Copyright Enforcement: Evidence from Two Field Experiments*

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Abstract

Effective dispute resolution is important for reducing private and social costs. This paper studies the effects of price differences and communication style on copyright infringement settlement. We use a novel dataset of infringement incidences by businesses generated from two field experiments run by a stock-photography agency. We find that a substantial reduction in the requested amount generates a small increase in settlement rate; given the same reduced request, a message informing infringers of the price reduction and acknowledging possible unintentionality generates a large increase; and including a deadline further increases the response. The small price effect (when compared to the large message effect) can be explained as the result of two effects that counteract each other: price inducement to settle early, but a lower threat of escalation. Furthermore, acknowledging possible unintentionality may encourage collaborative behavior due to the typically inadvertent nature of these incidences. The resulting higher settlement rate avoids additional legal action and reduces social costs.

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1 Introduction

Disputes such as breach of contracts, overdue payments, and violation of property rights are commonplace between businesses and individuals. Effective resolution of these disputes is important to save legal expenses and to reduce opportunity costs of time and stress. Threat of legal sanction is credible in only some circumstances, since, for example, it is impractical when monetary claims are small. It also may not be desirable even if effective, since a litigious reputation may drive away customers. Encouraging collaborative outcomes in these situations may require alternative, creative methods.

Copyright enforcement is an interesting example of this problem and is important in the management of intellectual property (IP). As above, monetary amounts are generally small and content producers typically want to avoid a litigious reputation because their primary source of revenue is licensing and selling goods. Legal actions against file-sharing networks and individuals (notably by trade associations in the music and movie industries) have been controversial and have met with limited success. Despite these challenges, digital technologies have substantially lowered the costs of detecting infringement, making enforcement an increasingly relevant option.[1] In this paper, we study the effectiveness of different, new approaches to copyright enforcement on the settlement outcome. In particular, we focus on two aspects: (1) the requested amount; and (2) communication.

Our empirical application comes from the stock-photo industry.[2] Stock photos are pre-shot images that are readily available for licensing. On behalf of photographers, agencies such as Corbis Images and Getty Images manage, market, and license images to business customers. The extent of piracy is enormous in this market as digital images are easily accessible online through search engines and social media sites, and users often have limited knowledge about their legal obligations of using images. Furthermore, the common use of third-party advertisers and web designers also results in many indirect infringement instances, for which end-users are ultimately liable. Our data are provided by one of the leading agencies (hereafter, the Agency), which monitors the online use of a small set of the most expensive images it manages and pursues only infringement for commercial purposes. The dataset contains detailed information on all infringement instances for which the Agency pursued settlement in the U.S. and Canada between October 2013 and March 2014, including the requested amount, infringing firm characteristics, and the settlement outcomes.

Our data are novel for the following reasons. First, empirical studies on settlement have previously

[1] Some recent examples of anti-piracy services that have been developed by private companies include Digimarc in the publishing industry and MarkMonitor (purchased by Thomson Reuters in 2012) in industries including movies, music, software, and publishing. Bechtold (2013) surveys recent studies of the impacts of digital-rights management technologies.

[2] Glückler and Panitz (2013) estimates that the global revenue of the stock-photography industry was $2.88 billion in 2011. In comparison, the revenues of ASCAP and BMI were $1B each in 2012.

depended primarily on court filings, which capture only a small percentage of disputes.[3] Our sample is 'unselected' in that it includes all instances that the Agency pursues settlement, and the data capture the earliest stage of the enforcement process. This is important since infringers and settlement behaviors at this stage are likely to differ from the few cases that reach litigation. Second, it is rare for field data to contain exogenous variation in enforcement methods, and laboratory experiments may be hard to generalize to real-world settings. Our data are generated by two field experiments and include exogenous variation both in pricing and in communication. Third, infringing firms in our sample are largely representative of the U.S. firm population.[4] This is valuable because it not only documents the prevalence of infringement among businesses, but it also provides insight into the resolution of disputes and bargaining between firms (rather than among individuals as typically studied in lab experiments).

Prior to either experiment, the requested settlement amount includes a baseline licensing fee plus a $400 per-image surcharge to recover the Agency's costs of enforcement. The licensing fee depends on the nature of the infringing use and is a weighted average of image list prices, which in turn vary by specific use categorization. The two price components, however, are not separately broken down in the letter to the infringer. The Agency ran the first *pricing* experiment independently, prior to our involvement. They exogenously vary the requested settlement amount, by eliminating the surcharge in some cases but not in others. The wording of the letter is otherwise kept identical (no information on the price reduction is provided in either case). Baseline licensing fees range from $380 to $825 per image, so removing the surcharge is economically significant.

After the pricing experiment, the Agency drops the surcharge for all instances.[5] After this policy change, we collaborate with the Agency on the second *message* experiment. An extra statement is inserted in the letters sent to four treatment groups, with no extra statement added for the control group. The first two messages explain that the Agency forgives $400 per image either as a waiver of enforcement costs or as a discount. To justify the reduction, the messages acknowledge that the infringement may have been unintentional. It is unfortunate that, in this experiment, we cannot separately identify the effect of this acknowledgement and that of the price-reduction information. The last two treatment messages are the same as the first two, but with a deadline, after which the forgiven amount will be added back.

[3] Trubek et al. (1983) estimate that 90 percent of civil disputes are settled without filing suit. In our setting, according to Lex Machina (a legal analytics database), the Agency filed twelve cases in the U.S. courts between 2008 and 2013. In contrast, the Agency pursues settlement for about a thousand cases per month in the U.S., resulting in a percentage of litigation of about 0.02.

[4] According to the 2012 Statistics of U.S. Businesses, 62 percent of U.S. firms have 0-4 employees, 17 percent have 5-9, 10 percent have 10-19, 8.6 percent have 20-99, 1.4 percent have 100-499, and 0.3 percent have more than 500. The corresponding percentages in our data are 50, 17.6, 12, 15, 5.1, and 0.89. Firms in our analysis sample are slightly larger because the Agency stopped pursuing the smallest firms for settlement in January 2014.

[5] The Agency also stops pursuing settlement from relatively small firms. Instead, they provide them with coupons for alternative, lower-priced images. The removal of the infringed image(s), however, is still requested.

Here, we focus on 30-day outcomes of these interventions to avoid influence by the Agency's follow-up actions. The pricing experiment shows that, on average, removing a substantial amount from the requested amount alone increases the settlement probability by three percentage points. However, this increase is small and is offset by the significantly lower revenue for those cases that do settle. As a result, the expected revenue per case is slightly lower for the lower-priced group (but the difference is not significant). In contrast, the message experiment shows that adding either of the first two non-deadline messages (price-reduction information and acknowledgement of possible unintentionality combined) increases the settlement probability by 12 percentage points and expected revenue by 80 percent. Adding a deadline to either message further improves the settlement rate by another six to seven percentage points, thus increasing expected revenue by 130 percent relative to the control group.

The large positive effect from the first two non-deadline messages is particularly salient when compared to the small price effect observed in the first pricing experiment, suggesting that the price of settlement is far from the only factor influencing infringers' behaviors. One plausible explanation is that proactively acknowledging possible unintentionality encourages collaborative outcomes by moving the infringers' frame of mind away from calculating legal risks (which are likely to be small in such circumstances). The effect of these messages is large and positive both for small "mom-and-pop shops" and for the largest firms. There are at least two sub-mechanisms at work. This acknowledgement may have encouraged intrinsic motivation to correct a mistake, which is consistent with findings in the tax compliance literature. For example, Feld and Frey (2002a) and Feld and Frey (2002b) argue that paying tax is quasi-voluntary and show that courteous treatment by the tax authorities (e.g., a presumption of innocence) dampens tax evasion. For larger firms, however, behavioral considerations may be less relevant. There, the acknowledgement of possible unintentionality may make the settlement request letter conform more closely to other standard invoices, providing a smoother path for processing payment instead of invoking the costly internal legal process.

We do not have a treatment message that explicitly increases the threat of legal sanction, since the Agency already decided to move away from explicitly threatening enforcement policies. However, our results show that threat seems to matter for relatively small firms. Specifically, for firms in the lowest three quintiles, a $400 price change in the initial requested amount makes a small difference in settlement probability, but results in a significantly higher settlement rate (ten percentage points) when combined with a deadline. A potential explanation for this result is that firms have limited information about the risks of resisting payment, and they perceive the Agency as less serious when the requested amount is lower. In other words, a lower request may not generate a higher settlement rate if it simultaneously sacrifices the threat of escalation. The dynamic payment structure implied by the deadline appears to simultaneously leverage the inducement of a lower price today while signaling a willingness to escalate in the future. In contrast,

including a deadline has no effect for larger firms in the top two quintiles. This may be because larger firms have more precise knowledge about the legal risk and, thus, are not influenced by the implied threat.

Finally, the treatment messages also substantially reduce social costs. The results show that the messages reduce the probability of engaging professional law firms for enforcement by 4.6 to 12.4 percentage points (9.8-27 percent) relative to the control group. The estimated savings in legal costs (for the Agency and infringing firms combined) range between 2.7 and 7.3 percent of the Agency's in-house settlement revenue from the control group. This calculation is likely to underestimate the savings in total social costs because it does not take into account the opportunity cost of time nor the stress associated with prolonged disputes.

1.1 Related literature

This paper brings together two sets of literature on settlement that investigate the issue of cases failing to reach efficient settlement and instead going to trial. The first group of papers are from law and economics (see surveys by Cooter and Rubinfeld (1989) and Spier (2007)). Theory in this literature typically applies bargaining models and attributes settlement failures to information asymmetry (Bebchuk (1984) and P'ng (1983)), divergent expectations (Priest and Klein (1984)), or strategic bargaining (e.g., Cooter et al. (1982) and Spier (1992)). Empirical work in this area in turn has studied determinants of settlement (versus trial), including the expected size of the verdict, litigation costs, asymmetric beliefs, and legal environments (e.g., Danzon and Lillard (1983), Viscusi (1988), Waldfogel (1995), Fournier and Zuehlke (1996), and Eisenberg and Farber (1997)). We contribute to this literature by introducing a novel dataset examining pre-court settlement and two large-scale field experiments that provide exogenous variation in enforcement methods.

The second set of studies on settlement is from behavioral law and economics and uses lab experiments to study the effects of psychological factors on pre-trial bargaining (see a survey by Jolls et al. (1998)). For example, Loewenstein et al. (1993) and Babcock et al. (1995) study the roles of self-serving biases in bargaining outcomes. Rachlinski (1996) shows that, consistent with prospect theory (Kahneman and Tversky (1979)), disputants are more likely to accept a settlement offer if they view it as a gain relative to provided references. While we do not set out to test a specific behavioral theory and are limited in our ability to identify precise mechanisms, our field experiments are of particular interest in that they capture real-world disputes. Rather than the individuals typically studied by lab experiments, our data describe interactions between firms. Furthermore, our paper highlights the role of culpability in dispute resolution. To the extent that acknowledging possible unintentionality contributes to our results, we provide evidence that is consistent with Korobkin and Guthrie (1994). They find that victims are more likely to settle if there is a sympathetic explanation for the harm they have suffered, reflecting general concerns for fairness and reciprocity (e.g., Güth et al. (1982) and Kahneman et al. (1986)).

Recent studies of copyright enforcement in economics have examined the effects of stronger enforcement on file-sharing and sales in the music and movie industries (Bhattacharjee et al. (2006), Danaher et al. (2014), Peukert et al. (2015), and Reimers (2015)). Our study differs from these papers and from the broader consumer piracy literature (see survey by Waldfogel (2012)) in its investigation of infringement by businesses and its focus on the settlement outcomes. Some related literature (also on consumer piracy) in law studies the legal strategies for copyright litigation. It generally argues that sanctions are effective in inducing settlement because statutory damages for willful infringement are high (Lantagne (2004) and DeBriyn (2012)). Fellner et al. (2013), for example, carry out a field experiment that randomizes messages mailed to Austrian households that evade TV licensing. They observe a significant positive effect on compliance as a result of threat, while moral appeal (emphasizing compliance as a matter of fairness) and social-norm information (highlighting the high level of compliance) have no effect. One salient difference between our paper and these studies is the nature of infringement. For example, Fellner et al. (2013) argue that moral persuasion lacks effect due to a particularly dishonest sample of infringers, and we are among the first to assess infringement incidences that are more likely to be inadvertent.

Most IP enforcement literature studies patents, for which ex-post licensing is a common aspect of settlement agreements. Our paper instead contributes empirical evidence to the literature on copyright enforcement and settlement, which is much less understood. For example, by matching filed cases to a control group of similar patents, Lanjouw and Schankerman (2001) show that litigation is more likely when either the value of a patent or the benefit of a tough reputation is higher. Similarly, Cohen et al. (2014) show that non-practicing entities target companies based on expected profitability of litigation (e.g., firms with more cash).[6] It is important to note that the two contexts, though conceptually similar, differ in substantial ways. First, liability in our context is generally clear, given the accuracy of detection technology and the simpler nature of copyright infringement; liability is much harder to establish in patent disputes. Second, patent claims (for complaints filed in court) are typically much larger. These differences may thus limit the effectiveness of our particular interventions in patent contexts.

Finally, our paper joins the small but increasing body of work that uses large-scale field experiments to study the effects of small, low-cost interventions (especially communication). Other enforcement contexts include tax compliance and enforcement (Hallsworth et al. (2014) and Perez-Truglia and Troiano (2015)) and loan repayments (Cadena and Schoar (2011) and Karlan et al. (2015)).[7] DellaVigna and Gentzkow (2010) surveys empirical evidence on the effects of persuasive communication in several domains and de-

[6] Examples of theoretical papers on patent litigation include Meurer (1989) and Bessen and Meurer (2006), and empirical studies include the role of cross-licensing (Lanjouw and Schankerman (2004) and Galasso et al. (2013)), non-practicing entities (Bessen et al. (2011) and Morton and Shapiro (2014)), and effects on the value of patenting and innovation (Lanjouw and Lerner (1998), Hall and Ziedonis (2001), and Cockburn and MacGarvie (2009)).

[7] Studies in other settings include advertising (Bertrand et al. (2010)) and donations (Frey and Meier (2004), and Falk (2007)).

fines a persuasion rate that harmonizes results across them.[8] Compared to the 17 previous studies surveyed here, in which the persuasion rate ranges from 0.7 to 29.7 percent, our results show generally high persuasion rates of 14 to 20 percent for messaging within the first 30 days.

The rest of the paper proceeds as follows. Section 2 introduces the two experiments. Section 3 describes the sample and the variables. Section 4 reports the results. Section 5 discusses plausible explanations and welfare effect, and Section 6 concludes.

2 Background and Experiments

The Agency monitors the online use of images that satisfy the following criteria: 1) the image is governed by a 'rights-managed' license model, which allows a licensee a one-time use of the image for a fee that depends on the specified scope of use (e.g., a medium-resolution image placed on a firm's home page for three months), and 2) the Agency distributes the image exclusively, allowing the Agency to determine whether the use is unauthorized by checking its own licensing database. Images that satisfy these criteria are the most expensive ones and account for less than five percent of the number of images in the Agency's complete portfolio. The Agency pursues enforcement only if infringement involves commercial use of an image, and it drops cases that involve small non-profit organizations or current customers.[9]

For cases the Agency pursues, a letter is sent to the infringer that (1) informs it of the detected infringement, (2) requests the removal of the image(s), and (3) asks for a settlement that covers the (past) infringing use. The requested amount is the baseline licensing fee plus a surcharge to recoup some of the enforcement costs incurred by the Agency. In the letter, a single amount is displayed instead of a breakdown between these two components.[10] Table 1 lists the six use categories for a single image, the corresponding baseline licensing fees for the sample period we study, and the percentage of cases in our combined experimental groups (described later) that corresponds to each use category. When multiple images are involved in a case, the licensing fee is the sum for all the images. The price posted on the Agency's website varies by additional dimensions, including image type (e.g., theme and quality) and duration of use. The fee offered for an infringing use is a weighted average of a few listing prices from within one of the six categories listed in table 1. Prior to January 2014, the surcharge added is $400 per image.

[8] The notion of 'persuasion rate' is first introduced by DellaVigna and Kaplan (2007), which estimates the percentage of receivers that change behavior among those that receive a message and are not already persuaded. For a binary outcome with treatment group T and control group C, the persuasion rate defined by DellaVigna and Gentzkow (2010) is $f = 100 \times \frac{y_T - y_C}{e_T - e_C} \frac{1}{1-y_0}$, where e_i is the share of group i receiving the message, y_i is the share of group i adopting the behavior of interest, and y_0 is the share that adopts in the absence of a message. Where y_0 is not observed, it is approximated by y_C.

[9] Current customers may infringe if the use is beyond the scope of the current license. Beyond-scope use for previous licensees is still pursued.

[10] The letter comprise seven pages total, with the invoiced amount displayed on the third page.

Table 1: Licensing fee

Image-use category	Licensing fee	% of cases
Low resolution & secondary page	$380	28
High resolution & secondary page	$475	31
Low resolution & home page	$565	8
Low resolution & repeat pages	$665	4
High resolution & home page	$775	12
High resolution & repeat pages	$825	7
Multi-image cases	Varies	10

Notes: This table describes the licensing-fee part of the total requested amount per image. The actual licensing fee may deviate slightly due to taxes that differ by state. The corresponding percentages are based on our combined experimental groups, described later.

2.1 Two experiments

2.1.1 The requested amount

Between late October and December 2013, for cases in the U.S. and Canada, the Agency randomly select a subset of cases for which it removes the surcharge completely (the '$0-Surcharge' group); for the rest of the cases, it continues to add $400 per image on top of the licensing fee (the '$400-Surcharge' group). The letters to the two groups are otherwise identical. That is, no explanation is given about the price reduction for the $0-Surcharge group. This exogenous price variation is valuable because, otherwise, it is not possible to separate the effect of a price change from the nature in which the image is used, as the licensing fee is completely determined by the image use category.

2.1.2 The messages

In January 2014, the Agency implemented the following changes in its enforcement policy. First, it no longer requests settlement from infringers in tiers 4 and 5 (infringers are categorized into five tiers, with tier 1 being the most likely to settle and tier 5 the least likely), even though it still requests removal of the images. Second, it no longer adds any surcharge for cases it continues to pursue. Following the policy change, we collaborated with the Agency to conduct a second experiment, also for cases in the U.S. and Canada.

In the message experiment, we maintain the $0 surcharge, while also providing information about the price reduction. Cases are randomly allocated into four treatment groups and one control group. All groups are asked the same licensing fee (given the image use), while the letter wording varies. The wording used in the control group is the same as in the pricing experiment; that is, it provides no information about the price reduction. For the treatment groups, an extra message (in boldface) is placed just below the invoiced

amount.[11] The four messages differ by how the forgiven amount is presented and whether a 22-day deadline is imposed. Because all four messages acknowledge that the infringement may have been unintentional as justification for the price reduction, it is unfortunately not possible in this experiment to separately identify the effect of this acknowledgement from that of the price-reduction information. The four messages are:

1. Control group: no extra message.
2. (Waive the surcharge) Please note, we are only charging the average licensing fee for commercial use of the rights-managed image(s) found on your website. The Agency has incurred additional costs of $400 per image related to the pursuit of this matter; we are currently waiving this cost, as we understand this unlicensed use may have been unintentional.
3. (Waive the surcharge + Deadline) Please note, we are only charging the average licensing fee for commercial use of the rights-managed image(s) found on your website. The Agency has incurred additional costs of $400 per image related to the pursuit of this matter; we are currently waiving this cost, as we understand this unlicensed use may have been unintentional. However, cases not settled before xx-xx-xx will be charged the additional $400 cost per image related to the pursuit of this matter.
4. (Discount) Please note, this settlement amount is $400 per image lower than the average unauthorized use settlement offer. We are providing this discount, as we understand this unlicensed use may have been unintentional.
5. (Discount + Deadline) Please note, this settlement amount is $400 per image lower than the average unauthorized use settlement offer. We are providing this discount, as we understand this unlicensed use may have been unintentional. However, cases not settled before xx-xx-xx will no longer be eligible for this discount.

An infringer may contact the Agency to negotiate a lower price. Employees in the compliance department at the Agency (case handlers) respond to calls from infringers, and have latitude to negotiate with an infringer as they see fit. According to the Agency, case handlers are not given instructions to treat groups differently in either experimental period, mainly so as not to confuse the handlers. In principle, the handlers can observe the group to which a particular case is allocated. Our interviews with the handlers, however, suggest that they do not incorporate that information during conversations with infringers.

2.1.3 Allocation process

The Agency allocated cases to each group weekly during the trial periods. First, a subset of all cases was allocated as 'trial cases,' and the Agency enforced the rest using their default approach. These default cases

[11] Panel (b) in figure A1 in Appendix A shows the positioning of the message in the letter.

thus represent the $400-Surcharge group in the pricing experiment and the control group in the message experiment. Second, trial cases from each combination of infringer tier and price category were placed sequentially into each treatment arm.[12] Only some weeks included any trials, and the number of cases allocated as trial cases each week depended largely on the Agency team's overall workload. In the pricing experiment, we use data from five weeks within which trials were conducted. In the message experiment, trials were conducted every week between the end of January and the end of March, 2014.

It is not ideal that the allocation did not follow a strict randomization protocol, and in particular we do not know exactly how trial cases were allocated in the first step. According to the Agency, they selected trial cases sequentially from a list of all cases after receiving them from the technology company each week and screening them internally. They are not aware of non-independence between this list and settlement likelihood, which is reasonable given that neither the technology company nor the Agency's screening team base their tasks on settlement outcome. To further mitigate this issue, we conduct balance tests on the requested amount and infringer characteristics to verify that their allocations are consistent with random allocation (see table 3 below).

3 Sample and variables

The dataset we use for the paper includes all the infringement instances for which the Agency pursued settlement during the two experiments described previously. The information includes requested amount, characteristics of infringing use, and settlement outcomes. The data on infringer characteristics come from Dun & Bradstreet (D&B), including annual sales, number of employees, age, industry, and firm location.

The final analysis sample excludes cases as defined here, although basic conclusions do not change because of any exclusions (refer to table A6 in the Online Appendix for results using unfiltered data). First, because the Agency does not pursue settlement from infringers in tiers 4 and 5 during the message experiment, we remove cases in the pricing experiment that involve infringers in these two tiers (30 percent) in order to make the populations of the two experiments comparable. This leaves us with 5,660 cases. We further exclude case in which (1) the mail is undeliverable (10 percent); (2) the case is later closed because the infringer is able to show valid licenses or permissions from the photographers (6.3 percent); (3) there is no information on the firm's annual sales (8.5 percent); or (4) more than six images are involved, ensuring that the maximum number of images in all groups is the same (19 cases). The eventual analysis sample includes 1,983 cases in the pricing experiment and 2,295 cases in the message experiment for a total of 4,278 cases.

[12] In the pricing experiment, there was also a small treatment arm in which a $100 surcharge was added to the licensing fee. The Agency discontinued this price point after a short time. We exclude these observations in the current results, but including them does not qualitatively change the basic conclusions.

Panel 1 in table 2 summarizes the requested amount (inclusive of the surcharge when applicable) and the number of images involved in each case. The median requested amount is $699. Ninety percent of all cases involve a single image, and nearly 60 percent of the cases are in the two lowest-priced use categories (as shown in table 1). For cases involving multiple images, the median number is two.

Table 2: Summary statistics of case and firm characteristics

Variables	N	Mean	SD	Min	Median	Max
Panel 1: Price and image use						
Requested amount	4,278	748.0	438.3	354.9	699.0	5040.0
Single-image case	4,278	0.90	0.30	0	1	1
Image count (if a multi-image case)	437	2.49	0.85	2	2	6
Panel 2: Firm characteristics						
Annual sales ($000's)	4,278	23165.7	423542.4	0.3	320.0	23.7M
Employees	4,278	112.9	1348.5	0	5	67800
Age	4,155	17.8	21.1	0	11	271

Notes: This table summarizes the requested amount, the number of images, and the characteristics of the firm using cases in both experiments. Industry and state (province) dummies are omitted.

Panel 2 in table 2 summarizes infringer size and age. The median firm has $320K in annual sales; the median number of employees is five and the median firm age is eleven years. Annual sales and the number of employees are highly correlated (the correlation is 0.92), so we use only the former to measure firm size. The top ten industries (defined by 2-digit SIC codes) are responsible for 63 percent of all cases, and they are largely service industries. The top three states are California, Florida, and New York.

Table 3 compares key variables for different groups by experiment. Because sales and age are skewed, we summarize the mean as well as the median of the variables and the mean of their log transformation. Panel (a) shows that, in the pricing experiment, there is no significant difference in the average baseline price (i.e., the licensing-fee portion of the requested amount) or the summary statistics of the distributions of firm size and age between the two surcharge groups. Panel (b) summarizes the same information for the control and four treatment groups of the message experiment, along with p-values of two-sided t-tests (or median tests) comparing each treatment group to the control group. The variables are similar between the treatment groups and the control with the following exceptions: compared to the control, (1) the average requested amount in the 'Waive the surcharge' group is significantly higher; (2) firms in the two deadline message groups are smaller in log(Sales), even though the mean and the median of the level of sales are not statistically different from the control; and (3) firms in the 'Waive the surcharge + Deadline' group are younger.

Consultation with the compliance team at the Agency does not identify any sources of these incidences of

Table 3: Balance check

(a) Pricing experiment

Group	N	Baseline price	Sales, $1,000		log(Sales, $)	Age		log(Age+1)
			mean	median	mean	mean	median	mean
$0-Surcharge	707	642.6	15533	324	13.1	18	11	2.5
$400-Surcharge	1,276	623.2	13797	281	13.0	17	11	2.5
(p-value)		(0.22)	(0.84)	(0.44)	(0.41)	(0.42)	(0.58)	(0.92)

(b) Message experiment

Group	N	Baseline price	Sales, $1,000		log(Sales, $)	Age		log(Age+1)
(p-value, diff. to control)		(=Requested amount)	mean	median	mean	mean	median	mean
Control	598	590.7	30614	390	13.4	19	11	2.6
Waive the surcharge	378	636.8	50682	385	13.4	19	11	2.5
		(0.03)	(0.40)	(0.91)	(0.93)	(0.86)	(0.83)	(0.86)
Waive the surcharge + Deadline	414	595.3	7951	290	13.1	16	9	2.5
		(0.82)	(0.16)	(0.13)	(0.03)	(0.04)	(0.17)	(0.06)
Discount	448	588.4	10112	305	13.2	18	12	2.5
		(0.90)	(0.19)	(0.13)	(0.13)	(0.48)	(0.73)	(0.85)
Discount + Deadline	457	580.2	55206	360	13.0	17	11	2.5
		(0.59)	(0.61)	(0.47)	(0.01)	(0.18)	(0.59)	(0.37)

Notes: Panel (a) summarizes the baseline price (i.e., the licensing-fee portion of the total requested amount), the number of images, and firms' basic characteristics between the two groups in the pricing experiment. Two-sided t-test p-values are reported in parentheses. Panel (b) summarizes the same information by group for the message experiment. Two-sided t-test p-values are between each treatment group and the control group.

imbalance. If the suggestions of imbalance here are not false positives, they will at worst make our estimates of the treatment effects more conservative (since our results consistently show that settlement is less likely for smaller and younger firms and for cases with a higher requested amount).[13] We have further verified that the regression results are similar either with or without using controls (both of which are consistent with the raw data), indicating that the allocation is not systematically correlated with observable variables.

After about 30 days, the Agency sends follow-up letters unless the case has already been settled. Eventually, cases that do not settle are sent to external law firms.[14] In the main analysis, we focus on the 30-day outcomes as a clean assessment of the interventions. Two factors confound assessments made at later time periods. First, more follow-up letters are sent to groups that have lower settlement rates. These endogenously-determined follow-up actions are designed to encourage settlement, and should cause the worst-performing groups to 'catch up' over the longer horizon. Second, software constraints at the Agency have accidentally resulted in more intense follow-up for a designated 'default' group. The 'default' group was defined (in the software) as the $400-Surcharge group in the pricing experiment, and the control group

[13] Given the number of multiple hypotheses tested here, we expect 1-2 to reach a 0.05 level of significance by chance alone. The t-test will also be overly conservative in the case of bounded, skewed measures such as sales or age.

[14] In our sample, 90 percent of cases sent to external law firms are sent 90-100 days after the first letter.

in the message experiment.[15] In the Discussion section, we provide bound estimates for the longer-term outcomes, including the 120-day settlement outcomes and the effects of these interventions on the probability of escalating to external law firms. Notice that all cases in our sample are older than five months, and for cases that settle within our sample period, 51 percent settle by 30 days, and 98 percent settle by 120 days.

Table 4 summarizes 30-day outcomes. Taking settlement probability into account, the average revenue per case is $104. For settled cases, the average revenue collected is $555. Infringers and the Agency negotiate a lower settlement amount for 38 percent of settled cases, and for those cases, the median reduction is 35 percent. The overall settlement rate is 19 percent. Breaking down by firms' responses to the initial letter, seven percent settle directly without making contact; 27 percent contact the Agency (43 percent of which settle by 30 days); and 66 percent ignore the letter.

Table 4: 30-day outcomes

(a) 30-day revenues

Variables	N	Mean	SD	Min	Median	Max
Revenue per case	4,278	104.2	255.8	0.0	0.0	2992.3
Revenue (if settled)	803	555.2	313.4	91.0	475.0	2992.3
Paid a reduced amount? (if settled)	803	0.38	0.49	0	0	1
Negotiated reduction % (if reduced)	305	0.36	0.17	0.02	0.35	0.88

(b) 30-day settlement rate and infringer response

Contact/Outcome	Settle (19%)	Not Settle (81%)
Contact Agency (27%)	12%	15%
Do not contact Agency (73%)	7%	66%

Notes: Panel (a) summarizes the 30-day revenues using cases in both experiments. Revenue is coded as $0 if the case does not settle within 30 days. Panel (b) summarizes the 30-day settlement rate and detailed responses by infringers.

4 Results

For each of the two experiments, after presenting the baseline results for an average case, we report the heterogeneity (or lack thereof) in the effects across two dimensions: size of the infringing firm and the extent of the price variation (in percentage terms) that is either induced (by the pricing experiment) or implied (by the message experiment).

[15] Refer to Section C in the Online Appendix for a detailed description of the Agency's follow-up actions after 30 days.

4.1 Pricing experiment

Table 5 shows that, on average, the 30-day settlement rate of the $0-Surcharge group is three percentage points higher than that of the $400-Surcharge group (15.6 vs. 12.5 percent with a p-value of 0.054). Although this represents a 25 percent increase, the difference is only marginally significant. For settled cases, the average revenue collected is $211 lower in the $0-Surcharge group. This suggests that more extensively negotiated reductions for the higher-priced group offset roughly half of the difference in the requested amount.Taking into account the difference in the settlement probability, the expected 30-day revenue of a case is $10 higher for the $400-Surcharge group, but the difference is not statistically significant.

Table 5: Price effects on settlement outcomes

	$0-Surcharge	$400-Surcharge	Difference	p-value
All cases:				
Settlement probability	0.156	0.125	-0.031	0.054
Revenue	82.6	92.4	9.8	0.432
N	707	1,276		
Settled cases:				
Revenue	530.9	741.5	210.6	0.000
Whether discounted	0.36	0.64	0.28	0.000
Discount	81.9	284.4	202.5	0.000
N	110	159		

Notes: This table summarizes the 30-day outcomes of the $400-Surcharge and the $0-Surcharge groups in the pricing experiment.

The marginal effect of a $400-Surcharge dummy on revenue and the likelihood of settlement estimated from regressions (table 6) are consistent with the raw data. The control variables include the baseline licensing fee; characteristics of the infringing use, including image-use category indicators and number of images; characteristics of the infringer, including log(annual sales), log(age + 1), ten 'top' industry indicators (defined by two-digit SIC codes), a U.S. dummy, and ten 'top' state/province indicators; and week dummies indicating when the settlement letter was mailed.[16] For all regressions in the paper, we use the same set of control variables and report robust standard errors, clustered by industry.

On average, firms are not price-elastic in the sense that the substantial reduction in the requested amount does not result in higher expected revenue. Firms are more likely to settle if they are offered a lower price. However, the increase in the settlement probability is not large enough to offset the lower revenue for those cases that do settle. More formally, the expected revenue of a case is the settlement probability multiplied

[16]76 firms (four percent) do not have age information. To preserve the sample size, a dummy variable indicating that the age information is missing is included in the regressions, and log(age+1) is replaced with 0 for these observations.

Table 6: Price effects on settlement outcomes

Dependent variable	Settle	Revenue for settled cases	Revenue
	Logit	OLS	OLS
	(1)	(2)	(3)
\$400-Surcharge dummy	-0.03*	255.84***	13.72
	(0.02)	(34.79)	(11.45)
Use cat 2: High res. + secondary page	0.02	-131.03	3.65
	(0.02)	(80.16)	(27.71)
Use cat 3: Low res. + home page	-0.03	-325.96**	-24.43
	(0.05)	(143.73)	(49.89)
Use cat 4: Low res. + repeat pages	0.04	-285.46	30.10
	(0.06)	(178.13)	(74.11)
Use cat 5: High res. + home page	-0.00	-371.27	-12.47
	(0.07)	(249.95)	(94.20)
Use cat 6: High res. + repeat pages	0.00	-366.29	-4.53
	(0.07)	(263.55)	(93.50)
Use cat 7: Multi-image cases	0.03	-557.20***	20.58
	(0.08)	(190.23)	(99.43)
log(Baseline price)	-0.04	893.66***	41.77
	(0.09)	(319.06)	(124.66)
Number of images	-0.01	346.52**	17.09
	(0.04)	(156.38)	(75.92)
log(Annual sales)	0.01***	23.07*	17.20***
	(0.00)	(12.63)	(3.38)
log(Age+1)	0.02**	-7.09	10.03
	(0.01)	(13.25)	(6.75)
Missing-age dummy	0.10**	-97.38	46.87
	(0.04)	(99.54)	(36.44)
Top 10 industry dummies	Y	Y	Y
Top 10 state (province) dummies	Y	Y	Y
U.S. dummy	Y	Y	Y
Mail week dummies	Y	Y	Y
Price elasticity	-0.28	0.71	0.24
Mean(dependent variable) for the \$0-Surcharge group	0.155	530.9	82.6
Adj R-squared		0.645	0.031
N	1983	269	1983

Notes: This table reports the results (marginal effects) from the following regressions using observations from the pricing experiment. The dependent variables are (1) whether the case settles in 30 days; (2) the revenue for settled cases; and (3) the revenue of a case (coded as \$0 if not settled in 30 days). The independent variable is a dummy indicating the \$400-Surcharge group (the \$0-Surcharge group is the default). Baseline offer is the licensing-fee portion of the requested amount. Column (2) uses cases that settle in 30 days. The corresponding price elasticities are calculated based on the formula $\frac{\Delta DV}{\Delta p}\frac{p}{DV}$. For each regression, ΔDV takes the estimated marginal effect of the \$400-Surcharge dummy, Δp is the difference between the mean requested amounts of the two groups, and p and DV take the respective sample averages for the \$0-Surcharge group. All models report robust standard errors, clustered by industry (defined by the two-digit SIC codes). ***, **, and * are, respectively, significance levels of 1%, 5%, and 10%.

by the expected revenue conditional on settling.[17] The price elasticity of the expected revenue is the sum of

[17]We denote expected revenue as $R(p)$, where $R(p) = \Pr(p)\hat{R}(p)$, p is the requested amount, and $\hat{R}(p) \leq p$ because negotiation

the elasticity of the settlement probability and the elasticity of the expected revenue conditional on settling. The two elasticities based on the regression results are, respectively, -0.28 and 0.71, implying a positive elasticity of the expected revenue.

Larger firms are significantly more likely to settle and less likely to negotiate a discount conditional on settling; thus, they are associated with a significantly higher expected revenue. Older firms are also significantly more likely to settle, but generate only a slightly higher revenue (p-value is 0.15). The coefficient for log(Baseline price) is not always significant because it captures only residual differences in the licensing fee after the complete set of image-use dummies are controlled for (e.g., taxes that differ by state).

4.1.1 Price effects for different subsamples

In this section, we perform analysis for different subsamples because results for an average case may hide potential heterogeneity. For example, larger firms may be less price-sensitive, and firm size in our sample does vary substantially (the quintiles cut-offs are $111K, $190K, $480K and $1.7m in annual sales). Also, since the surcharge applied is uniform while licensing fees differ by infringing use, the surcharge represents anywhere from 43 to 107 percent of the licensing fee. One might also expect the difference in the settlement rate to be larger when the price-change percentage is greater.

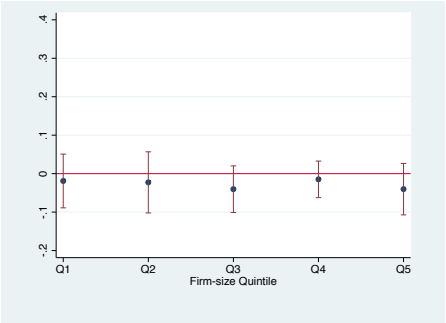
In fact, the results for an average case also hold for different subsamples, either when stratifying by firm size or by price-change percentage. Figure 1a plots the marginal effects of the $400-Surcharge dummy on the settlement probability by firm-size quintiles, with Q1 being the smallest firms in terms of annual sales and Q5 the largest (this and all other regression results for different subsamples are reported in the Online Appendix). For all size quintiles, the settlement probabilities are not statistically different between the two different surcharge groups. Consequently, for all quintiles, the expected revenue is higher for the higher-priced group, though none of the differences are statistically significant (see figure 1c). Figure 1b plots the marginal effects of the $400-Surcharge dummy on the settlement probability by the price-change percentage.[18] The effect of the price reduction increases monotonically with the percentage and reaches statistical significance when the percentage is medium or high (above 0.70). Even in these ranges, the expected revenue per case is not higher for the lower-priced group (see figure 1d).

is allowed. The decomposition of the price elasticities is $\frac{\partial R(p)}{\partial p}\frac{p}{R(p)} = \frac{\partial \mathrm{Pr(p)}}{\partial p}\frac{p}{\mathrm{Pr}(p)} + \frac{\partial \hat{R}(p)}{\partial p}\frac{p}{\hat{R}}$.

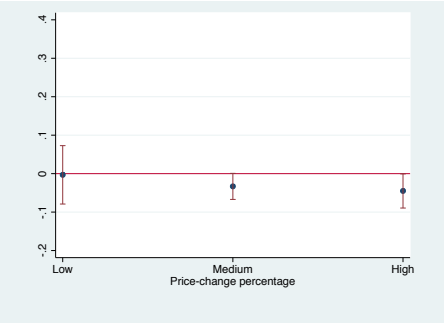
[18] The requested amount is discretely clustered due to the presence of six baseline prices. We categorize 30 percent of the cases as low, 40 percent as medium, and 30 percent as high. The separating thresholds are 0.70 and 0.90.

Figure 1: Price effects on settlement outcomes by firm size and price-change %

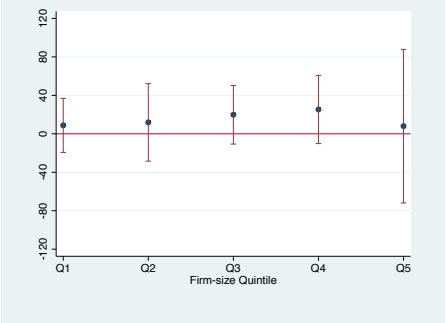
(a) Settlement probability (by firm size)



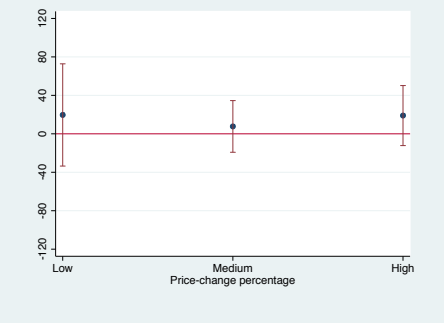
(b) Settlement probability (by price-change %)



(c) Revenue per case (by firm size)



(d) Revenue per case (by price-change %)



Notes: These figures report marginal effects of the $400-Surcharge dummy on 30-day settlement outcomes: settlement probability and expected revenue per case. Q1-Q5 indicate firm-size quintiles based on annual sales, with Q1 including the smallest firms and Q5 the largest. Price-change percentage is ($400×number of images)/licensing fee. Bands indicate 95 percent confidence intervals.

4.2 Message experiment

We analyze three separate comparisons within the message experiment: (1) comparing either non-deadline message to the control group, (2) comparing a deadline message to its corresponding non-deadline version, and (3) comparing the two non-deadline messages to each other.

Table 7a shows that, for an average case, relative to the control group, adding either of the two non-deadline messages increases the settlement probability by about 9 percentage points (a 64 percent increase); adding either of the two deadline messages improves the 30-day settlement probability by about 15 percentage points (a 107 percent increase relative to the control group); and all the improvements are highly statistically significant.[19] Furthermore, for each of the two different ways of presenting the forgiven amount (i.e., "Waive-the-Surcharge" and "Discount"), the difference between the deadline and non-deadline mes-

[19]The deadline is set for the 22nd day. Pre-deadline outcomes are reported in a later section and, in summary, show that the two deadline messages improve both the settlement rate and the expected revenue by about 150 percent relative to the control group (0.25 versus 0.10, and $120 versus $47).

sages is about five or six percentage points (p-values are 0.11 and 0.05, table 7b). However, given that a deadline is added (or not), there is no significant difference between the two different presentations. Regression results including the controls (table 8) are consistent with the raw data.

Table 7: Message effect on settlement probability

(a) Comparing the treatment groups to the control

Group	N	Settlement probability	Difference to Control	(p-value) diff. to control
Control	598	0.14		
Waive the surcharge	378	0.24	0.09	(0.00)
Waive the surcharge + Deadline	414	0.29	0.14	(0.00)
Discount	448	0.24	0.10	(0.00)
Discount + Deadline	457	0.30	0.16	(0.00)

(b) Comparing between different treatment groups

	No deadline	With deadline	Effect of a deadline	(p-value)
Waive the surcharge	0.24	0.29	0.05	(0.113)
Discount	0.24	0.3	0.06	(0.046)
Difference in presenting the forgiven amount	-0.003	-0.01		
(p-value)	(0.91)	(0.68)		

Notes: (A) Summary of 30-day settlement probabilities for the four treatment groups and the control group in the message experiment. Two-sided t-test p-values are between each treatment group and the control group. (B) Comparison of the settlement probabilities between different treatment groups and p-values for these differences. For example, for the waive-the-surcharge explanation, the difference in 30-day settlement probability between the deadline and the non-deadline messages is 0.05, and the p-value of the difference is 0.113.

The large positive effects of the treatment messages are in sharp contrast to the small price effect from the pricing experiment (Figure 2a). In terms of expected revenue, for an average case, substantially lowering the requested amount without informing the infringer of the reduction has no significant effect on expected revenue (-$12 with a p-value of 0.235). Given the same reduced request, the inclusion of a non-deadline message yields $66 more, and a deadline message yields $84 more.[20] This contrast pools the two non-deadline messages together and the two deadline messages; and, in both experiments, the baseline group adds no surcharge and does not include any extra message. Although the estimates are obtained from different samples, the two sample periods are close in time, and the settlement rates of the baseline group in the two experiments are not statistically different from each other (0.156 vs. 0.141 with a p-value of 0.44).

[20]For expected revenue, the difference between non-deadline and deadline messages is not statistically significant (p-value 0.19).

Table 8: Message effect on settlement outcomes

Dependent variable	Settle		Revenue for settled cases		Revenue	
	Logit		OLS		OLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Waive the surcharge	0.12***		-1.89		65.54***	
	(0.03)		(17.50)		(20.54)	
Waive the surcharge + Deadline	0.18***		7.31		86.08***	
	(0.03)		(17.05)		(15.53)	
Discount	0.13***		17.11		66.67***	
	(0.03)		(20.21)		(16.93)	
Discount + Deadline	0.19***		3.72		88.54***	
	(0.02)		(14.72)		(15.60)	
Non-deadline message		0.12***		4.89		65.17***
		(0.03)		(17.21)		(19.80)
Deadline message		0.18***		1.90		86.42***
		(0.03)		(16.99)		(15.45)
Control variables	Y	Y	Y	Y	Y	Y
Mean(dependent variable) for the control group	0.14	0.14	485.2	485.2	68.1	68.1
Adj R-squared			0.81	0.81	0.07	0.07
N	2291	2291	534	534	2295	2295

Notes: This table reports the results (marginal effects) from three sets of regressions using the message-experiment sample. The dependent variables are, respectively, whether the case settles in 30 days; the revenue for settled cases; and the revenue of a case (coded as $0 if not settled in 30 days). In columns (1), (3) and (5), the independent variables are four dummies indicating the treatment messages (the default is the control group). In the other columns, Non-deadline message equals one if the case belongs to either of the two non-deadline message groups; and Deadline message equals one if the case belongs to either of the two deadline message groups. Columns (3) and (4) use cases that settle in 30 days. In all regressions, the control variables are log(Requested amount), image count, log(Annual sales), log(Age+1), missing-age dummy, dummies indicating the top ten industries, the top ten states (provinces), the U.S., and the mail date. All models report robust standard errors, clustered by industry. ***, **, and * are, respectively, significant levels of 1%, 5%, and 10%.

4.2.1 Message effects for different subsamples

The rest of this section examines the effects of these messages for different subsamples. We focus on the settlement probability because the requested amount is the same across different groups given the same images use and the effects on expected revenue, thus, remain consistent with that for the settlement probability.

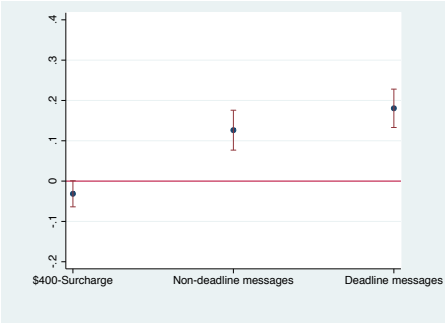
Comparing the non-deadline messages to the control

Overall, the results show that the effect of a non-deadline message is relatively flat across different subsamples (either by firm size or by the relative size of the forgiven amount). Figure 3a shows that adding a non-deadline message has an effect greater than seven percentage points except for firms in the third quintile.[21] Compared to the smallest firms in the first quintile, the message effect for larger firms are not

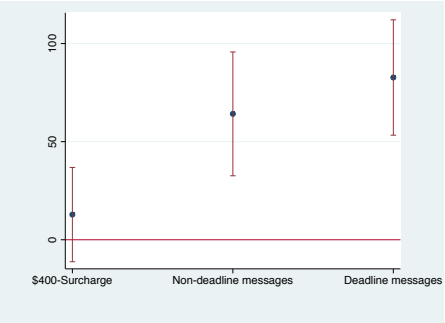
[21]The figure is based on logit regression results that use cases in the control group and the two non-deadline message treatment groups. The regression includes the interaction terms between the treatment indicator (which equals one if the case belongs to either of the two non-deadline message groups and zero if it belongs to the control group) and firm-size quintile indicators. The results

Figure 2: Comparing the price and message effects

(a) Settlement probability



(b) Expected revenue per case

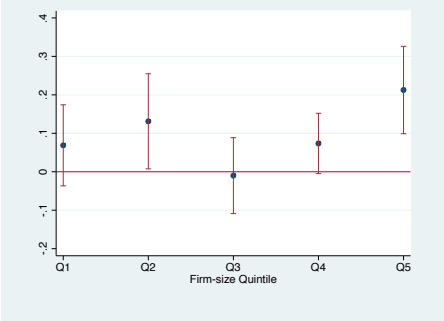


Notes: This figure compares the marginal effects on the 30-day settlement probability and the expected revenue of the $400-Surcharge dummy estimated from observations in the pricing experiment to that of the non-deadline message dummy and the deadline message dummy estimated from the message-experiment sample. The baseline group in both samples (normalized at 0) adds $0 surcharge and does not include any extra message. Refer to table 6 and table 8 for the regression results.

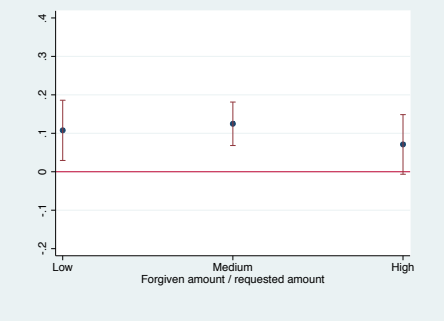
statistically different except for the largest firms in the top quintile, where it is 14 percentage points larger (p-value of the difference is 0.008).

Figure 3: Effects of a non-deadline message on settlement probability

(a) By firm size



(b) By $\frac{\text{forgiven amount}}{\text{requested amount}}$



Notes: This figure plots the marginal effect of the dummy variable that equals one if the case belongs to either one of the two non-deadline message groups (the baseline is the control group) on the 30-day settlement probability. Q1 are the smallest firms and Q5 the largest. Reported bands reflect 95% confidence intervals.

Recall that the forgiven amount is a uniform $400 per image, while the requested amount varies substantially by use category. The effect of a non-deadline message is large and statistically significant regardless of the proportion of the forgiven amount relative to the requested amount (figure 3b). The differences between different ranges are small and not statistically different from zero.

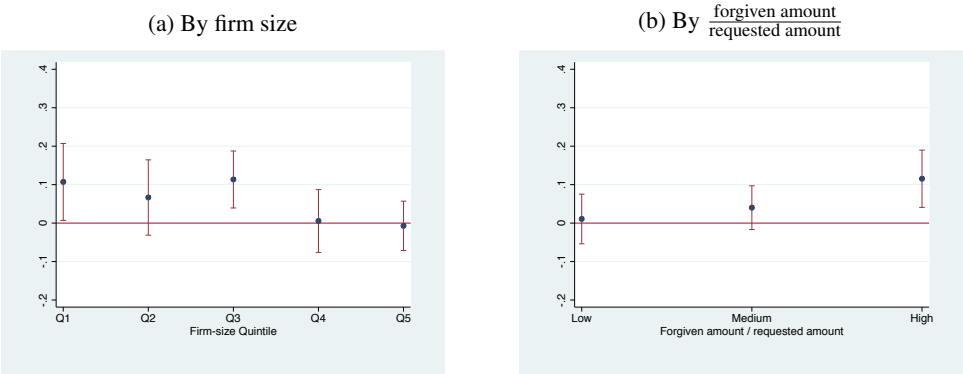
are reported in table A2 in the Online Appendix. A linear probability model with the interaction terms also produce similar results.

Comparing messages with and without a deadline

We evaluate the impact of adding a deadline after which the price-reduction offer expires by comparing outcomes for groups given a deadline to those not given a deadline, holding the rest of the message fixed.[22] The deadline is set for the 22nd day after the first letter is mailed. In practice, the Agency did not take action immediately after the deadline, nor did they increase the requested amount in subsequent letters. Thus, we focus on the 22-day outcome to provide the cleanest comparison.

For an average case, the addition of a deadline increases the 22-day settlement likelihood by 5.4 percentage points (the p-value is 0.007).[23] This effect, however, differs among subsamples. The effect of a deadline on pre-deadline settlement probability is positive (roughly ten percentage points) for smaller firms in the lowest three quintiles, but not for larger firms in the top two quintiles (figure 4a). The effects of firms in the second and the third quintiles are statistically indistinguishable from the first, while effects for the fourth and fifth quintiles are significantly smaller (differences of ten and eleven percentage points, p-values 0.069 and 0.051).

Figure 4: Effect of a deadline on pre-deadline (22-day) settlement probability



Notes: This figure plots the marginal effects of the dummy that equals one if the case belongs to either of the two deadline message groups on the pre-deadline (22-day) settlement probability, holding the rest of the message constant. The baseline are cases belonging to either of the two non-deadline message groups. Refer to table A3 for the regression results. Q1 are the smallest firms and Q5 the largest.

Adding a deadline is significantly more effective when the potential future price increase is larger relative to the requested amount (figure 4b). For cases with the highest ratios, the pre-deadline settlement rate increases by more than 10 percentage points (p-value of 0.0024) relative to the non-deadline messages;

[22] Note that this may underestimate the stand-alone effect of adding a deadline, since infringers are already motivated by the rest of the message to settle. One could alternatively create a second control group in which a deadline alone is added to the control letter.

[23] The regressions use cases from all four treatment groups of the message experiment. A 'deadline' indicator is used for cases from either of the two deadline message groups versus those from either of the two non-deadline groups. Refer to table A3 in the Online Appendix for the regression results.

and the effect of a deadline is significantly different from that for cases with the lowest ratio (p-value of the difference is 0.002). Summarizing this in combination with the stratification above, the addition of a deadline is not effective for the largest firms, but firms, on average, pay attention to the relative size of the potential price increase.

Comparing between the two non-deadline messages

The two different messages present the price reduction as either 'waiving the surcharge' intended to cover enforcement costs, or as a 'discount' from an average settlement offer. In this section, we compare the two messages, focusing on the non-deadline version of each one. As shown previously, for an average case, the two messages do not perform differently in the first 30 days. Regression results for different subsamples also show that the 30-day outcomes of the two groups are statistically similar regardless of firm size or the ratio between the forgiven and the requested amounts.[24]

5 Discussion

5.1 Plausible explanations

These results thus show a sharp contrast between the small effect of reducing the settlement offer versus a large effect from changing the communication messages, which is isolated due to experimental separation of the two types of changes. Multiple mechanisms might explain our findings, two of which include updates to the infringer's beliefs regarding the pecuniary payoffs associated with the settlement decision or a change in its approach to the problem. First, we propose a simple rational model in which the infringer begins with limited information about what may happen if it does not settle now. These beliefs are then exogenously influenced by the experiments' price reduction or messaging information. A second possible mechanism lies in the treatment messages' acknowledgment of possible unintentionality. This acknowledgment may switch the mindset of some infringers away from treating it as a legal matter, which, in turn, might encourage collaborative outcomes given that the monetary stake is not large.

5.1.1 Belief-updating mechanism

We first present a single-agent decision model, in which the infringer has three choices: settle now, settle later, or do not settle. This proves sufficient to recapitulate average-case results of both experiments and to

[24] Refer to table A4 in the Online Appendix for the regression results. We focus on the non-deadline messages because a deadline may interact differently with the different messages, and we do not have a good prior for the direction of these interaction effects. A comparison between the two deadline messages yields similar results for the 30-day outcome.

potentially explain some of the results by different subsamples. Consider the infringer's utility as:[25]

$$U = \begin{cases} -p_1 - \varepsilon_1 & \text{if settle now} \\ -p_2 - \varepsilon_2 & \text{if settle later} \\ -C(p_2) & \text{if not settle} \end{cases}, \tag{1}$$

where p_1 is the payment if the infringer settles now, p_2 is what the infringer thinks that it needs to pay for delayed settlement, and $C(p_2)$ is the expected cost from not settling. Importantly, we assume that $C(p_2)$ is a positive function of p_2 because the Agency is more likely to escalate higher-valued disputes.[26] Intuitively, the commercial value of the goods is positively correlated with price, and especially the price associated with the delayed settlement. ε_1 and ε_2 are independently distributed exogenous shocks that affect the infringer's willingness to settle in the two periods (with cumulative distribution F and density f).

This defines the probability of settling now as

$$\Pr(\text{Settle now}) = \Pr(-p_1 - \varepsilon_1 \geq -p_2 - \varepsilon_2, -p_1 - \varepsilon_1 \geq -C(p_2)). \tag{2}$$

In the pricing experiment, there is only one price for infringers in each group. To obtain the expected treatment effect of a higher settlement offer, let $p_1 = p_2$ and take the derivative of Pr(Settle now) with respect to p_1; that is,

$$\frac{\partial \Pr(\text{Settle now})}{\partial p_1} = (1 - F(C(p_1) - p_1)) f(C(p_1) - p_1)(C'(p_1) - 1). \tag{3}$$

By this definition (equation (3)), a higher settlement offer generates two effects that respectively decrease and increase settlement probability, offsetting each other and, thus, possibly explaining why a substantial reduction in price generated only a small difference in observed settlement rate. On one hand, a 'direct price' effect may lower settlement probability when the settlement offer is higher due to the disutility of paying (i.e., the demand for settling is downward sloping). Conversely, the 'threat' of a higher price may suggest a greater likelihood of escalating enforcement.

The message experiment can be represented in this model by considering all four treatment groups to have the same p_1 as the control group, but encoding knowledge of the Agency's $400 higher recoupable revenue (informed by the treatment messages) as a higher p_2.[27] We can then derive the effect of the extra

[25] For simplicity, we abstract away the discounting, which is not essential to illustrate the mechanism.

[26] In patent litigation, Lanjouw and Schankerman (2001) show that the likelihood of litigation is higher when the stake is higher either because the commercial value of the patent is higher, or because there is a greater incentive to establish a tougher reputation in a particular technology area.

[27] Findings in the marketing literature show that placing a sale sign on an item is sufficient to increase demand for the item

message by taking the derivate of Pr(Settle now) with respect to p_2:

$$\begin{aligned}\frac{\partial \Pr(\text{Settle now})}{\partial p_2} &= \int_{-\infty}^{C(p_2)-p_1} f(-p_2+p_1+\varepsilon_1) f(\varepsilon_1) d\varepsilon_1 \\ &\quad +(1-F(C(p_2)-p_2)) f(C(p_2)-p_1) C'(p_2).\end{aligned} \tag{4}$$

Thus, in contrast to the pricing experiment, the direct price effect and threat effect in the message experiment are synergistic (rather than oppositional) in making 'settling now' a more attractive option. Relative to the messages without a deadline, the two messages with a deadline yield a stronger effect by making both the inter-temporal price trade-off and the increased threat more explicit.

In addition to capturing average case results, the model may also help to explain why the pure effect of including a deadline is greater when the infringer firms are smaller and when the forgiven amount is larger relative to the requested amount (see figure 4). If larger firms are more price-inelastic than smaller firms or are more sophisticated and do not change belief about the potential risk of delay,[28] the difference resulted from the messages will be small (as observed). The monotonicity of the effect of a deadline with respect to the relative size of p_2 and p_1 is also intuitive. The effect from comparing the two non-deadline messages to the control group, however, is relatively flat across different subsamples (figure 3), in agreement with (1) the non-explicit price tradeoff implied in the two non-deadline messages and (2) the messages also contain the acknowledgement of possibile unintentionality.

5.1.2 Mindset-switching mechanism

The prevalence of unintentional infringement makes it plausible that the message's acknowledgement of possible unintentionality plays an important role in encouraging collaborative behavior from the infringer. Table 9 summarizes the (self-reported) reasons for infringement, which are collected from correspondence records between the Agency and firms that made contact during the message experiment.[29] The infringer claims to be unaware of any infringement (or have obtained the image online thinking it free to use) in 43 percent of cases. In 42 percent of cases, an outside party is involved in designing the website.[30] In

even without changing the actual price. Inman et al. (1990) find that promotional signs have a smaller impact for consumers that diligently and actively evaluate information than consumers that do not. Anderson and Simester (1998) and Anderson and Simester (2001) develop and test an equilibrium model, in which the concern for reduced credibility regulates retailers' use of sale signs and makes consumers' reliance on these cues an equilibrium strategy.

[28] For example, the correspondence data show that the larger the firm, the more likely the person that makes contact is internal legal counsel.

[29] We include infringers from the message experiment that made contact at *any* time during the sample period, not just in the first 30 days. In terms of observable characteristics, there is no significant difference in annual sales, age or the number of employees between infringers that made contact (about half of the cases) and those that either ignored the letters or settled without making contact.

[30] We define third-party involvement as (1) the party who makes contact is a third-party designer, family member or friend (17%), or (2) the end-user claims that a third-party designed the website (25%). It is possible that some family or friends make contact

some cases, the firm uses a previously-licensed image outside the specified scope (4%) or an image without a required watermark or as a placeholder for the website (7%). Recognizing that the incentive to claim unawareness is strong, the extent of unintentional infringement still seems substantial. Table 9 also shows that this phenomenon is similar across infringers of all sizes. Thus, firms may feel confused and frustrated when faced with enforcement because they were not aware of the mistake at the time of infringement.

Table 9: (Self-reported) reason(s) for infringement

Infringer tier	N	Third party	Unaware/obtain from the Internet	Improper use of license	Other reasons	Deny infringement
1	154	0.41	0.47	0.01	0.06	0.05
2	168	0.42	0.43	0.01	0.05	0.08
3	181	0.43	0.44	0.02	0.07	0.04
4	143	0.46	0.40	0.03	0.06	0.05
5	176	0.37	0.45	0.09	0.07	0.02
Total	909	0.42	0.43	0.04	0.07	0.05
Corr. with log(sales)		-0.04	0.02	0.17	-0.02	-0.06
p-value		(0.24)	(0.67)	0.00	(0.65)	(0.07)

Notes: The data are taken from correspondence records between the Agency and firms in the message-experiment sample that contact the Agency. Twenty percent of the cases for which firms make contact do not contain enough information and, thus, are not used in the tabulation. Size quintiles are based on annual sales, with Q1 being the smallest firms and Q5 the largest.

At least two different sub-mechanisms may work to shift the infringer's frame of mind away from the calculation of legal risk (which is small in such circumstances). First, the acknowledgement of unintentionality may uphold the infringers' intrinsic motivation to pay, which is especially effective when the amount of the claim is small. The literature on tax compliance also has similar findings. For example, Feld and Frey (2002a) and Feld and Frey (2002b) argue that paying tax is quasi-voluntary and show that courteous treatment (i.e., a presumption of innocence) dampens tax evasion. Second, a less behavioral mechanism may exist in which the acknowledgement of unintentionality makes the settlement request letter conform more closely to other standard invoices. When firms have routines in place for paying other bills or resolving disputes, this could provide a smoother path for processing payment instead of invoking a costly internal legal process.

5.2 Longer-term (120-day) outcomes

As explained previously, analysis of outcomes after 30 days are influenced by the follow-up letters (see table A8 in the Online Appendix for the proportion of cases receiving different types of follow-up letters).

because they have a legal background. However, we group these calls with third-party designers because anecdotal evidence from the Agency suggests that friends and family are usually involved with the design of the website.

The difference in the follow-up intensity is relatively small between the two surcharge groups in the pricing experiment and, thus, we evaluate the 120-day performance using the actual data without further adjustment. The results are consistent with the 30-day results. Removing the $400 per-image surcharge results in a 7 percentage points increase in the 120-day settlement probability; but the increase in the settlement probability is not enough to outweigh the decrease in the revenue conditional on settlement ($211). As a result, the expected revenue per case is statistically similar between the two groups (the lower-priced group generates $11 lower, but the p-value of the difference is 0.49).

The confounding problem, however, is likely to be severe for the message experiment because substantially more follow-up letters are sent for cases in the control group than the treatment groups.[31] Given the available information, we provide a bound estimate for the 120-day effect of the messages, using the actual difference as the lower bound and the 30-day difference as the upper bound assuming that the short-run effect is persistent. The results (reported in table A7b in the Online Appendix) show that the two messages that do not impose a deadline perform similarly as the control group after 120 days, while the two messages that impose a deadline yield a settlement rate that is three percentage points higher than the control (p-value is 0.20). Combining these actual differences with the 30-day estimates, the 120-day effect of the non-deadline messages is estimated to be between 0 and 10 percentage points (0-25 percent increase relative to the control group), and that of the two deadline messages is 3 to 15 percentage points (an increase of 7.5-33 percent relative to the control).

5.3 Effects on legal costs

Apart from increasing revenue for photographers, a higher settlement rate may also reduce the social costs of resolving disputes. We provide a rough calculation of the differences in legal costs associated with escalating the case to an external law firm attributable to the treatment messages. Very few cases end up in court, so we do not consider the potential savings from reduced litigation. Eventually, 50.5 percent of the cases in the control group and 45.8 percent in the treatment groups (pooled together) are sent to external law firms, and the difference is statistically significant (p-value is 0.052). Similar to 120-day outcomes, the actual difference in the probability of using external law firms is likely to substantially under-estimate the effect of these messages due to follow-up letters. Thus, we use the actual difference of 4.6 percentage points as a lower-bound estimate, and the difference in the 30-day settlement rate (12.4 percentage points) as an upper-bound estimate. Thus, the messages reduce the probability of escalating to external enforcement by

[31] For example, as reported in table A8 in the Online Appendix, 42 percent of the control group received a FedEx letter after around 30 days, while only 15 percent of the treatment groups did. The control group in the message experiment does catch up after 120 days. The timing of the start of the catchup (there is a discrete change in the slope in the cumulative settlement probability for the control group but not for the other groups) is after about 40 days, consistent with the firms responding to follow-up letters.

9.8-27 percent.

The main law firm that the Agency contracts with in the U.S. uses the following fee structure (the details are disguised for confidentiality). The Agency pays a fixed fee ($a) for each case sent and, for settled cases, the law firm first collects an attorney fee of $c and then b percent of the remaining collected revenue. Using this to approximate legal costs, we first calculate a settlement rate for cases sent to external law firms (d percent) based on historical data (consisting of infringement cases in 2011-2013) provided to us by the Agency.[32] Next, we assume that the average revenue per settled case is the same as for cases settled within 30 days of the message experiment ($505). Finally, we assume that infringers hire legal counsel for twenty percent of cases and that their attorney fee is also $c per case.[33]

Table 10: A rough calculation of savings in legal costs

	Lower bound	Upper bound
Panel 1: Assumptions		
Number of cases per month	1,000	1,000
Difference in the number of cases sent to external law firms between the control and the treatment groups	46	124
Contractual terms by the Agency's law firm:		
Fixed fee per case charged to the Agency	$a	$a
Contingency fee per settled case charged to the Agency	b%	b%
Attorney fee charged to the infringer	$c	$c
Settlement rate for cases sent to external law firms	d%	d%
Revenue collected per settled case	505	505
Percentage of infringers obtaining legal service	0.2	0.2
Attorney fee per case charged to the infringer	$c	$c
Panel 2: Results		
Savings for the Agency (fixed and contingency fees)	$866.5	$2,335
Savings for the infringer	$4,347	$11,718
Total savings	$5,214	$14,053

Notes: This table presents a calculation of savings in the legal costs due to the treatment messages (relative to the control group) for the population of cases in the message experiment. As an upper bound estimate, the savings for the Agency consist of (1) fixed fees (which is $124 \times \$a$), and (2) contingency fees ($124 \times d\% \times \$505 \times b\%$). The savings for the infringing firms consist of (1) the attorney fees for firms that employ legal counsels ($124 \times 20\% \times \$c$), and (2) attorney fees requested by the Agency's law firm for firms that settle ($124 \times d\% \times \$c$).

Assuming 1,000 cases per month in the U.S. and Canada, the savings in legal costs are approximately $866-$2,335 for the Agency and $4,347-$11,718 for infringing firms (table 10). Total in-house enforcement revenue (revenue obtained without the use of external law firms) per thousand cases for the control group in the message experiment is $192,000. Thus, savings in total legal costs are between 2.7 and 7.3 percent of

[32] We use historical data for these statistics because enforcement through external law firms typically takes a long time, and the time frame of our experimental sample is not long enough to capture all associated outcomes.

[33] We do not have information about the percentage of infringers that employ legal counsel after the Agency moves a case to an external law firm. The correspondence data show that, at the in-house enforcement stage, infringing firms are already employing external legal counsel 8 percent of the time. Once the case is escalated by the Agency to outside law firms, we expect the percentage to be higher.

the Agency's in-house enforcement revenue for the control group. This may in fact underestimate the total savings in social costs due to additional factors such as opportunity cost of time and the psychological costs of stress for both parties if entangled in prolonged disputes.

6 Conclusion

In this paper, we study the effects of different enforcement methods on settlement outcomes for instances of copyright infringement by businesses. We used a novel, proprietary dataset generated from two large-scale field experiments run by a leading stock-photography agency. The experimental design avoids the confounding effects often encountered during real price changes, and we found that, on average, a substantial reduction in the requested amount alone generates only a small increase in the settlement probability. In contrast, given the same lower requested amount, the addition of a message that informs infringers of the price reduction and acknowledges the possibility of unintentional infringement has a large positive effect on settlement. In addition, including a deadline further improves the settlement rate. Beyond generating higher revenues for copyright owners, the higher settlement rates resulting from these messages also substantially reduce the social costs of dispute resolution.

Our results suggest that, when disputes are likely to be the result of inadvertent mistakes, proactive acknowledgment of this possibility may encourage collaborative outcome (at least when the monetary stakes are small). This result may be generalized to other contexts of similar nature. Given the representativeness of the sample firms, our observations for digital images in this paper are likely to generalize to other types of copyrighted materials used by businesses (videos, music, designs, etc.). For consumer piracy, contexts studied by the existing literature largely involve willful infringement (e.g., repeat file-sharers of music and movies). There are, however, areas in which users are unfamiliar with their legal obligations. An interesting example is with the increasing use of 3D printing: many people download designs from the Internet without being aware of its illegality (Depoorter (2014)). Beyond copyright, inadvertent mistakes due to forgetfulness, disorganization, and limited awareness could also result in conflicts from a wide variety of contexts that are mitigable using such strategies.

More generally, our results highlight that communication can have an important impact on economic outcomes in certain situations. Existing evidence from the lab and field are primarily based on individuals (see, e.g., Roth and Murnighan (1982) on the role of information in bargaining games, DellaVigna and Gentzkow (2010) for a survey of studies on persuasive communication in a variety of contexts, and Thaler and Sunstein (2008)). Our study shows that these interventions can also influence firms. In this sense, it provides a small but important step towards deepening our understanding of these types of mechanisms

beyond individual consumers in the broader economy.

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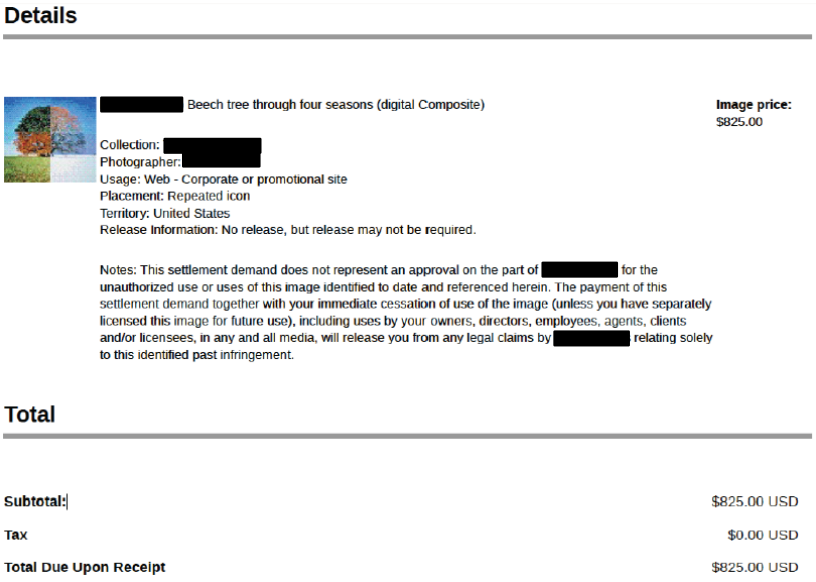
Appendix A. Additional Tables and Figures

Figure A1: Settlement demand letter examples

(a) No message



Details

[redacted] Beech tree through four seasons (digital Composite)

Image price: $825.00

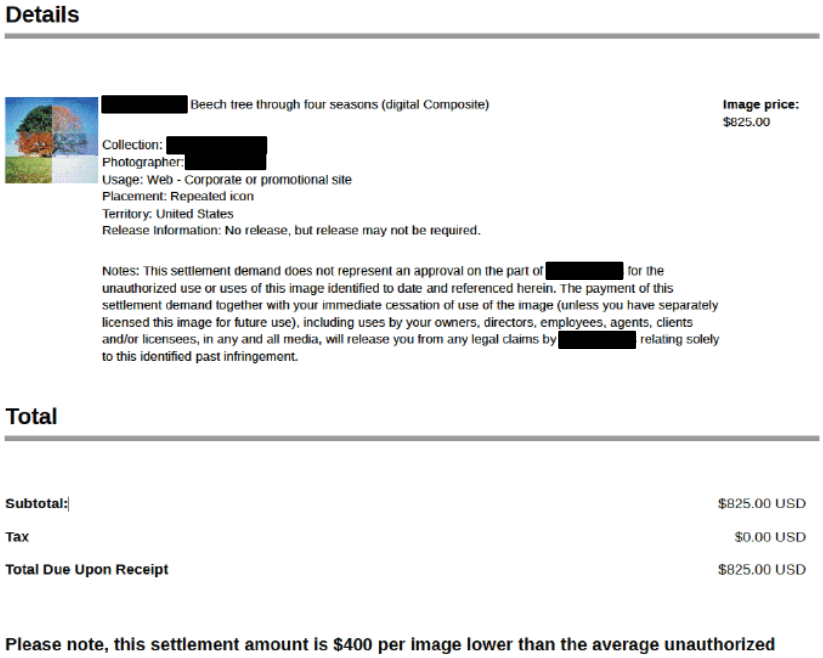
Collection: [redacted]
Photographer: [redacted]
Usage: Web - Corporate or promotional site
Placement: Repeated icon
Territory: United States
Release Information: No release, but release may not be required.

Notes: This settlement demand does not represent an approval on the part of [redacted] for the unauthorized use or uses of this image identified to date and referenced herein. The payment of this settlement demand together with your immediate cessation of use of the image (unless you have separately licensed this image for future use), including uses by your owners, directors, employees, agents, clients and/or licensees, in any and all media, will release you from any legal claims by [redacted] relating solely to this identified past infringement.

Total

Subtotal:	$825.00 USD
Tax	$0.00 USD
Total Due Upon Receipt	$825.00 USD

(b) Message added



Details

[redacted] Beech tree through four seasons (digital Composite)

Image price: $825.00

Collection: [redacted]
Photographer: [redacted]
Usage: Web - Corporate or promotional site
Placement: Repeated icon
Territory: United States
Release Information: No release, but release may not be required.

Notes: This settlement demand does not represent an approval on the part of [redacted] for the unauthorized use or uses of this image identified to date and referenced herein. The payment of this settlement demand together with your immediate cessation of use of the image (unless you have separately licensed this image for future use), including uses by your owners, directors, employees, agents, clients and/or licensees, in any and all media, will release you from any legal claims by [redacted] relating solely to this identified past infringement.

Total

Subtotal:	$825.00 USD
Tax	$0.00 USD
Total Due Upon Receipt	$825.00 USD

Please note, this settlement amount is $400 per image lower than the average unauthorized use offer. We are providing this discount, as we understand this unlicensed use may have been unintentional.

Table A1: Heterogenous price effects on settlement outcomes

Dependent variable	Settle		Revenue for settled cases		Revenue	
	Logit		OLS		OLS	
	(1)	(2)	(3)	(4)	(5)	(6)
$400-Surcharge dummy	-0.02	-0.00	155.77	324.20***	8.77	19.63
	(0.04)	(0.04)	(98.81)	(52.12)	(14.34)	(27.13)
Size quintile 2 × $400-Surcharge	-0.00		30.39		3.11	
	(0.06)		(111.78)		(28.35)	
Size quintile 3 × $400-Surcharge	-0.02		188.53		11.08	
	(0.06)		(115.43)		(26.16)	
Size quintile 4 × $400-Surcharge	0.00		66.22		16.55	
	(0.04)		(115.06)		(22.53)	
Size quintile 5 × $400-Surcharge	-0.02		170.03		-0.80	
	(0.05)		(106.42)		(45.26)	
Size quintile 2	0.01		80.13		13.33	
	(0.06)		(91.75)		(31.68)	
Size quintile 3	0.04		7.06		8.78	
	(0.06)		(83.24)		(24.63)	
Size quintile 4	0.04		108.86		41.95	
	(0.05)		(90.01)		(32.48)	
Size quintile 5	0.06		130.29		92.71	
	(0.08)		(123.70)		(60.51)	
Medium price-change % × $400-Surcharge		-0.03		-89.41		-11.95
		(0.04)		(63.42)		(29.47)
High price-change % × $400-Surcharge		-0.04		-92.44		-0.66
		(0.04)		(63.01)		(32.65)
Medium price-change %		0.05		-104.84		-1.90
		(0.05)		(164.30)		(61.53)
High price-change %		0.13*		-27.85		57.20
		(0.07)		(245.03)		(102.86)
Control variables	Y	Y	Y	Y	Y	Y
Adj R-squared			0.653	0.646	0.030	0.031
N	1983	1983	269	269	1983	1983

Notes: This table reports the marginal effects of three sets of regressions using the observations in the pricing experiment, in which the dependent variables are (1) whether the case settles in 30 days; (2) the revenue for settled cases; and (3) the revenue of a case (coded as $0 if not settled in 30 days). In all regressions, the independent variable is a dummy indicating the $400-Surcharge group (the $0-Surcharge group is the default). Size quintiles are based on the annual sales, with quintile 1 including the smallest firms. Price-change percentage is defined by ($400*number of images)/licensing fee. The controls in all regressions include log(Baseline price), image count, log(Annual sales), log(Age+1), a missing-age dummy, and dummies indicating the top ten industries (defined by the two-digit SIC codes), the top ten states (provinces), a U.S. location, and the mail week. All models report robust standard errors, clustered by industry. ***, **, and * are, respectively, significant levels of 1%, 5%, and 10%.

Table A2: Comparing the two non-deadline messages and the control

	Logit model: DV = Settle		
	(1)	(2)	(3)
Non-deadline message	0.10***	0.07	0.11***
	(0.02)	(0.05)	(0.04)
Size quintile 2 × Non-deadline message		0.06	
		(0.09)	
Size quintile 3 × Non-deadline message		-0.08	
		(0.08)	
Size quintile 4 × Non-deadline message		0.00	
		(0.07)	
Size quintile 5 × Non-deadline message		0.14***	
		(0.05)	
Size quintile 2		-0.04	
		(0.06)	
Size quintile 3		0.08	
		(0.05)	
Size quintile 4		0.05	
		(0.05)	
Size quintile 5		0.00	
		(0.07)	
Medium ratio × Non-deadline message			0.02
			(0.05)
High ratio × Non-deadline message			-0.04
			(0.04)
Medium ratio			-0.03
			(0.06)
High ratio			0.01
			(0.08)
Control variables	Y	Y	Y
N	1420	1420	1420

Notes: This table reports logit regression results (marginal effects) using cases in the two non-deadline messages and the control groups in the message experiment. The dependent variable is whether the case settles in 30 days. Non-deadline message equals one if the case belongs to either of the two non-deadline message groups (the default is the control group). Size quintiles are based on the annual sales, with quintile 1 including the smallest firms. Medium ratio equals one if $0.77 < \frac{\text{forgiven amount}}{\text{requested amount}} < 0.98$; and high ratio equals one if the ratio is higher than 0.98. In all regressions, the control variables are log(Requested amount), image count, log(Annual sales), log(Age+1), missing-age dummy, dummies indicating the top ten industries (defined by the two-digit SIC codes), the top ten states (provinces), the U.S., and the mail date. All models report robust standard errors, clustered by industry. ***, **, and * are, respectively, significant levels of 1%, 5%, and 10%.

Table A3: Comparing messages with and without a deadline

	Logit model: DV = Settle (in 22 days)		
	(1)	(2)	(3)
Deadline message	0.05***	0.11**	0.01
	(0.02)	(0.05)	(0.03)
Size quintile 2 × Deadline message		-0.04	
		(0.06)	
Size quintile 3 × Deadline message		0.01	
		(0.06)	
Size quintile 4 × Deadline message		-0.10*	
		(0.06)	
Size quintile 5 × Deadline message		-0.11*	
		(0.06)	
Size quintile 2		0.08	
		(0.06)	
Size quintile 3		0.05	
		(0.05)	
Size quintile 4		0.13**	
		(0.05)	
Size quintile 5		0.20***	
		(0.07)	
Medium ratio × Deadline message			0.03
			(0.05)
High ratio × Deadline message			0.10***
			(0.03)
Medium ratio			0.02
			(0.05)
High ratio			0.01
			(0.05)
Control variables	Y	Y	Y
N	1696	1696	1696

Notes: This table reports logit regression results (marginal effects) using cases in all four treatment groups in the message experiment. The dependent variable is whether the case settles in the first 22 days. Deadline message equals one if the case belongs to either of the two deadline message groups (the default group are cases that belong to either of the two non-deadline messages). Size quintiles are based on the annual sales, with quintile 1 including the smallest firms. Medium ratio equals one if $0.77 < \frac{\text{forgiven amount}}{\text{requested amount}} < 0.98$; and high ratio equals one if the ratio is higher than 0.98. In all regressions, the control variables are a dummy indicating the discount framing, log(Requested amount), image count, log(Annual sales), log(Age+1), missing-age dummy, dummies indicating the top ten industries (defined by the two-digit SIC codes), the top ten states (provinces), the U.S., and the mail date. All models report robust standard errors, clustered by industry. ***, **, and * are, respectively, significant levels of 1%, 5%, and 10%.

Table A4: Comparing the two non-deadline messages

	DV = Settle (in 30 days)			DV = Settle (in 120 days)		
	(1)	(2)	(3)	(4)	(5)	(6)
Discount	0.02	0.08	0.02	0.06	0.17	0.01
	(0.04)	(0.11)	(0.05)	(0.05)	(0.10)	(0.06)
Size quintile 2 × Discount		-0.10			-0.12	
		(0.08)			(0.09)	
Size quintile 3 × Discount		-0.04			-0.12	
		(0.13)			(0.11)	
Size quintile 4 × Discount		-0.10			-0.18	
		(0.13)			(0.12)	
Size quintile 5 × Discount		-0.06			-0.14	
		(0.13)			(0.12)	
Size quintile 2		0.08			0.04	
		(0.08)			(0.08)	
Size quintile 3		0.02			0.06	
		(0.08)			(0.09)	
Size quintile 4		0.13			0.08	
		(0.11)			(0.11)	
Size quintile 5		0.24**			0.26*	
		(0.11)			(0.15)	
Medium ratio × Discount			0.00			0.05
			(0.06)			(0.06)
High ratio × Discount			-0.03			0.08
			(0.05)			(0.08)
Medium ratio			-0.03			-0.01
			(0.07)			(0.08)
High ratio			-0.05			-0.01
			(0.10)			(0.10)
Control variables	Y	Y	Y	Y	Y	Y
N	825	825	825	825	825	825

Notes: This table reports logit regression results (marginal effects) using cases in the two non-deadline message groups in the message experiment. For all regressions, the dependent variable is whether the case settles in the 30 or 120 days. Discount equals one if the case belongs to the Discount message group. Size quintiles are based on the annual sales, with quintile 1 (i.e., Q1) including the smallest firms. Medium ratio equals one if $0.77 < \frac{\text{forgiven amount}}{\text{requested amount}} < 0.98$; and high ratio equals one if the ratio is higher than 0.98. In all regressions, the control variables are a dummy indicating the discount framing, log(Requested amount), image count, log(Annual sales), log(Age+1), missing-age dummy, dummies indicating the top ten industries (defined by the two-digit SIC codes), top ten states (provinces), and the U.S. All regressions report robust standard errors, clustered by industry. ***, **, and * are, respectively, significant levels of 1%, 5%, and 10%.

Table A5: Balance check for the unfiltered sample

(a) Pricing experiment

Group	N	Baseline price	Sales				Age			
				Sales, $1,000		log(Sales, $)		Age		log(Age+ 1)
			N	mean	median	mean	N	mean	median	mean
$0-Surcharge	945	662.3	896	25749	330	13.1	910	19.5	11	2.5
$400-Surcharge	1,800	658.6	1,649	13020	290	13.0	1,593	18.1	11	2.5
		(0.85)		(0.20)	(0.41)	(0.15)		(0.16)	(0.71)	(0.70)

(b) Message experiment

Group	N	Baseline price	Sales				Age			
		(= Requested		Sales, $1,000		log(Sales, $)		Age		log(Age+ 1)
(p-value, diff. to control)		amount)	N	mean	median	mean	N	mean	median	mean
Control	866	639.3	754	25420	383	13.3	756	19.2	11	2.6
Waive the surcharge	549	675.3	458	44562	348	13.4	455	19.5	11	2.6
		(0.15)		(0.32)	(0.64)	(0.86)		(0.82)	(0.88)	(0.91)
Waive the surcharge + Deadline	564	612.0	493	11023	300	13.1	494	16.9	9	2.5
		(0.24)		(0.28)	(0.13)	(0.07)		(0.08)	(0.16)	(0.09)
Discount	571	609.7	526	10071	320	13.2	528	18.2	12	2.5
		(0.19)		(0.23)	(0.26)	(0.21)		(0.42)	(0.80)	(0.75)
Discount + Deadline	577	652.6	526	48841	378	13.1	533	17.6	10	2.5
		(0.79)		(0.55)	(0.89)	(0.01)		(0.19)	(0.30)	(0.32)

Notes: This table reports (1) the balance tests and (2) the raw-data comparison of the settlement outcomes using the unfiltered sample (that is; without dropping cases for which the mail is returned or if the sales information is missing, etc.). Both the balance tests and the settlement outcomes are consistent with what we report in the paper.

Table A6: 30-day settlement outcomes for the unfiltered sample

(a) Pricing experiment

	$0-Surcharge	$400-Surcharge	Difference	p-value
Settlement probability	0.12	0.10	-0.02	(0.06)
Revenue for settled cases	528.09	1080.1	552.1	(0.02)
Revenue per case	65.94	109.8	43.9	(0.12)
N	945	1,800		

(b) Message experiment

Group	N	Settlement probability	Difference (compared to control)	p-value
Control	866	0.12		
Waive the surcharge	549	0.19	0.07	(0.00)
Waive the surcharge + Deadline	564	0.25	0.13	(0.00)
Discount	571	0.21	0.09	(0.00)
Discount + Deadline	577	0.27	0.15	(0.00)

Table A7: Price and message effects on the 120-day outcomes

(a) Pricing experiment

	$0-Surcharge group	$400-Surcharge group	Difference	(p-value)
Settlement probability	0.32	0.25	-0.07	(0.00)
Revenue for settled cases	530.9	741.5	210.6	(0.00)
Revenue per case	167.9	178.9	11.0	(0.49)

(b) Message experiment

(p-value is relative to the control)	120-day settlement probability	120-day difference (lower bound)		30-day difference (upper bound)	
Control	0.40				
Non-deadline messages	0.40	0.00	(0.76)	0.10	(0.00)
Deadline messages	0.44	0.03	(0.20)	0.15	(0.00)

Notes: This table reports the 120-day settlement outcomes for different groups in both experiments. For the message experiment, we report only the effects on the settlement probability because the requested amount is similar across groups given the same image use and, thus, the effects on the expected revenue per case are consistent with that on the settlement probability. In the message experiment, long-term outcome analysis for the message experiment can be substantially confounded by systematically more follow-up letters for the control group. For example, as reported in table A8, 42 percent of the control group received a FedEx letter after around 30 days, while only 15 percent of the treatment groups did. 82 percent of the control group also received a standard second letter, while 64-72 percent in treatment groups did. Finally, 14 percent of the control group received an additional email reminder, while none of the cases in the four treatment groups did. As reported in this table, the control group in the message experiment does catch up after 120 days. The timing of the start of the catchup (there is a discrete change in the slope in the cumulative settlement probability for the control group but not for the other groups) is after about 40 days, consistent with the firms responding to follow-up letters.

Appendix B: The stock photography industry

The stock photography industry provides images that are readily available for licensing. On behalf of individual photographers or organizations (such as National Geographic), stock photography agencies manage, market and license images to business customers, such as advertising and graphic design agencies, publishers and corporations.

Rights-managed (RM) and royalty-free (RF) are two typical license types. An RM license allows the licensee a one-time use of the image (e.g., 100 billboards in Germany for three months). For a given image, the licensing fee depends on the specified use. A licensee who wants to use the image beyond the specified scope must purchase a new license. In contrast, an RF license gives the licensee the right to use the image with few restrictions with a one-time payment. Under the RF model, some agencies price the images à la carte, while others use subscription pricing. According to a survey by Graphic Design USA, 32, 98, and 54 percent of the responding designers had licensed images under the RM, à la carte RF, and subscription RF models, respectively, in 2011.

Stock images are categorized as editorial or creative, depending on whether commercial use is allowed. Editorial images portray specific people, places, things and events that provide context for newspaper and magazine articles, blog posts, and other non-commercial presentations. Because there are typically no permissions from these subjects, editorial images cannot be licensed for advertising or promotional purposes. In contrast, creative images are produced and staged by the photographer. Because they feature generic objects or people who have given their permission, creative images can be licensed for both non-commercial and commercial purposes.

The industry is divided into traditional (premium) and micro-stock segments. Leading agencies in the traditional segment include Corbis Images and Getty Images; and leading agencies in the micro-stock segment are Fotolia, iStockphoto and Shutterstock. Suppliers of the traditional segment are typically professional photographers who target customers and projects that require high-quality images. Images in this segment are licensed under the RM or the à-la-carte RF model. Depending on the quality of the image and the specified use, the licensing fee ranges from a couple of hundred to tens of thousands of dollars.[34] In addition to facilitating transactions, agencies in this segment also provide complementary services, including searching for images with specific themes, large-project management, rights clearance and protection against copyright liabilities.

Agencies in the micro-stock segment source their images from a wide range of photographers, including professionals and hobbyists. Images in this segment are licensed under the RF model. The price level is significantly lower than in the traditional segment. For example, the vast majority of images on iStockphoto (à la carte pricing) are priced between $2 and $100 per image, depending on the size of the digital file; and, at Shutterstock (subscription pricing), the user can download up to 25 images per day for a monthly fee of $249.

[34] The most expensive cases usually occur because the licensed use is exclusive.

Appendix C. Further details about the experiments

The Agency sends three types of follow-up letters. First, a second letter is sent after about 30 days unless the case has been settled by then. Second, also after 30 days or so, an extra FedEx letter is sent to a set of relatively large firms that have not yet responded (the first and the second letters are sent by USPS standard mail). Third, after 60 days, the Agency sends a final notice by email if the firm has ignored the previous letters. Cases that do not settle (either because the firms ignore all the letters or do not settle after making contact) are eventually sent to external law firms. In our sample, about half to the cases are sent to external law firms, and 90 percent of these cases are sent between 55 and 165 days.

The proportion of cases receiving the second letter is determined by the initial performance of this particular group. The intensity of the FedEx letter and the final email, however, is systematically affected by a software problem. The Agency's software records the information indicating the group to which a case belongs in a field that is used to record whether the infringer makes contact. However, this group information is *not* recorded for the group that takes the default approach at the time (i.e., the $400-Surcharge group in the pricing experiment and the control group in the message experiment). Normally, the extra FedEx letter and the last email reminder are sent only if the case-handler field is empty (and, thus, the firm ignores the case). During the trial periods, the non-default groups do not get these two types of follow-up letters because the case-handler field is not empty even if the firm has not made contact. This is sometimes corrected for, but not always.

Table A8: Follow-up letters by group

	Pricing experiment		Message experiment				
	$400-Surcharge	$0-Surcharge	Control	Waive the surcharge	Waive the surcharge + Deadline	Discount	Discount + Deadline
Second letter	82.6%	79.6%	82.8%	72.8%	66.7%	71.7%	64.3%
FedEx letter	5.2%	0%	41.9%	16.3%	15.6%	14.5%	14.2%
Final email	7.9%	0%	14.1%	0%	0%	0%	0%

Notes: This table reports, by group, the proportion of cases that receive different types of follow-up letters.

Table A8 reports the percentage of cases that receive these three types of letters by group. The differences suggest that the potential upward bias for the default group is likely to be substantial for the message experiment. These incidences, though not ideal, reflect the complexity and constraints in conducting field experiments. Here, it is fortunate in the sense that we know the exact data-generating process, so we can discover the confounding factors if there are any.