

CHAPTER 2

EXAMINING THE ROLE OF CLIENT REVIEWS AND REPUTATION WITHIN ONLINE PROSTITUTION

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2.1 INTRODUCTION

SELLERS frequently have the opportunity to shirk their obligations to buyers in various ways. A seller may simply refuse to provide a good for which he has been paid, fail to provide some contractually specified aspects of the good, or offer a product of lower quality than agreed upon. In cases where contracts are incomplete, a seller may shirk on complementary noncontractible characteristics of the good (Hart 1975).

Litigation is one means by which sellers are given incentives to fulfill contracts by giving buyers the option to sue. However, in many industries, litigation is either unavailable or prohibitively costly (relative to a buyer's loss from an unfulfilled contract). In such cases, seller reputation can substitute, at least in part, for litigation (Klein and Keffle 1981). To the extent that buyers can observe seller reputation and have a lower willingness to pay for goods provided by low-reputation sellers, sellers have incentives to keep buyers satisfied in order to protect their reputations.

Previous literature has documented the role of the Internet and other new communications technologies in creating scale economies in the sharing of information between buyers, raising the value of reputation, and thereby improving seller behavior and expanding markets. For instance, Cabral and Hortacsu (2010) show how buyer feedback mechanisms on eBay allow small-scale sellers of low-price items to develop reputations for quick delivery of products through the mail. These markets functioned poorly before sites like eBay, since a buyer's cost to sue a seller who failed to deliver a product was often prohibitive.

In this chapter, we focus on the behavior of professional escorts, a relatively high-price segment of the market for prostitution. Since prostitution is illegal in most countries, including most locations in the United States,¹ litigation to resolve contract disputes between sellers and buyers is generally problematic. Even when clients have been assaulted or robbed by a prostitute or her management (pimp), incentives to involve law enforcement are low because of embarrassment and fear of arrest (Reynolds 1986). Moreover, because of the relative infrequency of repeat buyers, incentives to provide noncontractible services, such as enthusiasm, that enhance the buyer’s fantasy are weak. For these reasons, prostitution markets are frequently concomitant with poor behavior on the part of sellers as well as buyers, including assaults and failure to reduce the risks of sexually transmitted infections.

The Internet has, by many accounts, had profound effects on the industrial organization of both brick-and-mortar and illegal markets (including the market for prostitution).² One key recent development in the market for prostitution is the growth of online rating and reviewing websites wherein buyers create profiles of escorts they have seen with detailed information about the worker and ratings of the quality of their experience with the worker along numerous dimensions. There are several regional sites like these, but the most prominent national site is the Erotic Review (TER).³ Using data on more than 90,000 sex workers profiled throughout the United States on TER since 1999, we constructed a variable indicating the importance of the site in various US cities over time. We then examined the relationship between site growth and client self-reported scores of customer satisfaction. We found broad-based growth in client-reported quality of sexual encounters over time, and we found that this correlation also operates across cities; cities where the site grew more quickly saw faster growth in quality. These facts are consistent with the role of TER and similar sites in creating a reputational mechanism in the market for escorts.

In an extension of the empirical model, we also took advantage of a natural experiment that occurred during this period when Craigslist opened advertising sites where sex workers advertise in various cities at different times. We showed that the appearance of Craigslist caused disruptions in usage of TER, and we used two-stage least squares to estimate the causal effect of growth in the reputational mechanism on client-reported quality rankings. We found consistent evidence that the site’s reputational mechanism caused prostitutes to receive higher quality ranking scores along numerous dimensions.

¹ Prostitution is legal in certain rural counties of Nevada.

² See, e.g., Logan and Shah (2013); Cunningham and Kendall (2011); Edlund, Engelberg, and Parsons (2009).

³ <http://www.theeroticreview.com>

2.2 CONCEPTUAL MODEL

2.2.1 Contract Enforcement and Performance

Market interactions between prostitutes and clients are subject to shirking, particularly since many aspects of the client relationship are difficult to define precisely and contract upon. For instance, prostitutes typically attempt to present an illusion of intimacy to clients, acting as though they care about them and really enjoy time spent together, despite being only briefly acquainted. Prostitutes sometimes offer a fantasy of love and fulfillment or of sudden, overwhelming carnal desire (or both).

In fact, the very attempt to define and clearly contract for certain services in many cases undermines the illusion of intimacy. Bargaining over precisely which sexual positions or practices are to be involved, the amount of kissing, eye contact, cuddling, and so on, may make the experience “clinical” and destroy the buyer’s fantasy.

Moreover, the fact that prostitution involves social stigma and a chance of arrest means that time spent negotiating an explicit contract is costly, as it increases the probability of being observed. For these reasons, most bargaining between clients and prostitutes (e.g., discussion on the street or by email) is expedited and involves the use of terminology intended to avoid police operations (e.g., “sensual massage,” “girlfriend experience,” “full service”).

The lack of formal negotiation and the importance of noncontractible services create opportunities for shirking. The problem of shirking is exacerbated because market participants recognize that they will likely not be able to rely on formal contract enforcement by the legal system in case of breach of contract.

Hart (1975) showed that in such circumstances, welfare theorems do not apply, and serious market failures may occur. Moral hazards such as inefficiently low levels of STI testing, attempts to rob clients, and violence between clients and prostitutes are specific examples endemic to prostitution markets.

Klein and Keffle (1981) show that in the absence of formal methods of contract enforcement, seller reputation (what they call the “market mechanism”) may operate to mitigate these problems. Sellers offer buyers high-quality service because they value their reputation. MacLeod (2006) provides a general review of the substantial literature on informal incentives to enforce incomplete contracts.

Repeat customers are one limiting form of such an effect, but public reputation, by which even new customers can observe a signal of sellers’ prior behavior, holds the potential to be even more effective. For escorts, sites like TER can create an observable measure of reputation.

A sizable literature has examined the role of the Internet in facilitating reputational mechanisms to ensure contract fulfillment. Most of this literature has focused on markets in which products are legal but transactions costs are high. For instance, eBay offers long- distance market transactions through the mail for relatively inexpensive

goods, and the eBay “feedback” mechanism attempts to allow buyers to punish sellers who provide poor service (Cabral and Hortacsu 2010). Other sites, such as Amazon.com, Tripadvisor.com, and Angieslist.com, similarly facilitate word of mouth between geographically disparate buyers and appear to discipline sellers. Dellarocas (2003) and Chevalier and Mayzlin (2006) examine word of mouth online. Milgrom, North, and Weingast (1990) show that private institutions that assist in maintaining records of seller reputation are nothing new such as the Law Merchant system that operated among medieval merchants in the eleventh century.

By contrast with prior literature, we focus on a case in which it is not so much geographic distance or infrequency of repeat business that creates the moral hazard but instead the illegality of the product. Prohibitions disrupt markets by eliminating the ability of buyers and sellers to contract optimally, which reduces sellers’ incentives to provide quality service and generates opportunities for violence (Miron 2001). Websites like TER form, in part, a de facto partial legalization (Cunningham and Kendall 2014) and so hold the possibility of circumventing the historical market failure problems associated with legal prohibition. Since, as a consequence, these sites likely also facilitate the consumption of illegal goods, their overall welfare impact is unclear.

2.2.2 Reputation and Selection within Peer-to-Peer Markets

One of the more significant impacts of the Internet on markets has been the efficiencies generated by coordinating informal transactions. The “sharing economy,” via peer-to-peer businesses like Airbnb lower search costs and improve matching for individuals renting homes and apartments temporarily (*The Rise of the Sharing Economy* 2013). Peer-to-peer institutions like Airbnb have been controversial in some quarters and have faced opposition from traditional incumbents, such as hotels and city governments which stand to lose potential tax revenue (Harris 2013).

This controversy highlights both the way in which these peer-to-peer institutions affect coordination and search costs and also the degree to which market participants represent changes in the extensive versus intensive margin. For instance, the creation of new peer-to-peer rental in housing may have had some effect on people’s willingness to purchase manufactured goods. A startup platform called 1000 Tools, for instance, allows people to rent cement mixers from each other but in so doing alters the incentives people have to purchase these goods at all. Along some dimensions, individual incentives to make fixed-cost investments in capital may fall if people can simply rent the items at a price that is less than the presently discounted price of purchase. But on the other hand, insofar as there now exists a secondary market for cement mixers, the overall net price may be lower and increase purchasing. The differences represent the net changes in spending on manufactured goods. Both the intensive margin of cement mixer purchases and the extensive margin of which individuals will or will not become owners at all are affected by the peer-to-peer institutions like Airbnb and other forms of sharing.

While it may seem crude to compare sex to cement mixers and bed-and-breakfast residencies, there are important overlaps. TER, like others, is a digital institution that, via its forums, profiles of sellers, and especially the ability for buyers to rate the sellers themselves, has had analogous effects on people willing to exchange sex for money. For one thing, the advantage of review websites is the potential for clients to more efficiently learn more about unobserved heterogeneous quality among women in a given area. Insofar as men are willing to pay higher prices for quality, these reviews may be welfare enhancing. On the supply side, though, that the reviews provide valuable information to buyers creates incentives for sellers to supply illicit labor as prostitutes to the degree that TER and other websites address these types of problems. For incumbents, this may mean higher prices and thus an increase in seller surplus. But for women with marginally better unobserved and observed attributes at the extensive margin, such institutions may cause selection into prostitution altogether.

Reputation is valuable in such scenarios because of its potential to enforce contracts in the underground market. Sellers of higher unobserved quality should receive higher earnings if clients value these attributes and prior reviews capture some of that information. Individual sellers, furthermore, have additional incentives to produce these higher-quality services so long as the marginal psychic and monetary costs do not exceed the difference in the price between high and low reputation levels.

2.3 DATA AND METHODOLOGY

Reputation is a two-sided matching phenomenon; consumers value it more when other consumers are also using the same “platform.” This kind of “chicken and egg” problem makes identifying its causal effects on performance difficult as a result of simultaneity bias and other forms of endogeneity. In this section, we explain the testable predictions of our model, discuss our measures of reputational mechanisms and behavioral outcomes, and explain the research design we employ to estimate the causal effect of reputational mechanisms on sex worker performance.

2.3.1 Empirical Implications of the Model

Reputational mechanisms are valuable to market participants to the degree that the mechanism is widely adopted by market participants and insofar as the reputational mechanisms convey meaningful information about past performance. At times and locations when TER was relatively unpopular, escorts rarely encountered clients who were familiar with the site. As TER grows in popularity among market participants, escorts recognize that many of their clients frequent the website, which means that behavior with a given client is more likely to be reported on the site and seen by other

potential clients. Therefore, we predict that growth in TER popularity should lead to greater exertion of effort by escorts to please clients.

Such efforts likely expand the demand for escort services, which in turn increases the labor market participation of escorts. Therefore, as the site grows, the number of women entering the escort industry should rise.⁴

To evaluate our model’s theoretical predictions, we used the popularity of TER in a month/city cell as a proxy for changes in various client-reported measures of escort behavior. Specifically, we focused on two different types of behavioral outcomes: first, client-rated “quality” measures of the escort’s performance, including whether the client reported that the escort “delivered as promised,” whether the client felt that the escort’s performance “felt rushed,” whether the escort showed up to the meeting on time, the escort’s “overall quality” score (0–10), and the wage chafed by the escort.

2.3.2 Description of the Data

We used the TER website because it is reportedly an important website for this market, has wide coverage, and contains information on the key behavioral outcomes contained in our model (Brooks 2009).⁵ In 2007, we harvested 378,266 reviews on 77,907 individual escorts from the site using a data-scraping program. These data included information on escorts from 44 cities and/or regions of the United States, Canada, and Mexico and some European cities (e.g., London). We omitted escorts whose primary cities were European (e.g., London), Mexico (e.g., Tijuana), and Canada (e.g., Toronto), which left us with a sample of 72,104 unique American escorts from 39 city-regions from January 1999 through December 2007.

Reviews reflect an individual client’s self-reported experience with a specific escort. While it is possible that some reviews do not reflect accurate information, the reviewing process is detailed, and reviews are vetted by TER before being posted, limiting the incentives to post incorrect information.

Although our analysis exploits both regional and temporal variation in the data, we first present simple aggregate information to help the reader understand both the data series and the empirical strategy we employ. Figure 2.1 is a time-series plot of the average quality score on a scale of 0 to 10 that escorts in our sample received for every month of our sample. We define the average quality as a national average over all reviews at the month cell. The overall trajectory of the escort quality in the data has been upward although with notable variance. Table 2.1 shows the change in average quality scores by city for the combined 1999–2007 period and the percentage change between these two periods. The average score for the entire United States increased 4.4 percent,

⁴ See Brooks (2009) for discussion of the importance and widespread use of ratings websites, of which TER is the most prominent example.

⁵ These data have also been studied by other economists in recent years (Cunningham and Kendall 2011; Edlund, Engelberg, and Parsons 2009)

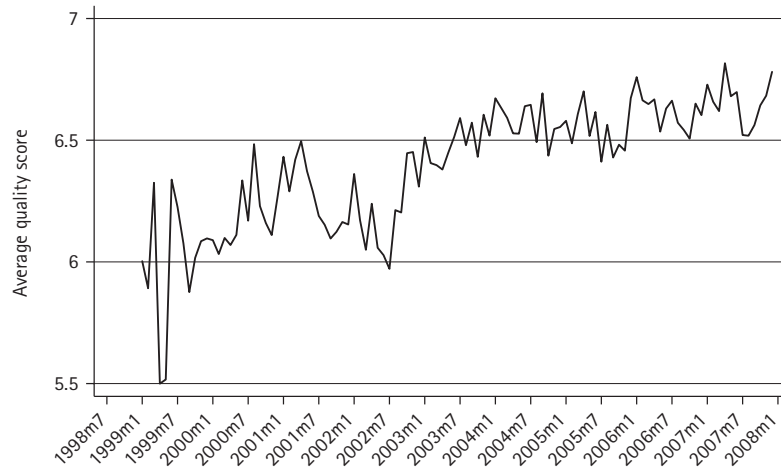


FIGURE 2.1 Average quality for TER Escorts, 1999–2007.

from 6.32 to 6.60. But this aggregate change masks considerable heterogeneity at the city level. Although not all cities saw growth in quality, most did. Figure 2.2 shows the distribution of average client-submitted performance in 2000 and 2007. As each escort has multiple reviews, we took the average and rounded it to the nearest integer and presented this average in Figure 2.1 for the two periods. In 2000, the mean and standard deviation score was 6.18 and 1.75, with a median of 6.5. In 2007, the mean and standard deviation score was 6.66 and 1.88, respectively, with a median of 7. Figure 2.1 shows that the increase in quality scores over the time period is driven primarily by a growth in the right tail of the quality distribution.

We constructed an index of TER’s popularity by summing the number of total reviews that appeared at the site in a given month/city cell. As our sample contains more than 39 US cities/regions, we present a visualization of TER popularity in Figure 2.3. The website’s popularity increased rapidly from late 1999 to early 2004, at which point the website appeared to plateau. This plateau lasted approximately three years, during which the number of unique reviews posted to TER in a month was 5,000. Toward the end of the series, TER experienced a second wave of popularity and grew to more than 7,000 unique reviews each month by the end of 2007.

Increase in website popularity can be decomposed into two separate effects. The website’s growth is both within-city and a result of TER’s penetration into new markets over time. For example, in 2000, 50.52 percent of escorts were associated with Los Angeles (43.86 percent) or Orange County (6.66 percent).⁶ But in 2007, only 14.95 percent of escorts listed the Los Angeles area as their base of operations. A second element of the growth in website popularity a result of the entrance of more prostitutes

⁶ TER allowed for clients to list Los Angeles or Orange County as an escort’s city of operations.

Table 2.1 Average quality scores by city from 1999 to 2007.

	1999–2003	2004–2007	Percent change
Atlanta	6.33	6.59	4.11%
Austin	6.42	6.98	8.72%
Boston	6.57	6.63	0.91%
Carolinas	6.98	6.9	-1.15%
Chicago	6.41	6.47	0.94%
Cleveland	6.53	5.87	-10.11%
Columbus	5.73	6.67	16.40%
Dallas	6.8	7.00	2.94%
Denver	6.68	7.03	5.24%
Detroit	6.84	6.94	1.46%
Gold Coast CA	5.69	6.00	5.45%
Hawaiian Islands	6.3	6.5	3.17%
Houston	6.94	6.88	-0.86%
Indiana	6.83	6.96	1.90%
Jacksonville	—	7.54	—
Las Vegas	6.39	6.62	3.60%
Los Angeles	5.85	6.41	9.57%
Miami	6.78	6.84	0.88%
Minnesota	6.06	6.04	-0.33%
Nashville	6.91	6.92	0.14%
New England	6.72	6.64	-1.19%
New Jersey	6.68	6.65	-0.45%
New Mexico	6.18	7.00	13.27%
New Orleans	6.41	6.33	-1.25%
New York	6.6	6.72	1.82%
Orange County CA	5.35	6.08	13.64%
Orlando	8.07	6.38	-20.94%
Palm Springs	6.17	6.97	12.97%
Philadelphia	6.77	6.56	-3.10%
Phoenix	6.35	6.9	8.66%
Portland	6.3	6.68	6.03%
Reno	6.76	6.81	0.74%
Salt Lake City	6.3	6.24	-0.95%
San Diego	5.37	6.26	16.57%
San Francisco	6.3	6.64	5.40%
Seattle	6.83	6.95	1.76%
Tampa	6.53	6.68	2.30%
Tucson	7.48	7.29	-2.54%
Washington DC	6.35	6.43	1.26%
United States	6.32	6.60	4.4%

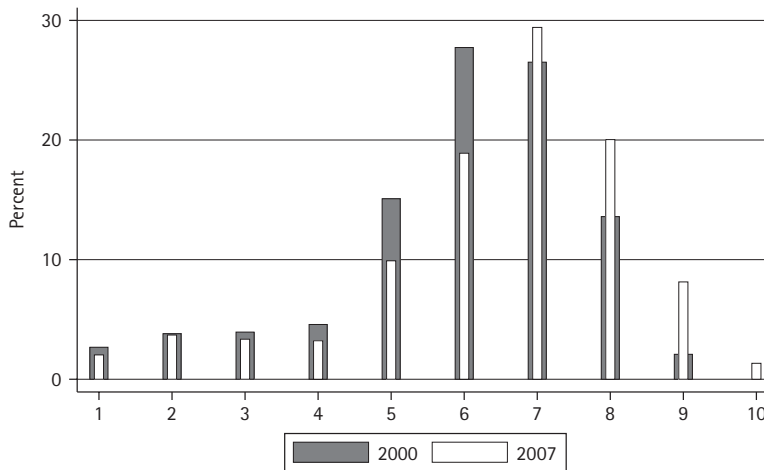


FIGURE 2.2 Histogram of client-submitted performance ratings for 2000 and 2007.

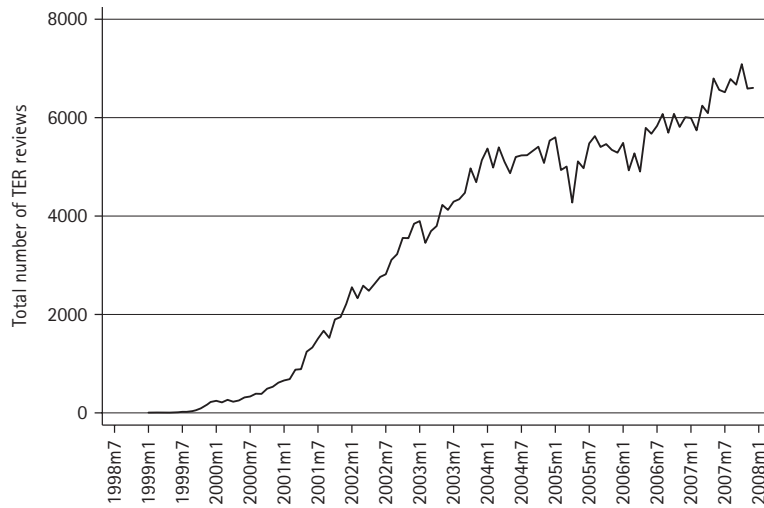


FIGURE 2.3 Total number of new reviews by month for the TER website.

into existing markets as well. In 2000, there were 1,774 unique escorts and 2,359 unique reviews, which is 1.33 reviews for every escort. In 2007, there were 15,289 unique escorts and 16,987 unique reviews, which is 1.11 reviews per escort.

Table 2.2 illustrates the average number of monthly reviews by city over time. While the popularity of TER grew over time, this table shows that there was also considerable within-city/region variation in growth patterns.

Table 2.2 Average number of monthly reviews by city from 1999 to 2007.

	1999–2003	2004–2007	Percent change
Atlanta	123.93	262.59	111.89%
Austin	7.33	25.054	241.96%
Boston	112.76	224.91	99.47%
Carolinas	71.88	122.54	70.47%
Chicago	149.01	321.30	115.62%
Cleveland	16.70	71.39	327.40%
Columbus	14.10	28.63	103.09%
Dallas	48.31	148.06	206.49%
Denver	65.98	98.08	48.65%
Detroit	42.81	84.35	97.03%
Gold Coast CA	4.88	9.75	99.75%
Hawaiian Islands	14.07	23.45	66.65%
Houston	54.65	85.83	57.06%
Indiana	10.59	19.72	86.25%
Jacksonville	—	5.44	—
Las Vegas	82.98	194.76	134.70%
Los Angeles	418.09	643.91	54.01%
Miami	112.64	202.40	79.68%
Minnesota	65.21	179.58	175.41%
Nashville	6.49	13.41	106.66%
New England	7.73	38.21	394.58%
New Jersey	67.25	185.40	175.67%
New Mexico	3.15	5.53	75.49%
New Orleans	8.97	13.33	48.52%
New York	292.49	533.00	82.23%
Orange County CA	33.36	162.96	388.43%
Orlando	2.64	59.71	2164.97%
Palm Springs	4.00	6.79	69.76%
Philadelphia	39.05	103.15	164.15%
Phoenix	53.63	239.29	346.17%
Portland	35.94	67.32	87.32%
Reno	7.49	14.23	90.04%
Salt Lake City	11.65	26.75	129.59%
San Diego	98.52	136.23	38.29%
San Francisco	321.02	310.68	−3.22%
Seattle	75.58	111.19	47.12%
Tampa	30.46	97.90	221.42%
Tucson	6.62	18.28	176.37%
Washington D.C.	168.85	434.09	157.09%
United States	193.06	269.92	39.81%

2.3.3 Econometric Model and Identification Strategy

We are interested in estimating the following linear model:

$$Y_{i,c,m,y} = \delta D_{c,m,y} + \beta X_{i,c,m,y} + \chi_c + \mu_m + \omega_y + \varepsilon_{i,c,m,y} \quad (2.1)$$

where $Y_{i,c,m,y}$ is the outcome of interest which is a unique individual-level quality score or transaction variable unique to an individual (i) in a city/region (c), month (m), and year (y); $D_{c,m,y}$ is our proxy for the reputational effectiveness of the website proxied by the city/month number of reviews; $X_{i,c,m,y}$ is a matrix of individual-level covariates (see table 2.1); χ_c is a city/region fixed effect; μ_m is a month fixed effect, and ω_y is a year fixed effect.

The disturbance term is assumed to be uncorrelated with the reputational factor itself. In one robustness specification, we introduced state-specific linear time trends to net out unobserved trends unique to a city. All standard errors are robust to heteroskedasticity.

We estimated equation (1) using OLS and tested for the robustness in several ways. First, we included individual level controls that may be correlated with outcomes of interest, such as female attractiveness measures. Second, we included in some specifications the gross inflation-adjusted price. Third, we experimented with specifications for city-specific trends, such as the linear and quadratic trend. And finally, we estimated equation (1) using two-stage least square (2SLS). In our 2SLS model, we instrumented for city website popularity using the entry of Craigslist’s “erotic services” into the city, which had a disruptive effect on website popularity, which we discuss below.

There are some shortcomings to this approach. A relevant issue with our research design is that the composition of sellers and buyers may change across time and may also be correlated with the expansion of TER and the entry of Craigslist in city markets. Our analysis ultimately cannot disentangle the behavioral ramifications of increased utility of reputation to enforce contracts and the change in the composition of sex workers and clients over time and space.

2.4 RESULTS

We present basic summary statistics for our regression baseline regression sample in table 2.3. The mean performance score (our proxy for quality) is 6.51 for the entire sample, with a standard deviation of 1.88. Eighty-eight percent of respondents said that the escort had “delivered as promised,” and 33 percent stated they felt the escort had tried to rush the session so as to end it too soon (from the client’s perspective). Ninety percent of the sample scored the escort as punctual. The inflation-adjusted gross price for the entire period was \$276.90. As this is unadjusted for session length, this is a gross measure and not the worker’s wage. The average number of reviews for the period was

259 reviews per month. Detailed demographic information can be interpreted in table 2.3 by the reader.

2.4.1 Baseline regression results

We present baseline regression results in table 2.4. Each column is a separate regression, and while the information is not reported here for the sake of readability, we also controlled for year, city, and month fixed effects.⁷ Column 1 of table 2.4 controls additionally for a city trend, whereas column 2 (and all subsequent even-numbered columns) controls for individual observable variables listed in table 2.3. Website popularity has been rescaled by dividing the monthly reviews by 100 so that the estimated coefficients could be interpreted using three decimal places only. Therefore, one should interpret the coefficients as an increase in 100 additional reviews within cities over months.

Going from left to right, we find that including controls for individual-level covariates did not have a substantial effect on the magnitude or precision of our parameter estimates, and therefore we will focus on the odd-numbered columns since these represent our saturated models. A 1-standard-deviation increase in website popularity was associated with a 0.07-point increase in an escort’s quality score. Put another way, an additional 1,000 reviews within a city over time improved the average quality of an escort by 5.5 percent.⁸

Other results are interesting. For instance, website popularity is also correlated with higher (conditional) probabilities of meeting client satisfaction and escort punctuality. An additional 1,000 reviews in a city were associated with 4.5 percent higher probability that clients considered the service experience, *ex post*, consistent with *ex ante* expectations. And 1,000 additional reviews by city were associated with a 10 percent higher probability of escort punctuality. While website popularity was associated with reduced probabilities of claiming the experience felt “rushed,” this relationship was not statistically significant at conventional levels.

In table 2.5, we include the log gross price as a covariate and find that our results do not change significantly from when we did not control for price. The magnitude of quality score increases from 0.036 to 0.049, although these are not statistically different from each other at conventional levels. The effect on client expectations remained positive but is only marginally significant. The magnitude and precision on whether clients felt rushed improved, but the effect on punctuality remained the same.

Tables 2.6 and 2.7 add a vector of city-specific quadratic trends as controls to each previously discussed model. As before, we focus on the odd-numbered columns.

⁷ The entire output is available upon request.

⁸ Our linear model predicts that 1,000 additional reviews were associated with a 0.36 increase in escort quality score. Using a mean of 6.51 (see table 2.4, column 2), an additional 0.36 is equivalent to increasing quality by 5.5 percent.

Table 2.3 Summary statistics for TER individual-level variables (1999–2006).

Dependent Variables	Obs.	Mean	Std. Dev.
Performance score	72,104	6.51	1.88
Delivered as promised	72,104	0.88	0.32
Client felt rushed	72,104	0.33	0.47
Punctual arrival	72,104	0.90	0.30
Inflation-adjusted gross price	72,104	\$276.90	\$364.81
Covariates			
Monthly Website Reviews (× 100)	72,104	2.59	1.96
18–20 years old	72,104	0.11	0.31
21–25 years old	72,104	0.44	0.50
26–30 years old	72,104	0.26	0.44
36–40 years old	72,104	0.05	0.22
41–45 years old	72,104	0.02	0.14
46+ years old	72,104	0.01	0.10
A cup	72,104	0.07	0.26
B cup	72,104	0.30	0.46
C cup	72,104	0.34	0.47
Escort	72,104	0.76	0.43
Anal sex	72,104	0.02	0.15
Massage	72,104	0.14	0.34
Tantra	72,104	0.00	0.06
Massage and fellatio	72,104	0.02	0.15
BDSM	72,104	0.02	0.13
Independent	72,104	0.53	0.50
Answers telephone	72,104	0.66	0.47
Incall only	72,104	0.36	0.48
Outcall only	72,104	0.15	0.36
Incall/outcall	72,104	0.49	0.50
Transsexual	72,104	0.06	0.24
Athletic	72,104	0.27	0.44
Average build	72,104	0.19	0.39
Muscular	72,104	0.00	0.07
Baby fat	72,104	0.12	0.33
Fat	72,104	0.07	0.26
Other build	72,104	0.02	0.13
≤ 4'9"	72,104	0.00	0.03
4'9"–4'11"	72,104	0.01	0.11
4'11"–5'2"	72,104	0.14	0.35
5'2"–5'5"	72,104	0.42	0.49
5'5"–5'8"	72,104	0.33	0.47
5'8"–5'11"	72,104	0.08	0.27
5'11"–6'2"	72,104	0.01	0.08
6'2"–6'5"	72,104	0.00	0.02
≥ 6'5"	72,104	0.00	0.01

Table 2.4 Effect of website popularity on service quality (OLS), with linear city trends.

Depvar	Quality score		Delivered as promised		Felt rushed		Punctual	
	1	2	3	4	5	6	7	8
Website popularity	0.040*** (0.013)	0.036*** (0.012)	0.005** (0.002)	0.004* (0.002)	-0.005 (0.003)	-0.004 (0.003)	0.011*** (0.002)	0.009*** (0.002)
N	72,104	72,104	72,104	72,104	72,104	72,104	72,104	72,104
R squared	0.04	0.17	0.01	0.08	0.02	0.06	0.01	0.06
Mean dependent variable	6.51	6.51	0.88	0.88	0.33	0.33	0.90	0.90
Std. dev. dependent variable	1.88	1.88	0.32	0.32	0.47	0.47	0.30	0.30

All models controls for city, year, and month fixed effects, as well as city-specific linear trends. Standard errors corrected for heteroskedasticity. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 2.5 Effect of website popularity on service quality (OLS), with linear city trends.

Depvar	Quality score		Delivered as promised		Felt rushed		Punctual	
	1	2	3	4	5	6	7	8
Website popularity	0.062*** (0.012)	0.049*** (0.012)	0.005** (0.002)	0.003 (0.002)	-0.008** (0.003)	-0.006* (0.003)	0.010*** (0.002)	0.009*** (0.002)
Log gross price	0.636*** (0.013)	0.416*** (0.014)	-0.007*** (0.002)	-0.030*** (0.002)	-0.084*** (0.003)	-0.064*** (0.003)	-0.022*** (0.002)	-0.012*** (0.002)
N	71,944	71,944	71,944	71,944	71,944	71,944	71,944	71,944
R squared	0.07	0.18	0.01	0.08	0.03	0.07	0.01	0.06
Mean dependent variable	6.51	6.51	0.88	0.88	0.33	0.33	0.90	0.90
Std. dev. dependent variable	1.87	1.87	0.32	0.32	0.47	0.47	0.30	0.30

All models controls for city, year, and month fixed effects, as well as city-specific linear trends. Standard errors corrected for heteroskedasticity. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 2.6 Effect of website popularity on service quality (OLS), with linear and quadratic city trends.

Depvar	Quality score		Delivered as promised		Felt rushed		Punctual	
	1	2	3	4	5	6	7	8
Website popularity	0.037** (0.016)	0.034** (0.014)	0.003 (0.003)	0.001 (0.003)	0.003 (0.004)	0.003 (0.004)	0.009*** (0.002)	0.007*** (0.002)
N	72,104	72,104	72,104	72,104	72,104	72,104	72,104	72,104
R squared	0.04	0.17	0.02	0.09	0.02	0.06	0.01	0.06
Mean dependent variable	6.51	6.51	0.88	0.88	0.33	0.33	0.90	0.90
Std. dev. dependent variable	1.88	1.88	0.32	0.32	0.47	0.47	0.30	0.30

All models controls for city, year, and month fixed effects, as well as city-specific linear and city-specific quadratic trends. Standard errors corrected for heteroskedasticity. * p < 0.10, ** p < 0.05, *** p < 0.01

Table 2.7 Effect of website popularity on service quality (OLS), with linear and quadratic city trends.

Depvar	Quality score		Delivered as promised		Felt rushed		Punctual	
	1	2	3	4	5	6	7	8
Website popularity	0.051*** (0.015)	0.041*** (0.014)	0.003 (0.003)	0.001 (0.003)	0.001 (0.004)	0.002 (0.004)	0.009*** (0.002)	0.007*** (0.002)
Log gross price	0.638*** (0.013)	0.418*** (0.014)	-0.007*** (0.002)	-0.030*** (0.002)	-0.084*** (0.003)	-0.065*** (0.003)	-0.022*** (0.002)	-0.012*** (0.002)
N	71,944	71,944	71,944	71,944	71,944	71,944	71,944	71,944
R squared	0.07	0.18	0.02	0.09	0.03	0.07	0.01	0.06
Mean dependent variable	6.51	6.51	0.88	0.88	0.33	0.33	0.90	0.90
Std. dev. dependent variable	1.87	1.87	0.32	0.32	0.47	0.47	0.30	0.30

All models controls for city, year, and month fixed effects, as well as city-specific linear and city-specific quadratic trends. Standard errors corrected for heteroskedasticity. * p < 0.10, ** p < 0.05, *** p < 0.01

Including city-specific linear and quadratic trends had little effect on the magnitude and precision of the quality score, which remains in the range previously found in table 2.4 with a coefficient of 0.034. Delivered as promised is positive but no longer statistically significant, whereas punctuality has a similar magnitude as reported in table 2.4 and is precise. We find similar effects in table 2.7 as in table 2.5. The most robust evidence from these baseline regressions is positive associations between website popularity, escort quality scores, and escort punctuality.

2.4.2 Instrumental Variables Results

Our baseline regression analysis supports the conjecture that website popularity on a reputational website was associated with a rise in escort quality. This empirical strategy may be inappropriate, though, if there are unobservable variables correlated with outcomes of interest as well as website popularity. For instance, if website popularity is associated with changing economic conditions associated with changes in the outcomes of interest that are not captured by our fixed effects, time shocks, or linear and quadratic city time trends, then our baseline regressions are biased. To overcome this possibility, we add as a robustness an instrumental variables research design by using Craigslist’s “erotic services” portal as an instrument for website popularity.

We use Craigslist’s entry into a market as an instrument for the reputational factor because Craigslist was an imperfect substitute for TER briefly during this period. This instrument provides a natural experiment wherein the usefulness of TER’s reputation mechanism was affected by the appearance of a classified advertising portal. Unlike TER, Craigslist does not contain reputational information about escorts. Individual escorts could place (at the time) free classified advertisements to promote themselves, which, as in the case of TER, helped to minimize search costs. It was also supply-side driven, whereas TER is demand-side driven as clients place reviews at TER but escorts place advertisements at TER.

Table 2.8 shows city-specific dates in which Craigslist launched the “erotic services” portals. All information about dates of entry were collected using the Way-Back Machine. Comparisons by city between the dates provided show that earlier in time, Craigslist’s clone would enter a market first, followed by its “erotic services” at a later date. This pattern became less common, though, later when Craigslist would enter a new city by providing its entire services to residents there.

We produce time-series figures to facilitate the reader’s understanding of our instrumental variables identification strategy. The top panel of figure 2.4 shows the change in total reviews per month for Las Vegas before and after Craigslist opened in the market. Immediately following Craigslist’s “erotic services” portal, TER reviews plummeted from approximately 180 reviews per month to a low of 125 reviews per month. Reviews would not return to pre-Craigslist levels for almost two years in Las Vegas. Not all cities followed such a stark reversal in trend following Craigslist’s entry. Houston, for instance, saw its reviews flatten, and then fall, after Craigslist entered the market.

Table 2.8 Dates when city-specific Craigslist "erotic services" boards launched.

Date of Introduction		City
Nov	2002	San Francisco
Jul	2003	Boston
		Los Angeles
		New York
Sep	2003	Phoenix
		San Diego
		Seattle
		Washington DC
Oct	2003	Austin
		Chicago
		Dallas
		Denver
		Detroit
		Houston
		Miami
		Minnesota
		Philadelphia
		Portland
Nov	2003	Atlanta
		Carolinias
		Cleveland
		Hawaiian Islands
		New Orleans
		Orlando
		Tampa
Feb	2004	Las Vegas
		Nashville
Mar	2004	Columbus
Apr	2004	Indiana
Sep	2004	Gold Coast CA
		Jacksonville
		New Mexico
		Salt Lake City
		Tucson
Nov	2004	Orange County CA
		Reno
Mar	2005	New Jersey
Jun	2005	New England
Feb	2006	Palm Springs

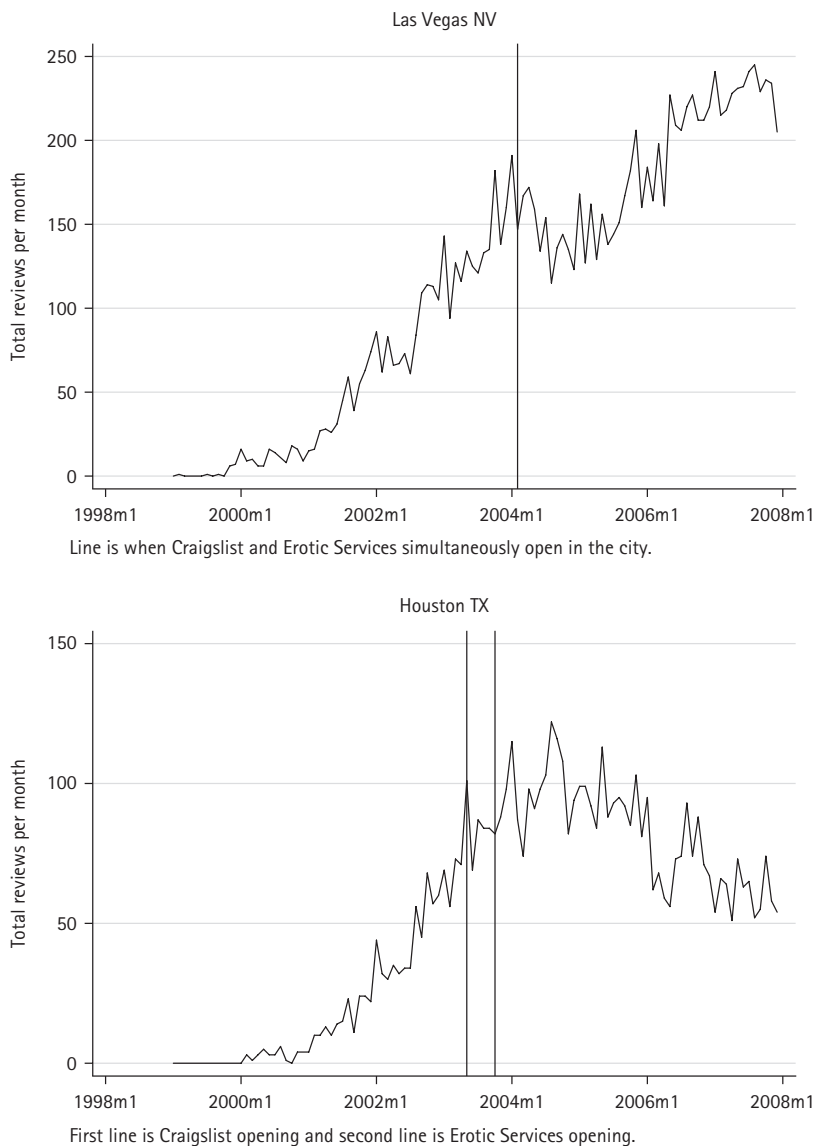


FIGURE 2.4 New reviews by month for select cities.

To better understand the association between the creation of erotic services and the usefulness of the TER website, we aggregated the number of monthly reviews over all cities/regions in our sample relative to when that erotic services opened in that city/region. We present this information in figure 2.5 using only the sample periods 48

Table 2.9 Effect of website popularity on service quality (2SLS), city-specific time trends.

Depvar	Quality score			
	promised	Delivered as	Felt rushed	Punctual
Website popularity	0.056 (0.070)	0.020* (0.012)	0.021 (0.019)	0.018 (0.012)
First Stage Instrument				
Months from erotic services entry	-0.050***	-0.050***	-0.050***	-0.050***
Robust standard error	0.001	0.001	0.001	0.001
<i>f</i> statistic for IV in first stage	2304.78	2304.78	2304.78	2304.78
N	72,104	72,104	72,104	72,104
Mean dependent variable	6.51	0.88	0.33	0.90
Std. dev. dependent variable	1.88	0.32	0.47	0.30

Instrumental variable equals 0 in city/months when Craigslist had not entered, and is then equal to the number of months since it opened for all periods after its opening date. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

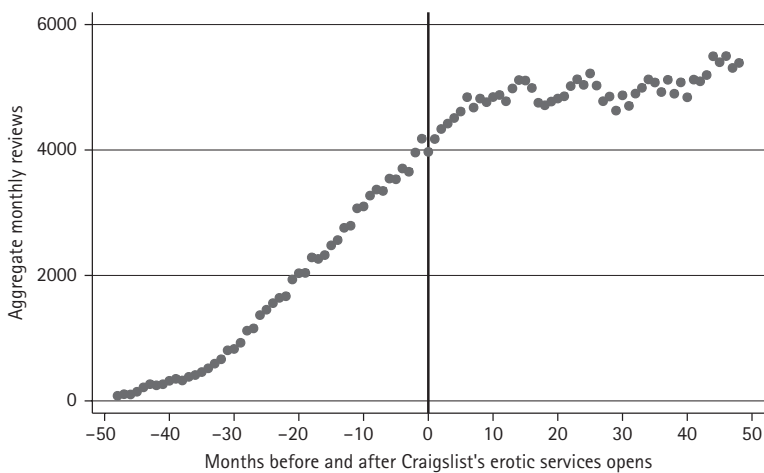


FIGURE 2.5 Aggregate TER monthly reviews relative to the date when Craigslist erotic services opened.

months prior and 48 months after erotic services opened in a city/region. This instrumental variables research design primarily exploits the break in trends shortly after the cutoff, which corresponds to when TER’s website began to experience substantial competition from Craigslist. We used both Craigslist’s entry and the erotic services opening as instruments because prior to erotic services, prostitution advertising occurred in other portals, such as the women-seeking-men classified section.

A valid instrumental variable has two properties: it must be highly correlated with the endogenous variable of interest, and it must be excludable from the structural equation of interest. Our figures, as well as regression analysis, allow us to examine the first element in this criteria. Craigslist’s entry by city and time is highly correlated with an unpredicted break in TER’s growth by city. The first stage in all our two-stage least squares models is very strong, with an F statistic testing the significance of excluding the instruments from the first-stage model exceeds the standard benchmark value of 10. The excludability of the instrument from the structural equation is not directly testable. Nevertheless, we argue that given the differing functions of the two websites—one is classified advertising and the other is review—it is unlikely that Craigslist’s strategy to enter a market was a result of factors related to supply supply-and-demand forces in the commercial sex market. This is even more unlikely when one considers that originally Craigslist didn’t earn any revenue from its “erotic services” portal.

Because we instrument for website popularity with the number of months since Craigslist opened erotic services in the escort’s city/region, we will provide some additional help for interpreting the results. First, we find that the effect of Craigslist entering the market was associated with a decrease in website popularity and equal to on average 5 fewer reviews per month controlling for city-specific time trends and individual-level covariates. As instrumental variables increase the standard errors, we note that the magnitudes observed with OLS are similar to (albeit somewhat larger than) what we estimated earlier but is no longer statistically significant. As before, we find quality scores are roughly equal to the magnitudes we found for OLS. While punctuality remains positive, it has doubled in magnitude and is only marginally significant. Our instrumental variables results recover a marginally significant association between the website’s popularity and customer expectations. An additional 100 reviews are associated with a 2.7 percent increase in the conditional probability of meeting client expectations.⁹

2.5 CONCLUSION

The growth in informal information-sharing websites has played an important role in the growth of indoor prostitution in the United States. One of the ways it has done so has been through the creation of a reputational mechanism that helps enforce informal agreements between buyer and seller, which is important for this market given that prostitution remains illegal in the United States outside of the rural counties of Nevada. The popularity of these websites, through the credible threat of a bad review and its effect on seller profits, now plays an important institutional role in facilitating prostitution transactions by increasing the incentive to provide “higher-quality” sex work to the market.

⁹ We calculated this using the mean of 0.88 and estimated coefficient of 0.02. The change in probability of customer satisfaction is equal to $\frac{0.02}{0.88} = 0.27$, or 2.7 percent.

Our study makes several contributions to the study of economics of sex work. For one, it illustrates the structural change in sex-work-related hazards as information technology has saturated the illegal marketplace. Insofar as "higher-quality" sex work corresponds to differences in STI risks, mortality risks, or compositional changes in sex worker populations, it is conceivable that the optimal policies under an information-rich technological environment differ considerably from what had been optimal before. If reputational mechanisms alleviate adverse selection, for instance, then the marginal sex worker may be lower risk overall, *ceteris paribus*, by drawing in individuals for whom the fixed and variable costs of production had been higher. More research would be needed to map out what effect this has had on the sexual network, as it is possible that despite the increase in sex workers, the positive selection on lower-STI-risk individuals may imply a lower transmission rate within the population for various STIs (Kremer and Morcom 1998).

The main insight may be simply to highlight the changes in composition of buyers and sellers brought on by new website services, including reputation-based reviewing. By providing informal means of enforcing contracts outside of the law itself, these reputational mechanisms may be slowly transforming what kinds of buyers and sellers engage in illicit sex trades. This would suggest that law enforcement and policy makers will need new insights into the role of technology, not only in shaping the marketplace but also in its effect on entry and exit.

Our study ultimately is unable to evaluate the change in social welfare, only to state that the reputational mechanism can make an illegal market function more efficiently as a result of simply providing information to future buyers about unobserved type. But insofar as information technology is altering the barriers to entry, it still remains the case that under prohibition, sellers will be less likely to cooperate with law enforcement, and therefore the risk of injury remains. Our model focuses primarily on the value of reputation to buyers, not sellers, in other words. Our study does not shed any light on how sellers can credibly manage their own risks, such as the risk of matching with a violent client. Our study also does not claim to have distinguished between TER's effect on behavior at the intensive margin among incumbents versus selection into prostitution at the extensive margin, only that the growth in this particular institution (TER) is correlated uniquely with the quality measures recorded by clients. Future work should focus on how these risks manifest in the emerging Internet environment.

REFERENCES

- Brooks, Amanda. 2009. *The Internet Escort's Handbook Book 2: Advertising and Marketing*, 1st ed. Golden Girl.
- Cabral, Luis, and Ali Hortacsu. 2010. "The Dynamics of Seller Reputation: Theory and Evidence from eBay." *Journal of Industrial Economics* 58, no. 1: 54–78.
- Chevalier, Judith, and Dina Mayzlin. 2006. "The Effect of Word-of-Mouth on Sales: Online Book Reviews." *Journal of Marketing Research* 43, no. 3: 345.

- Cunningham, Scott, and Todd D. Kendall. 2011. “Prostitution 2.0: The Changing Face of Sex Work.” *Journal of Urban Economics* 69: 273–287.
- Cunningham, Scott, and Todd Kendall. 2014. “Prostitution 3.0: A Comment.” *Iowa Law Review Bulletin* 98: 131–141.
- Dellarocas, Chrysanthos. 2003. “The Digitization of Word of Mouth: Promise and Challenges of Online Feedback Mechanisms.” *Management Science* 49, no. 10: 1407–24.
- Edlund, Lena, Joseph Engelberg, and Christopher Parsons. 2009. “The Wages of Sin.” Unpublished manuscript.
- Harris, Elizabeth A. 2013. “The Airbnb Economy in New York—Lucrative but Often Illegal.” *New York Times*, November 4.
- Hart, Oliver D. 1975. “On the Optimality of Equilibrium When the Market Structure Is Incomplete.” *Journal of Economic Theory* 11, no. 3: 418–443.
- Klein, Benjamin, and Keith B. Keffle. 1981. “The Role of Market Forces in Assuring Contractual Performance.” *Journal of Political Economy* 89: 615–641.
- Kremer, Michael, and Charles Morcom. 1998. “The Effect of Changing Sexual Activity on HIV Prevalence.” *Mathematical Biosciences* 151: 99–122.
- Logan, Trevon, and Manisha Shah. 2013. “Face Value: Information and Signaling in an Illegal Market.” *Southern Economic Journal* 79, no. 3: 529–564.
- MacLeod, Bentley. 2006. “Reputations, Relationships, and the Enforcement of Incomplete Contracts.” IZA discussion paper no. 1978.
- Milgrom, Paul, Doug North, and Barry Weingast. 1990. “The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges and the Champagne Fairs.” *Economics and Politics* 2, no. 1: 1–23.
- Miron, Jeffrey. 2001. “Violence, Guns and Drugs: A Cross-Country Analysis.” *Journal of Law and Economics* 44, no. 2, pt. 2: 615–634.
- Reynolds, Helen. 1986. *The Economics of Prostitution*. Springfield, IL: Charles C. Thomas.
- The Rise of the Sharing Economy*. 2013. *Economist*, March 9.