who are “worse” than incumbents along several observable dimensions and more likely to have reviews referencing a street. We also find that they were relatively less likely to do incall services, even though the net effect for the post-treatment period is an increase in total incalls. This, again, suggests heterogeneity, since outcalls are higher risk. Finally, the drop in price that we find appears to be much higher for entrants than for incumbents. Altogether, these Panel B estimates are suggestive of the fact that the marginal entrant is a woman entering the indoor market from a lower tier. While entrants screen less than incumbents, it is note-

worthy that any screening they do is presumably more than what they would have done on the street. We interpret these results as suggesting that despite the lower incidence of screening by entrants compared to incumbents, the reduction in homicides is likely a function of both increased screening by former street prostitutes who moved indoors as well as the movement indoors itself.

## 8 Discussion and Conclusion

The findings in this paper point to several potential positive impacts of allowing prostitutes to solicit through an online clearinghouse that enables transitioning indoors, screening, and improved matching with clients. One of these benefits is cost-effectiveness. Putting the magnitudes into context, we compare our estimates to the cost of achieving the same reductions in murders using an alternative mechanism: the hiring of additional police officers. How many more police officers would need to be hired to reduce female homicides by 17.4 percent?

Evans and Owens (2007) estimate the police-murder elasticity to be -0.84, which implies a police force employment increase of 20 percent.<sup>29</sup> We calculate the size of this counterfactual police force expansion using data from the 2001 LEOKA data (the year prior to ERS opening in the San Francisco Bay area), and aggregate the number of police and the size of the population. That gives us 1,003,441 total police employment, 289,627,938 population in 2001, and the number of police per 100,000 equalling 346.5. To find the number of additional police, we increase the police per 100,000 by 20 percent which gives us 415.8 police per 100,000, or 1,204,273 employed police officers, an increase of 200,832 police officers. Assuming an annual outlay of \$100,000 per officer, reducing female homicides by 17.4 percent would cost society an additional \$20 billion per year using higher levels of police employment. Craigslist ERS, in other words, saved 2,150 female lives at profoundly lower social cost.<sup>30</sup>

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<sup>29</sup>Using the definition of elasticity,  $-0.87 = \frac{-0.174}{P}$ , where  $P = 20$  percent.

<sup>30</sup>Using our lower bound estimate of a 1.1 percent reduction in female homicides yields a much lower number of averted homicides. We estimate that a 1.1 percent reduction in female homicide rates is equivalent to 136 fewer female murders from 2002-2010. To achieve 136 fewer female homicides would require 13,045 additional police officers, which at \$100,000 per officer is \$1.3 billion.

Our study suggests that dialog should continue regarding the costs and benefits of anti-ERS enforcement. The results of our study show that this dialog is likely to require more nuance than has previously been the case, though, as ERS may increase the size of the prostitution market while simultaneously reducing violence. In fact, it is the very reduction in risk that is likely — at least partly — responsible for the growth. More detailed investigation into the effect of ERS on serial killer activity in the US would potentially provide considerable value for understanding the repercussions of ERS in specific areas. There is still a great deal of research required in this area.

In addition, there are other important issues relating to the relationship between technology and sex markets that have not been analyzed. One opportunity for future research is the relationship between ERS and human trafficking. Unfortunately, we do not presently have the sort of data that would enable us to answer this question. Thus we have focused only on a segment of the market that openly advertised online.

This study sought to evaluate the impact that the widespread introduction and adoption of online ERS had on the illegal market for commercial sex work and public safety. To our knowledge, this is the first study to evaluate this question which, given recent law enforcement’s successful efforts to close down Backpage, makes the results both timely and relevant (Miller, 2010; Burns, 2017). We find strong evidence that Craigslist increased the proportion of independent prostitutes and the number of reviews at The Erotic Review. This suggests that ERS was a significant player in the market for commercial sex in the United States, despite the nation’s prohibition of prostitution.

In conclusion, we find support for prostitutes’ claims that the introduction of ERS made them significantly safer. We estimate that ERS led to a 17.4 percent reduction in female homicides. These negative effects on female homicides are consistent with theoretical predictions made by Logan and Shah (2012) and Persson and Lee (2016), suggesting that clearinghouses improve market (and potentially non-market) participant safety. Opposition may exist despite these gains due to “distaste for certain kinds of transactions” (Roth, 2007), or because prostitution is seen as being equivalent with sex trafficking. However, the potential improvements in female safety illustrated by our results suggest that it is important for policymakers to design policies that might improve the



lives of trafficked victims without simultaneously harming others.

## References

- AP. 2017. “Police, Victim Advocates: Backpage.com Shutdown Will Make Monitoring Sex Traffickers More Difficult.” *CBS Sacramento* <http://sacramento.cbslocal.com/2017/02/08/police-victim-advocates-backpage-com-shutdown-will-make-monitoring-sex-traffickers-more-difficult/>.
- Ashraf, Nava, Diego Aycinena, Claudia Martinez and Dean Young. 2015. “Savings in Transnational Households: A Field Experiment among Migrants from El Salvador.” *Review of Economics and Statistics* 47(2):332–351.
- Bass, Alison. 2014. “Shutting Down Websites Won’t Shut Down Prostitution.” *Huffington Post* [http://www.huffingtonpost.com/alison-bass/online-sex-workers\\_b\\_6121218.html](http://www.huffingtonpost.com/alison-bass/online-sex-workers_b_6121218.html).
- Bass, Alison. 2015a. *Getting Screwed: Sex Workers and the Law*. ForeEdge.
- Bass, Alison. 2015b. “Shutting Down Ads for Sex Workers Will Make Their Lives More Dangerous.” *PRI* <https://www.pri.org/stories/2015-07-09/shutting-down-ads-sex-workers-might-hurt-them>.
- Bennett, Victor M, Robert Seamans and Feng Zhu. 2015. “Cannibalization and option value effects of secondary markets: Evidence from the US concert industry.” *Strategic Management Journal* 36(11):1599–1614.
- Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan. 2004. “How Much Should We Trust Differences-in-Differences Estimates?” *Quarterly Journal of Economics* 119(1):249–275.
- Bisschop, Paul, Stephen Kastoryano and Bas van der Klaauw. 2017. “Street Prostitution Zones and Crime.” *American Economic Journal: Economic Policy* 9(4):28–63.
- Black, Sandra E., Paul J. Devereux, Petter Lundborg and Kaveh Majlesi. 2015. “Poor Little Rich Kids? The Determinants of Intergenerational Transmission of Wealth.” NBER Working Paper No. 21409.
- Brenčič, Vera. 2016. “The impact of Craigslist’s entry on competing employment websites.” *IZA Journal of Labor Economics* 5(1):1–15.
- Brewer, Devon D., Jonathan A. Dudek, John J. Potterat, Stephen Q. Muth, Jr. John M. Roberts and Donald E. Woodhouse. 2006. “Extent, Trends, and Perpetrators of Prostitution-Related Homicide in the United States.” *Journal of Forensic Science* 51(5):1101–1108.
- Brynjolfsson, E. and MD Smith. 2000. “Frictionless Commerce? A Comparison of Internet and Conventional Retailers.” *Management Science* 46(4):563–585.
- Burns, Janet. 2017. “Backpage Closes Adult Classifieds Section, Citing Pressure from Senate.” *Forbes* <https://www.forbes.com/sites/janetwburns/2017/01/10/backpage-closes-adult-classifieds-section-citing-censorship-pressure-from-senate/>.
- Cameron, Lisa, Jennifer Muz and Manisha Shah. 2016. “Crimes of Morality: Unintended Consequences of Criminalizing Sex Work.” UCLA Working Paper.
- Castillo, DN and EL Jenkins. 1994. “Industries and Occupations at High Risk for Work-related Homicide.” *Journal of Occupational Medicine* 36:125–132.
- Chalfin, Aaron and Justin McCrary. 2017. “Are U.S. Cities Underpoliced?: Theory and Evidence.” *The Review of Economics and Statistics* Forthcoming.
- Chan, J. and A. Ghose. 2014. “Internet’s Dirty Secret: Assessing the Impact of Online Intermediaries on the Outbreak of Sexually Transmitted Diseases.” *MIS Quarterly* 38(4):955–976.

- Church, Stephanie, Marion Henderson, Marina Barnard and Graham Hart. 2001. "Violence by clients towards female prostitutes in different work settings: questionnaire survey." *British Medical Journal* 322:524–525.
- Ciacchi, Riccardo and Maria Micaela Sviatschi. 2016. "The Effect of Indoor Prostitution on Sex Crime: Evidence from New York City." Columbia University Working Paper.
- Cunningham, Scott and Gregory DeAngelo. 2017. "Vertical Differentiation or Offsetting Behavior: Screening in Commercial Sex Markets." Unpublished Manuscript.
- Cunningham, Scott and Manisha Shah. 2017. "Decriminalizing Indoor Prostitution: Implications for Sexual Violence and Public Health." *Review of Economic Studies* Forthcoming.
- Cunningham, Scott and Todd D. Kendall. 2011a. "Prostitution 2.0: The Changing Face of Sex Work." *Journal of Urban Economics* 69:273–287.
- Cunningham, Scott and Todd D. Kendall. 2016. *Handbook on the Economics of Prostitution*. Oxford University Press chapter "Examining the Role of Client Reviews and Reputation within Online Prostitution".
- Cunningham, Scott and Todd Kendall. 2011b. *Handbook on Family Law and Economics*. Edward Elgar chapter "Prostitution, Technology, and the Law: New Data and Directions".
- DeAngelo, Gregory, Jacob N. Shapiro, Jeffrey Borowitz, Michael Cafarella, Christopher Re and Gary Shiffmann. 2017. "Rational Pricing in Prostitution: Evidence from Online Sex Ads." Working Paper.
- Delateur, Monica J. 2016. "From Craigslist to Backpage.com: Conspiracy as a Strategy to Prosecute Third-Party Websites for Sex Trafficking." *Santa Clara law Review* 531.
- Egger, Steven A. 2003. *The Need to Kill: Inside the World of the Serial Killer*. Financial Times Prentice Hall.
- Evans, William N. and Emily G. Owens. 2007. "COPS and Crime." *Journal of Public Economics* 91(1-2):181–201.
- Fox, James Alan and Marc L. Swatt. 2014. Uniform Crime Reporting Program Data [United States]: Supplementary Homicide Reports with Multiple Imputation, Cumulative Files 1976-2014. Technical report Inter-university Consortium for Political and Social Research.
- Fremstad, Anders. 2017. "Does Craigslist Reduce Waste? Evidence from California and Florida." *Economic Journal* 127:135–143.
- Gash, Tom. 2016. "We're Safer Than Ever Before, and It's All Thanks to Technology." *Wired*.
- Gertler, Paul, Manisha Shah and Stefano M. Bertozzi. 2005. "Risky Business: The Market for Unprotected Commercial Sex." *Journal of Political Economy* 113(3):518–550.
- Grant, Melissa Gira. 2009. "The Craigslist Sex Panic." *Slate* [http://www.slate.com/articles/technology/webhead/2009/05/the\\_craigslist\\_sex\\_panic.html](http://www.slate.com/articles/technology/webhead/2009/05/the_craigslist_sex_panic.html).
- Greenwood, Brad N. and Ritu Agarwal. 2016. "Matching Platforms and HIV Incidence: An Empirical Investigation of Race, Gender and Socioeconomic Status." *Management Science* 62(8):2281–2303.
- Henry, Noah. 2016. "10 American Serial Killers That Are Still Out There." *Crave Online* <http://www.craveonline.com/mandatory/1106490-10-american-serial-killers-that-are-still-out-there>.
- Hughes, Donna M. 2004. "Prostitution Online." *Journal of Trauma Practice* 2(3-4):115–131.

- Knibbs, Kate. 2016. "Digital Pimps or Fearless Publishers?" *The Ringer* <https://theringer.com/backpage-pimping-lawsuit-c4577180c95e>.
- Kolker, Robert. 2013. "The New Prostitutes." *New York Times* <https://opinionator.blogs.nytimes.com/2013/06/29/the-new-prostitutes/>.
- Kolker, Robert. 2014. *Lost Girls: An Unsolved American Mystery*. Harper Perennial.
- Kroft, Kory and Devin Pope. 2014. "Does Online Search Crowd Out Traditional Search and Improve Matching Efficiency? Evidence from Craigslist." *Journal of Labor Economics* 32(2):259–303.
- Levitt, Steven and Sudhir Alladi Venkatesh. 2007. "An Empirical Analysis of Street-Level Prostitution." University of Chicago Working Paper.
- Li, Xinxin and Lorin M Hitt. 2008. "Self-selection and information role of online product reviews." *Information Systems Research* 19(4):456–474.
- Logan, Trevon and Manisha Shah. 2012. "Face Value: Information and Signaling in an Illegal Market." *Southern Economic Journal* 79(3):529–564.
- Lowman, J. and L. Fraser. 1995. "Violence against persons who prostitute: The experience in British Columbia." Unpublished Manuscript.
- Mehta, Diana. 2017. "Canadian Police Mixed Over U.S. Shutdown of Adult Section on Backpage.com." *The Canadian Press* <http://globalnews.ca/news/3177482/canadian-police-mixed-over-u-s-shutdown-of-adult-section-on-backpage-com/>.
- Miller, Claire Cain. 2010. "Craigslist Say It Has Shut Its Section for Sex Ads." *New York Times* <http://www.nytimes.com/2010/09/16/business/16craigslist.html>.
- Mojumder, Probal, Jason Chan and Anindya Ghose. 2016. The Digital Sin City: An Empirical Study of Craigslist's Impact on Prostitution Trends. In *Thirty Seventh International Conference on Information Systems, Dublin 2016*.
- Moran, Rachel. 2015. *Paid for: My journey through prostitution*. WW Norton & Company.
- Peltzman, Sam. 1975. "The Effects of Automobile Safety Regulation." *Journal of Political Economy* 83(4).
- Pence, K. M. 2006. "The Role of Wealth Transformations: An Application to Estimating the Effect of Tax Incentives on Saving." *The B.E. Journal of Economic Analysis and Policy* 5(1).
- Persson, Petra and Samuel Lee. 2016. *Handbook on the Economics of Prostitution*. Oxford University Press chapter "Violence and Entry in the Market for Sex".
- Posner, Richard A. and Katharine B. Silbaugh. 1996. *A Guide to America's Sex Laws*. 1st ed. University of Chicago Press.
- Potterat, John J., Devon D. Brewer, Stephen Q. Muth, Richard B. Rothenberg, Donald E. Woodhouse, John B. Muth, Heather K. Stites and Stuart Brody. 2004. "Mortality in a Long-term Open Cohort of Prostitute Women." *American Journal of Epidemiology* 159(8):778–785.
- Potterat, John J., Donald E. Woodhouse, John B. Muth and Stephen Q. Muth. 1990. "Estimating the Prevalance and Career Longevity of Prostitute Women." *The Journal of Sex Research* 27(2):233–243.
- Quinet, Kenna. 2011. "Prostitutes as Victims of Serial Homicide: Trends and Case Characteristics, 1970-2009." *Homicide Studies* 15(1):74–100.

- Rao, Vijayendra, Indrani Gupta, Michael Lokshin and Smarajit Jana. 2003. "Sex Workers and the Cost of Safe Sex: The Compensating Differential for Condom Use among Calcutta Prostitutes." *Journal of Development Economics* 71:583–603.
- Reynolds, Helen. 1986. *The Economics of Prostitution*. Springfield, IL U.S.A.: Charles C. Thomas.
- Roth, Alvin. 2009. *Innovation Policy and the Economy*. University of Chicago Press chapter "What Have We Learned from Market Design?"
- Roth, Alvin E. 2007. "Repugnance as a Constraint on Markets." *Journal of Economics Perspectives* 21(3):37–58.
- Roth, Alvin E. 2008. *Innovation Policy and the Economy*. University of Chicago Press chapter "What Have We Learned from Market Design?"
- Schapiro, Rich and Lukas I. Alpert. 2011. "Craigslist Remains Haven for Hookers Despite Outrage Over Philip Markoff Case." *Daily News* <http://www.nydailynews.com/news/crime/craigslist-remains-haven-hookers-outrage-philip-markoff-case-article-1.155088>.
- Scott, Michael S. 2002. "Street Prostitution." *Problem-Oriented Guides for Police Series 2*.
- Seamans, Robert and Feng Zhu. 2014. "Responses to Entry in Multi-Sided Markets: The Impact of Craigslist on Local Newspapers." *Management Science* 60(2):476–493.
- Tarozzi, Alessandro, Aprajit Mahajan, Brian Blackburn, Dan Kopf, Lakshmi Krishnan and Joanne Yoong. 2014. "Micro-loans, Insecticide-Treated Bednets, and Malaria: Evidence from a Randomized Controlled Trial in Orissa, India." *American Economic Review* 104(7):1909–1941.
- Warren, Janet I., Robert R. Hazelwood and Park E. Dietz. 1996. "The Sexually Sadistic Serial Killer." *Journal of Forensic Science* 41(6).
- Weitzer, Ronald. 2011. *Legalizing Prostitution: From Illicit Vice to Lawful Business*. NYU Press.
- Williamson, Oliver. 2002. "The Theory of the Firm as Governance Structure: From Choice to Contract." *Journal of Economic Perspectives* 16(3):171–195.
- Wolf, Gary. 2009. "Why Craigslist is Such a Mess." *Wired* <https://www.wired.com/2009/08/ff-craigslist/>.

**Table 1** Summary Statistics for the Craigslist sample (1995-2009)

<b>Variables</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>N</b>
Female homicides per 100,000	0.13	0.40	60,207
Female forcible rape offenses per 100,000	2.76	3.99	58,632
Total reviews	85.65	126.86	4,150
Total providers	18.77	24.76	4,150
Craigslist email	0.002	0.04	68,450
Independent	0.56	0.50	68,450
Agency	0.34	0.47	68,450
Incall	0.84	0.36	68,450
Delivered as promised	0.87	0.33	68,450
Real photo	0.79	0.41	68,450
Hourly price	\$294.33	173.51	344,399
Screening	0.05	0.22	344,561
Repeat	0.15	0.37	344,561
Looks rating	7.46	0.98	344,561
Performance rating	7.32	1.42	344,561
Street	0.02	0.14	344,561
Female homicides from acquaintance killer per 100,000	0.02	0.11	60,381
Male homicides per 100,000	0.48	0.86	60,381
Manslaughters per 100,000	0.01	0.14	58,636

**Table 2** The effect of Craigslist's erotic services openings on production and intermediary characteristics

Dep var:	Reviews	Providers	Craigslist	Independent	Agency
ERS (first 10 months)	35.167** (14.579)	5.519** (2.463)	0.001** (0.000)	0.065*** (0.024)	-0.069** (0.031)
ERS (post-10 months)	56.919** (25.502)	8.049* (4.424)	0.004*** (0.002)	0.058* (0.033)	-0.073* (0.039)
N	4,150	4,150	68,450	68,450	68,450
Mean of dependent variable	85.65	18.77	0.00	0.56	0.34

Outcomes are binary variables equalling one if the vendor had the ascribed characteristic. Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 3** Poisson and OLS estimates of the effect of erotic services openings on female murders per 100,000

Dep var:	<b>Murders</b>			
	Poisson	Rate	Quartic root	Sine
ERS (first 10 months)	-0.015 (0.076)	-0.000 (0.010)	-0.005 (0.008)	-0.002 (0.006)
ERS (post-10 months)	-0.192** (0.077)	-0.019** (0.009)	-0.016* (0.009)	-0.011* (0.006)
N	60,207	60,207	60,207	60,207
Mean of dependent variable	0.13	0.13	0.19	0.09
Dep var:	<b>Rapes</b>			
	Poisson	Rate	Quartic root	Sine
ERS (first 10 months)	-0.013 (0.030)	-0.029 (0.079)	-0.029* (0.016)	-0.039 (0.037)
ERS (post-10 months)	-0.047 (0.044)	-0.077 (0.111)	-0.060** (0.027)	-0.109* (0.058)
N	58,636	58,636	58,636	58,636
Mean of dependent variable	2.76	2.76	0.97	1.81

The first column estimates a Poisson maximum likelihood model with the rate as the outcome. The second model estimates OLS with the rate as the outcome. The third model uses the quartic root as the outcome. And the fourth model uses the inverse hyperbolic sine transformation as the outcome. Models control for market and calendar date fixed effects. Robust standard errors clustered within city in parenthesis. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01



**Table 4** Falsification exercises: the effect of Craigslist’s erotic services on females murdered by acquaintances, all male murders and all manslaughters per 100,000

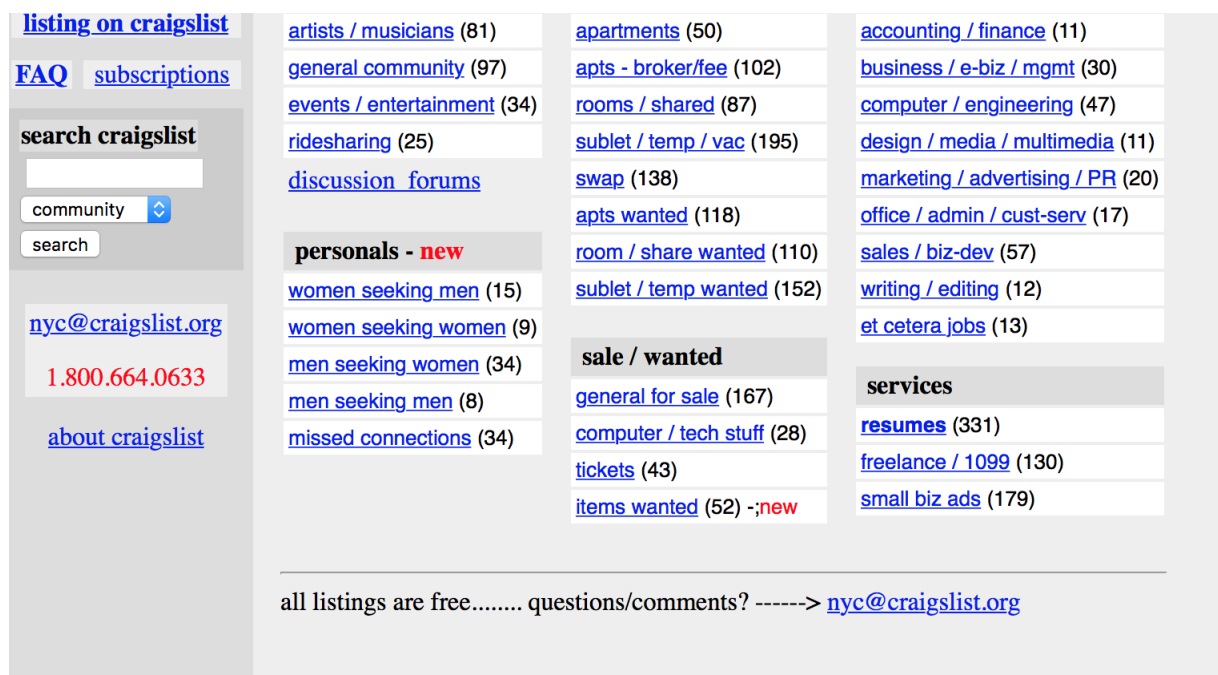
Dep var:	Females by acquaintances	Males	Manslaughters
ERS (first 10 months)	0.159 (0.178)	-0.001 (0.034)	0.057 (0.224)
ERS (post-10 months)	0.110 (0.184)	-0.020 (0.057)	0.165 (0.304)
N	60,381	60,381	58,636
Mean of dependent variable	0.02	0.48	0.01

Dependent variables are outcomes per population times 100,000. Models estimated with Poisson. Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

**Table 5** The effect of Craigslist's erotic services openings on characteristics of entrants

Dep var:	Panel A								
	Screen	Repeat	Looks	Performance	Street	As promised	Real photo	Incalls	Price
ERS (first 10 months)	0.000 (0.004)	0.020** (0.009)	-0.053* (0.030)	-0.066* (0.034)	-0.003* (0.001)	-0.001 (0.012)	-0.009 (0.015)	0.049*** (0.013)	-6.624* (3.555)
ERS (post-10 months)	-0.005 (0.007)	0.027** (0.013)	-0.131*** (0.049)	-0.110* (0.064)	-0.003* (0.002)	0.004 (0.018)	-0.022 (0.020)	0.087*** (0.024)	-14.823** (6.246)
Panel B									
Entrant 0-10mo post ERS	-0.002 (0.002)	0.004 (0.004)	-0.122*** (0.035)	-0.489*** (0.063)	0.000 (0.001)	-0.051*** (0.011)	-0.099*** (0.015)	-0.038*** (0.009)	-17.226*** (5.100)
Entrant 11-20mo post ERS	-0.006** (0.003)	0.011** (0.004)	-0.074** (0.033)	-0.430*** (0.042)	0.004*** (0.001)	-0.049*** (0.014)	-0.065*** (0.017)	-0.006 (0.015)	-11.016** (5.410)
Entrant 21-30mo post ERS	-0.002 (0.002)	0.005 (0.003)	-0.170*** (0.028)	-0.469*** (0.037)	0.001 (0.002)	-0.054*** (0.010)	-0.039*** (0.011)	-0.007 (0.008)	-21.764*** (6.888)
Entrant 31-40mo post ERS	-0.012*** (0.003)	0.004 (0.006)	-0.137*** (0.024)	-0.547*** (0.041)	0.002 (0.002)	-0.055*** (0.010)	-0.046*** (0.010)	-0.011 (0.009)	-13.644** (5.684)
Entrant 41-50mo post ERS	-0.022*** (0.003)	0.002 (0.003)	-0.252*** (0.023)	-0.667*** (0.033)	0.002 (0.001)	-0.079*** (0.010)	-0.072*** (0.016)	-0.024** (0.011)	-18.207*** (6.673)
Entrant 50mo post ERS	-0.039*** (0.004)	0.009** (0.004)	-0.522*** (0.017)	-1.073*** (0.049)	0.006*** (0.001)	-0.098*** (0.009)	-0.090*** (0.012)	-0.046*** (0.006)	-10.312 (6.353)
N	344,561	344,561	344,561	344,561	344,561	68,450	68,450	68,450	344,339
Mean of dependent variable	0.05	0.15	7.46	7.32	0.02	0.87	0.79	0.84	294.33

Models control for city and date fixed effects. Robust standard errors clustered within city in parenthesis. \* p&lt;0.10, \*\* p&lt;0.05, \*\*\* p&lt;0.01

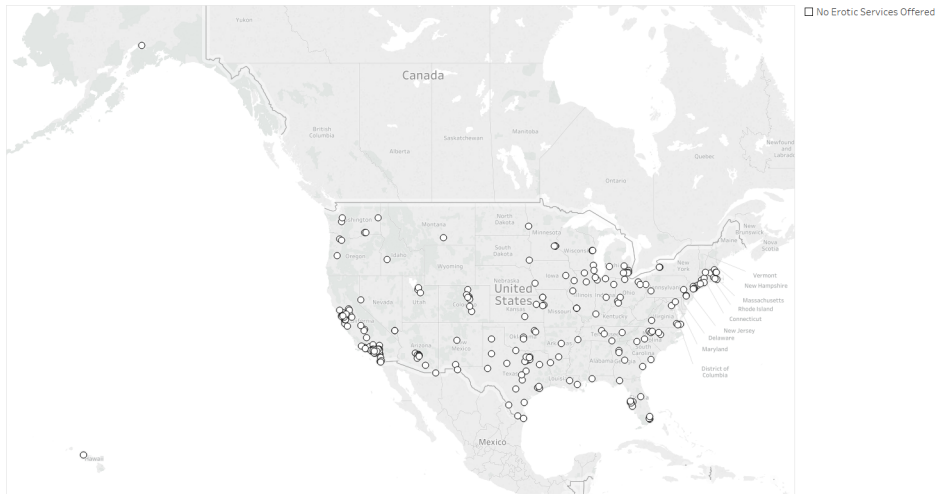


**Figure 1** Picture of NYC Craigslist front page before erotic services was an section.

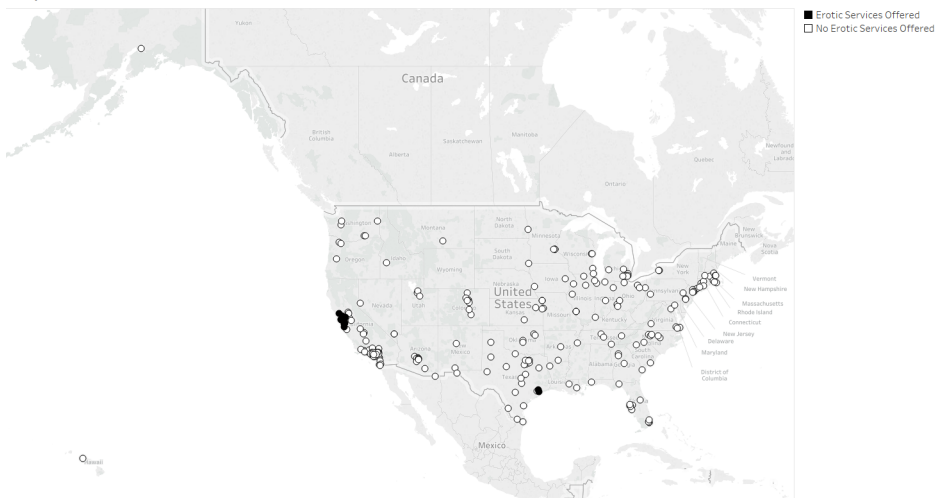


Figure 2 Picture of Craigslist front page with zoomed “services” section.

1995

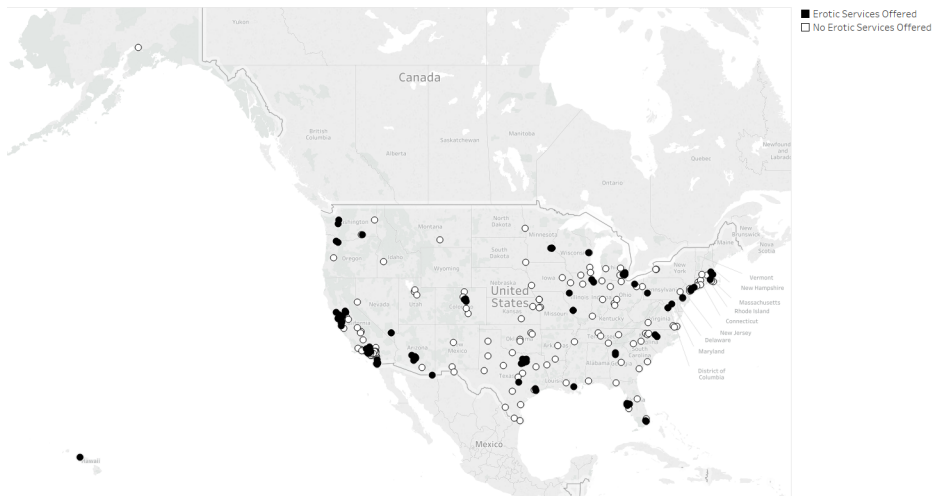


April 2003

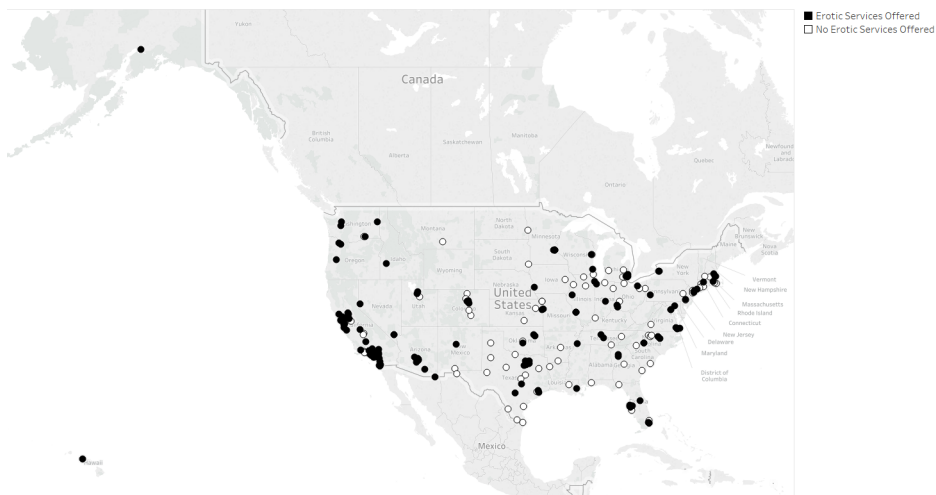


**Figure 3** Top panel is 1995. Bottom panel is April 2003.

Jan 2004

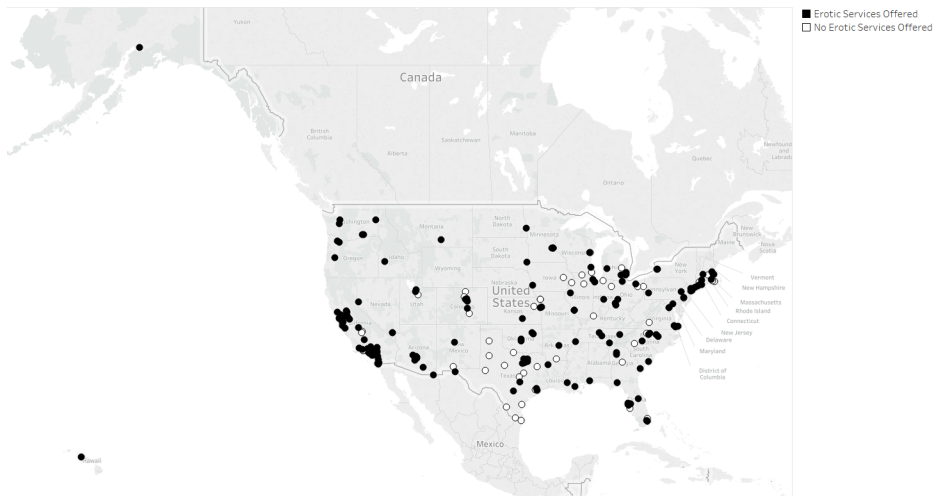


Jan 2005

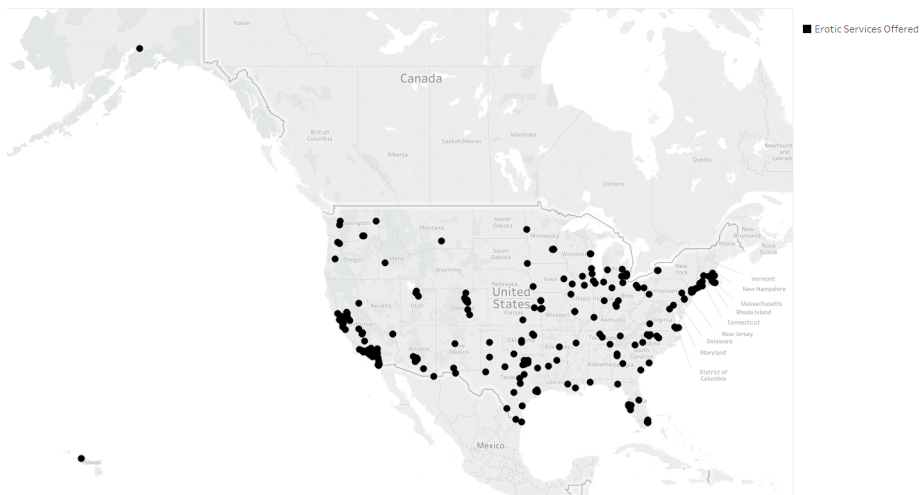


**Figure 4** Top panel is Jan 2004. Bottom panel is Jan 2005.

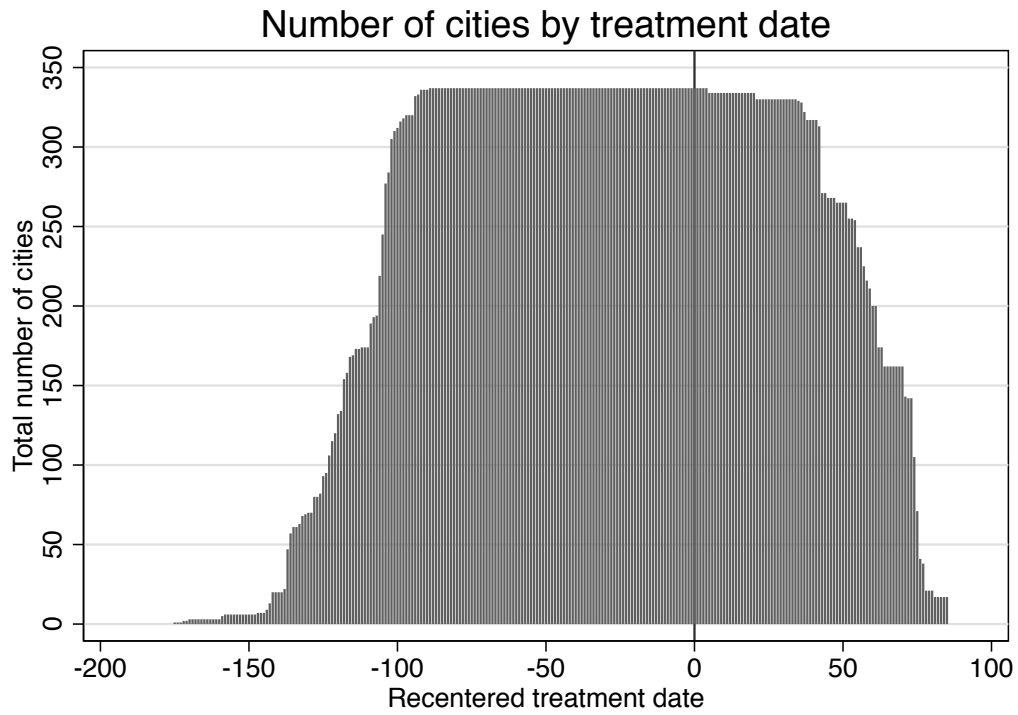
Jan 2006



2009

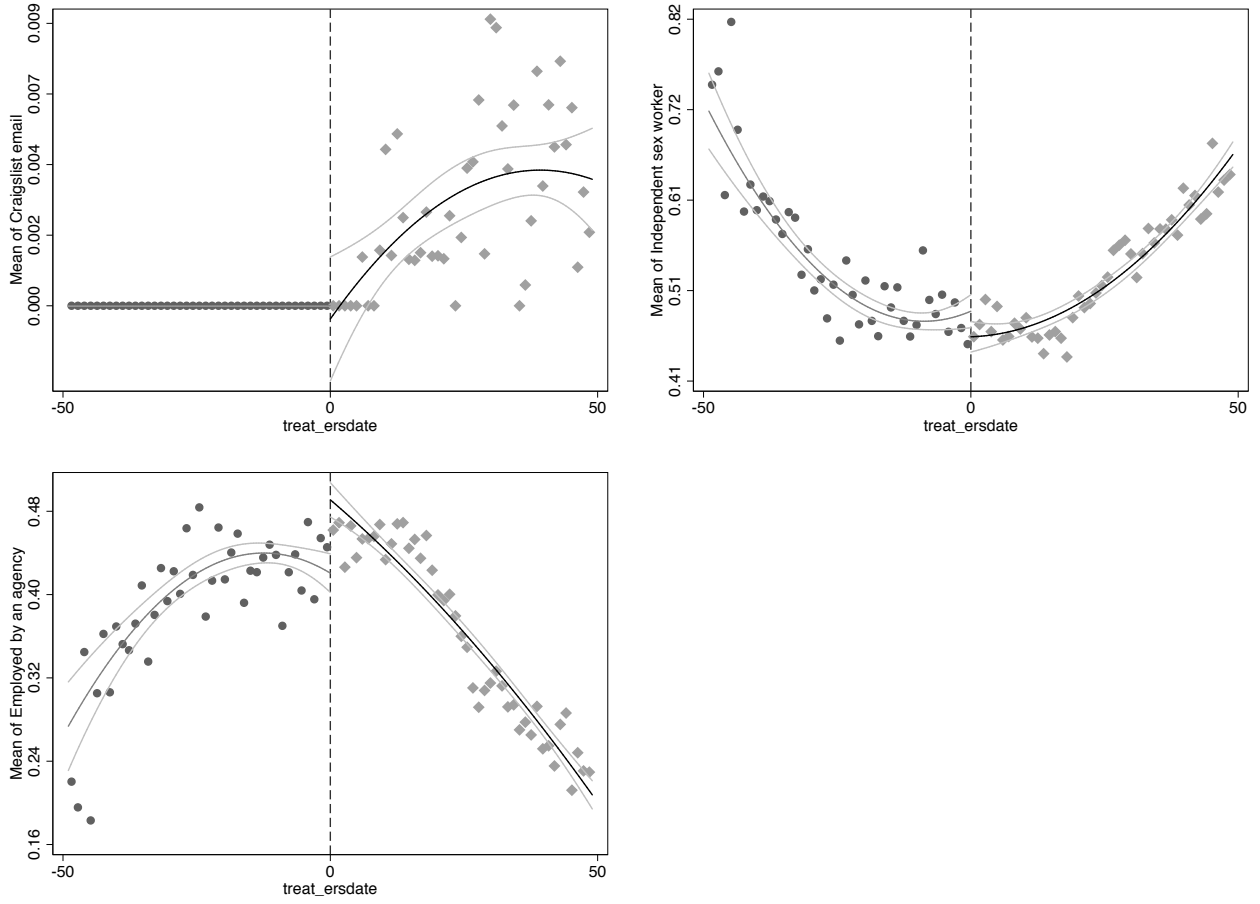


**Figure 5** Top panel is Jan 2006. Bottom panel is 2009.

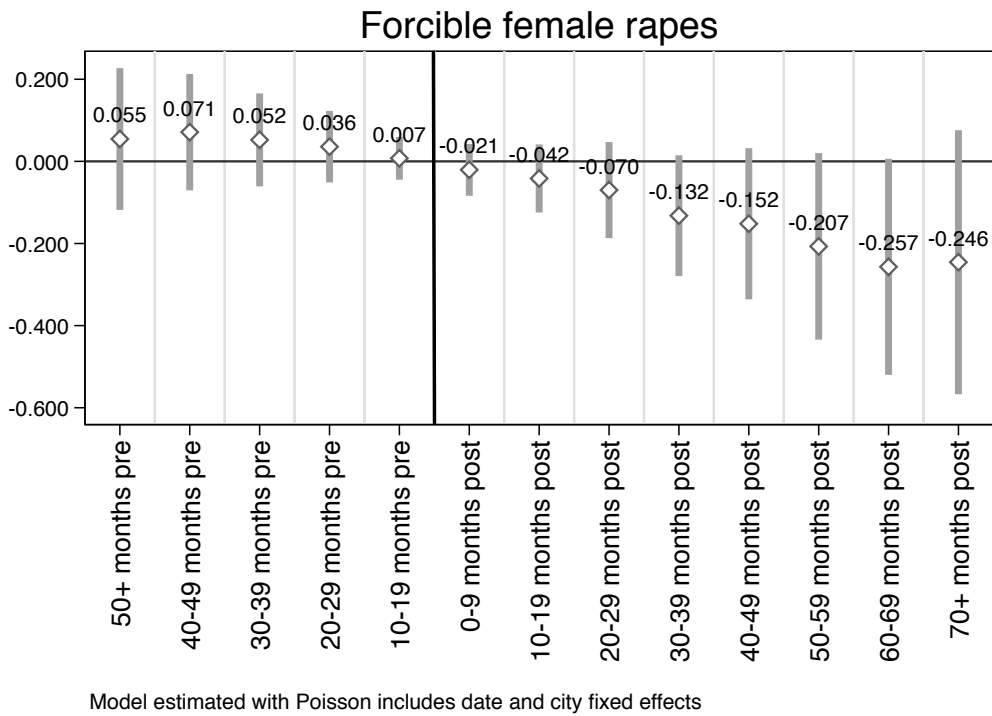
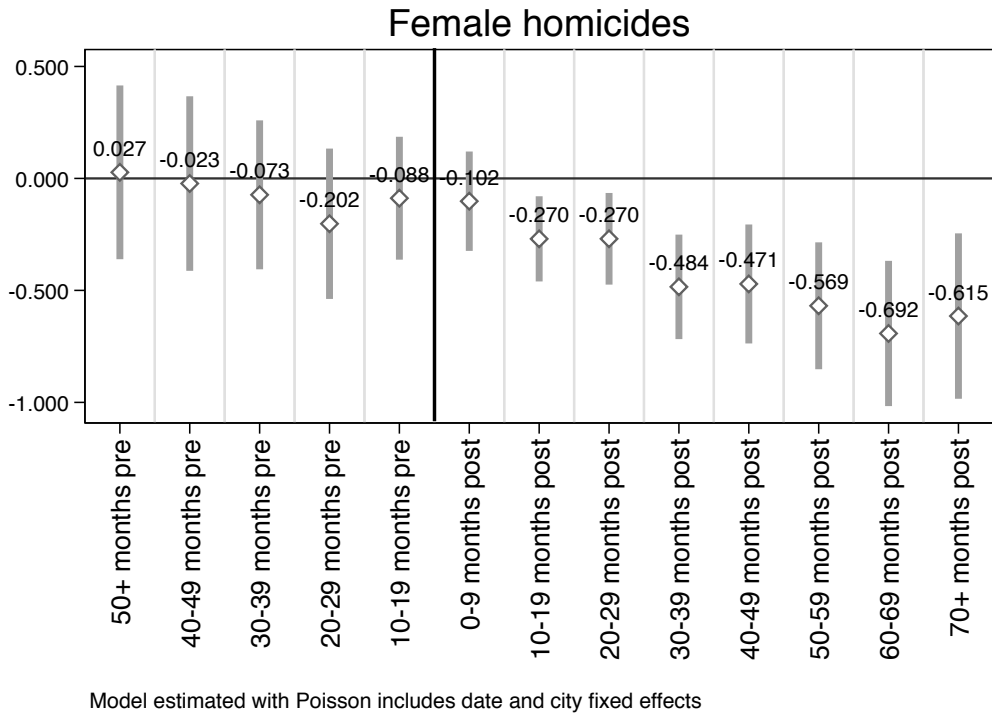


**Figure 6** Number of cities represented in our sample relative to the time of treatment. The x-axis depicts the number of months until or after the introduction of ERS. The y-axis presents the number of cities that appear in our panel with the recentered treatment value of the x-axis.

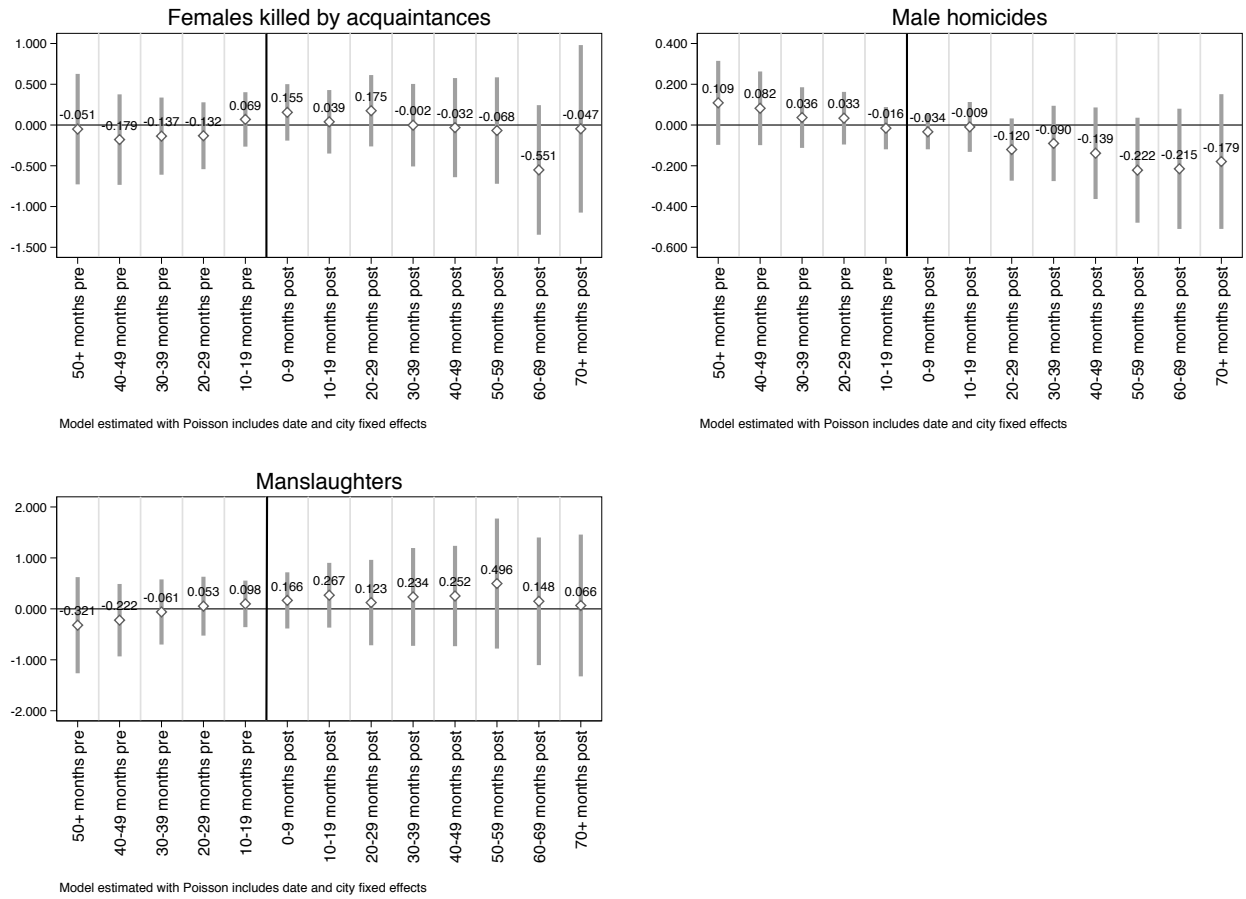




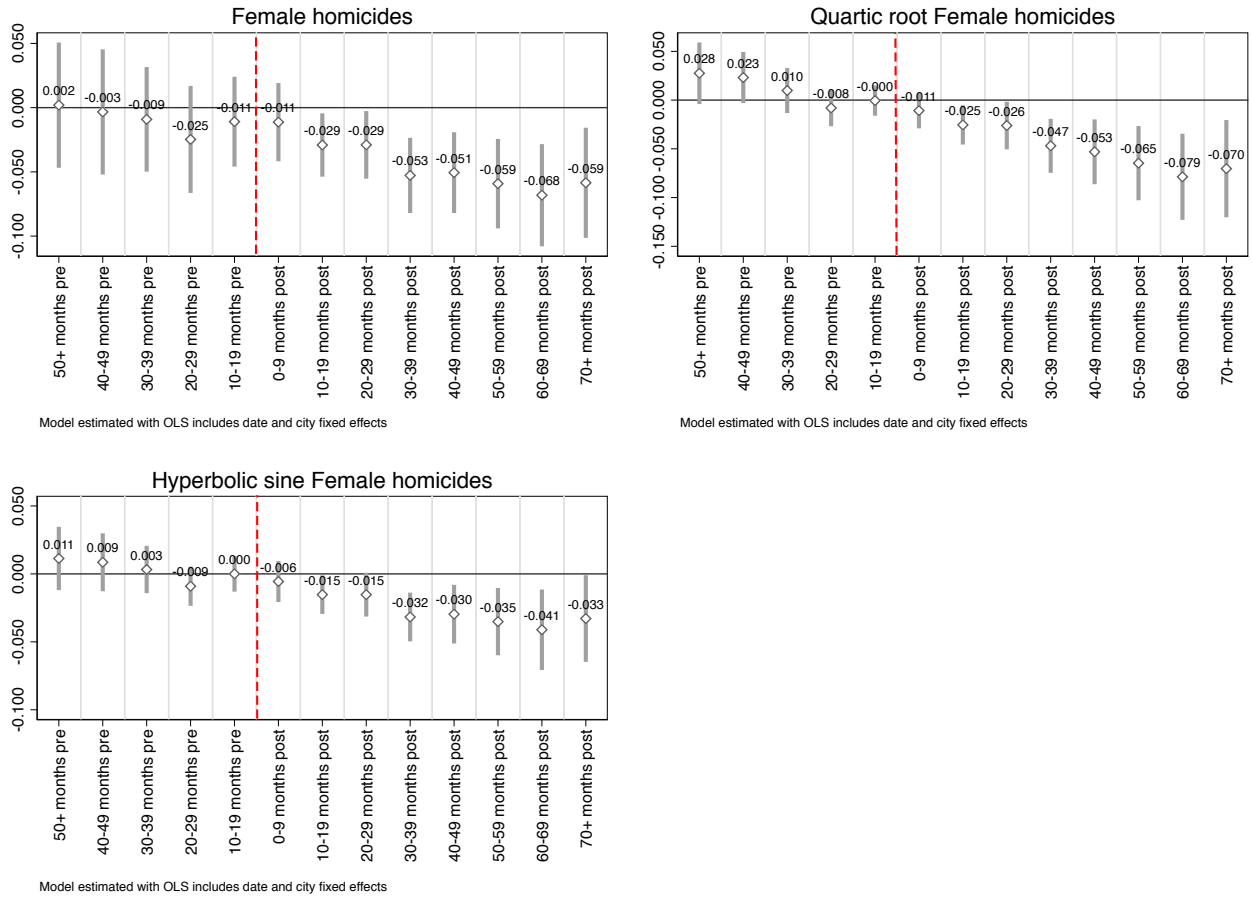
**Figure 7** Conditional (binned) means of characteristics of providers before and after ERS. Top left is the likelihood a provider has a Craigslist email address. Top right is the probability of working as an independent prostitute. Bottom left is the probability of working for an agency.



**Figure 8** Regression coefficient box plots from equation 2 for female murders (top panel) and forcible female rapes (bottom panel) using a Poisson MLE differences in differences model.

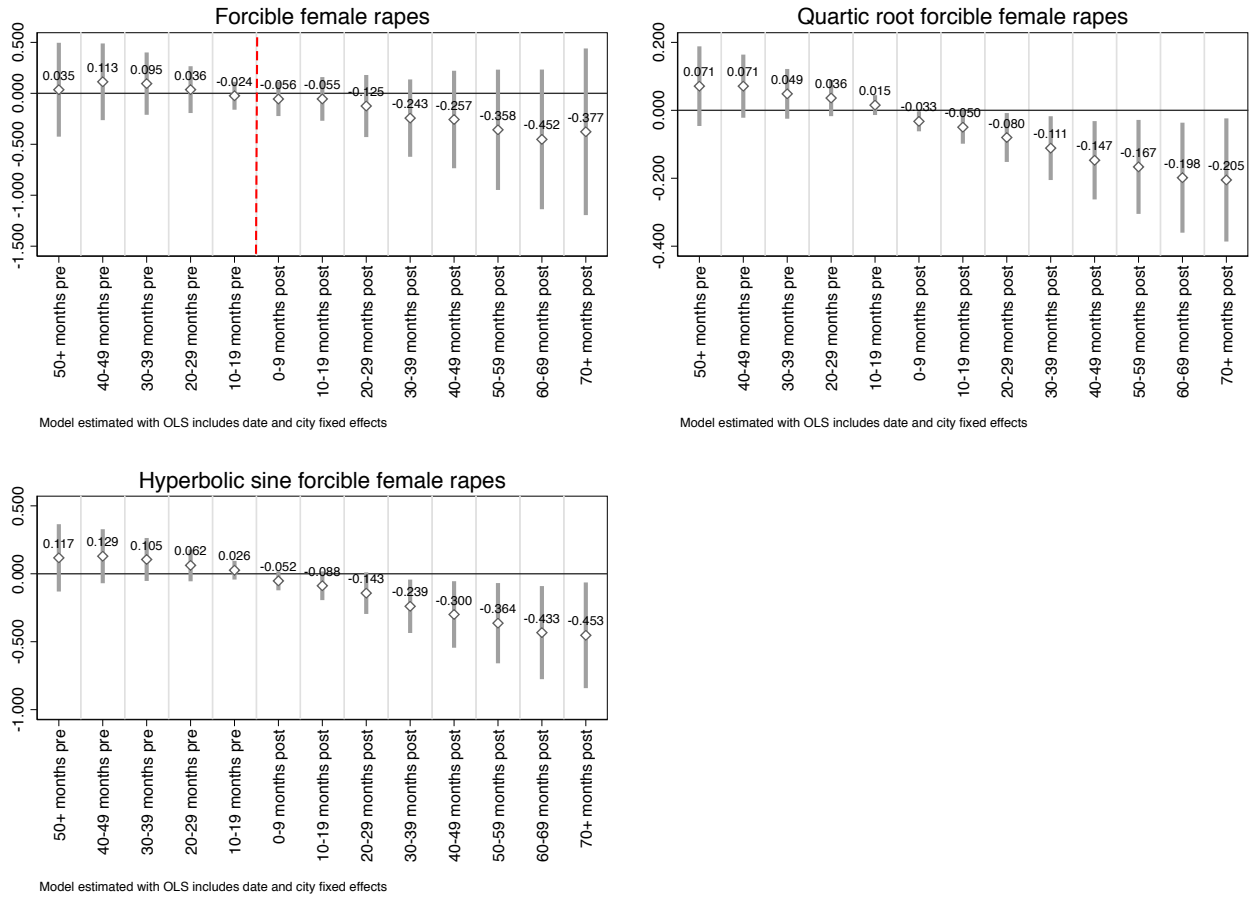


**Figure 9** Regression coefficient box plots from equation 2 for females murdered by acquaintances (top panel), male murders and manslaughter (bottom panels) using a Poisson MLE differences-in-differences model.



**Figure 10** Event study plots of female murders for alternative specifications. The first plot uses the OLS-levels specification. The second plots uses the quartic root, and the third uses the inverse hyperbolic sine.

## 9 Appendix



**Figure 11** Event study plots of female rape offenses for alternative specifications. The first plot uses the OLS-levels specification. The second plots uses the quartic root, and the third uses the inverse hyperbolic sine.