The Economics of the Right to be Forgotten∗

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February 22, 2015

Abstract

We examine the underlying economics behind the emerging issue of the so-called ‘right to be forgotten,’ which is the right for individuals to ask for ‘inadequate, irrelevant or no longer relevant, or excessive’ information about them to be dropped from Internet searches. At stake is the conflict between the privacy right and other fundamental rights such as the freedom of speech, expression, and access to information. First, we analyze a legal dispute game between a petitioner, claiming the right to be forgotten, and a dominant search engine. In particular, we characterize conditions under which litigation arises as an equilibrium outcome. Then we provide comparative static results on the probability of lawsuits and the likelihood of broken-links, in connection to the relative social value of the right to be forgotten. Our model offers a useful framework in understanding the effects of Europe’s expansion of the right to be forgotten to non-European websites: If the European ruling applies to all global search engine domains, then the expected amount of broken-links would fall.

Keywords: Right to be forgotten, privacy, litigation, internet services.

JEL Classification: C72, D82, K20, K41, L86.

∗First version: December 2014. This is a preliminary version. Any comment will be appreciated. We thank Jay Pil Choi and Lars Stole for helpful feedback.
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1 Introduction

Mario Costeja González, a lawyer from Spain, fought against Google Spain and Google Inc. in the European Court of Justice (ECJ) to remove search results on his name that are no longer relevant but defamatory. In 1998 he was in temporary financial trouble and put up his house for auction to pay his debt. After a decade, the house had been sold and his debt had lapsed; Mr. González was eager to move on. However the Internet did not forget his past. Google’s search results were still featuring links to digitized newspaper articles on his home-foreclosure notices during financial trouble. Mr. González then sued Google Spain, the dominant search engine that covers more than 90 percent of all online searches in Europe. In May 2014, the ECJ found against Google and ruled that both Google Inc. and its subsidiary Google Spain now must remove search results on Mr. González’s name. This European ruling set a major precedent over what is so-called the “right to be forgotten” – the right for individuals to ask Internet search sites to remove links to web pages that contain ‘inadequate, irrelevant or no longer relevant, or excessive’ information about themselves in the results page for searches of their names.¹

Since the European ruling, Google has received more than 219,000 removal requests, evaluated more than 795,000 links; 40.4% of which has been removed from European Google sites. Table 1 shows data on total number of requests Google has received, total number of URLs that Google has reviewed for removal, and the percentages of URLs removed for twenty-eight EU member states as of February 19, 2015 since the launch of Google’s official request process on May 29, 2014. Table 2 lists the ten domains where Google removed the most URLs from search results. Not surprisingly, Facebook.com tops among the most impacted domains, a majority of which offer search or social networking services.

At the heart of the debate on the right to be forgotten lie several conflicting interests. The individuals can rightly desire to avoid any harm incurred by the search result links that are defamatory, embarrassing, or misleading. Therefore, the individuals’ rights to delist the prominence of such information in search engine results are indispensable on the basis of privacy rights. But what about the rights of the individuals seeking information or

¹The definition of the right to be forgotten itself remains a controversial topic and the consensus is not yet made. We offer a brief literature review on the right to be forgotten in Section 2.
Table 1: European privacy requests for search removals

<table>
<thead>
<tr>
<th>Country</th>
<th>Total requests</th>
<th>Total URLs evaluated</th>
<th>% URLs removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>219,715</td>
<td>795,691</td>
<td>40.4</td>
</tr>
<tr>
<td>France</td>
<td>44,619</td>
<td>149,447</td>
<td>48.0</td>
</tr>
<tr>
<td>Germany</td>
<td>37,096</td>
<td>139,738</td>
<td>49.7</td>
</tr>
<tr>
<td>U.K.</td>
<td>27,930</td>
<td>109,262</td>
<td>34.8</td>
</tr>
<tr>
<td>Spain</td>
<td>20,255</td>
<td>66,437</td>
<td>35.3</td>
</tr>
<tr>
<td>Italy</td>
<td>16,615</td>
<td>57,103</td>
<td>25.6</td>
</tr>
<tr>
<td>Netherlands</td>
<td>13,461</td>
<td>48,862</td>
<td>41.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>6,577</td>
<td>26,493</td>
<td>37.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>6,774</td>
<td>24,578</td>
<td>44.8</td>
</tr>
<tr>
<td>Poland</td>
<td>5,705</td>
<td>23,033</td>
<td>36.8</td>
</tr>
<tr>
<td>Romania</td>
<td>3,884</td>
<td>16,044</td>
<td>26.7</td>
</tr>
<tr>
<td>Austria</td>
<td>4,123</td>
<td>15,668</td>
<td>51.2</td>
</tr>
<tr>
<td>Finland</td>
<td>3,155</td>
<td>10,411</td>
<td>44.1</td>
</tr>
<tr>
<td>Czech Rep.</td>
<td>2,242</td>
<td>9,303</td>
<td>31.9</td>
</tr>
<tr>
<td>Hungary</td>
<td>2,180</td>
<td>8,465</td>
<td>26.8</td>
</tr>
<tr>
<td>Portugal</td>
<td>2,031</td>
<td>8,396</td>
<td>24.1</td>
</tr>
<tr>
<td>Croatia</td>
<td>2,402</td>
<td>7,720</td>
<td>27.9</td>
</tr>
<tr>
<td>Denmark</td>
<td>2,213</td>
<td>7,649</td>
<td>41.7</td>
</tr>
<tr>
<td>Ireland</td>
<td>2,106</td>
<td>6,370</td>
<td>27.6</td>
</tr>
<tr>
<td>Greece</td>
<td>1,261</td>
<td>5,821</td>
<td>27.8</td>
</tr>
<tr>
<td>Estonia</td>
<td>1,531</td>
<td>5,374</td>
<td>40.4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>1,076</td>
<td>4,276</td>
<td>41.1</td>
</tr>
<tr>
<td>Latvia</td>
<td>910</td>
<td>4,102</td>
<td>29.9</td>
</tr>
<tr>
<td>Slovakia</td>
<td>927</td>
<td>3,740</td>
<td>34.9</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>867</td>
<td>3,277</td>
<td>20.8</td>
</tr>
<tr>
<td>Slovenia</td>
<td>829</td>
<td>2,831</td>
<td>26.5</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>338</td>
<td>967</td>
<td>45.1</td>
</tr>
<tr>
<td>Cyprus</td>
<td>196</td>
<td>556</td>
<td>46.6</td>
</tr>
<tr>
<td>Malta</td>
<td>176</td>
<td>528</td>
<td>29.0</td>
</tr>
</tbody>
</table>

Source: [https://www.google.com/transparencyreport/removals/europeprivacy/](https://www.google.com/transparencyreport/removals/europeprivacy/) (updated as of Feb. 19, 2015, 6 pm)

of the search engines providing information? Network users are deprived of the links that help them easily find contents and search engines experience profit loss from broken links. In essence, the removal of links under the pretext of protecting privacy rights can encroach other fundamental rights, such as the freedom of speech, expression, and access to information, and generate various layers of social costs.

Then what is the proper balance between clashing values of privacy and free speech, or the right to be forgotten versus the right to remember? Various attempts have been made
Table 2: Most impacted sites

<table>
<thead>
<tr>
<th>Web domain</th>
<th>Total URLs requested for removal</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>facebook.com</td>
<td>5,522</td>
<td>social networking service</td>
</tr>
<tr>
<td>profileengine.com</td>
<td>5,221</td>
<td>social network search</td>
</tr>
<tr>
<td>groups.google.com</td>
<td>3,702</td>
<td>discussion groups</td>
</tr>
<tr>
<td>youtube.com</td>
<td>3,384</td>
<td>video-sharing</td>
</tr>
<tr>
<td>badoo.com</td>
<td>3,307</td>
<td>dating-focused social networking</td>
</tr>
<tr>
<td>yasni.de</td>
<td>2,298</td>
<td>search engine</td>
</tr>
<tr>
<td>whereevent.com</td>
<td>2,267</td>
<td>event search tool</td>
</tr>
<tr>
<td>192.com</td>
<td>2,151</td>
<td>online directory</td>
</tr>
<tr>
<td>plus.google.com</td>
<td>2,150</td>
<td>social networking service</td>
</tr>
<tr>
<td>yasni.fr</td>
<td>1,900</td>
<td>search engine</td>
</tr>
</tbody>
</table>

Source: The same with Table 1; type is added by authors. (updated as of Feb. 15, 2015)

to discuss these issues, much of which take legal or philosophical perspectives. However, to
the best of our knowledge, any formal analysis on the underlying economics has hardly been
conducted. Does the number of requests for removal that are processed exceed the socially
optimum amount? Are there too many links taken down from a social welfare perspective?
How would the value of the right to be forgotten relative to the right to remember affect
individuals’ behavior and search engines’ response? In an attempt to answer these questions,
we build a game-theoretical model to provide the *economics* of the right to be forgotten. Our
goal in this paper is to offer not only theoretical insights but also practical implications on
the related issues.

In Section 3, we present a model of the right to be forgotten as an extensive-form legal
dispute game between a petitioner and a web search engine (Google). The petitioner first
claims the right to be forgotten, requesting the removal of related links; the claiming of the
right to be forgotten is a costly process. The search engine can either accept the claim or
reject it; and if the claim is rejected, then the petitioner can proceed to court against the
search engine, where litigation is costly for both parties. In line with the litigation literature,
the court’s decision rule is assumed to maximize social welfare – total payoffs of all associated
individuals. In particular, we assume that the court’s ruling depends on the value of the right
to be forgotten (measured by the petitioner’s harm from the links) and the value of the *right
to remember* (measured by network users’ and search engine’s loss from the broken links).2

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2For our purpose, the definition of the right to remember subsumes both the right of free speech and access
The petitioner's uncertainty about the search engine's loss from the broken links plays a key role in our model because the search engine, with private information, can make a better assessment of the trial's expected outcome.

In Section 4, we characterize conditions under which litigation may arise as an equilibrium outcome. Given the associated primitives, we obtain a unique sequential equilibrium in the legal dispute game. In particular, as long as the claim fee is sufficiently small, the petitioner will act aggressively and always claim his right to be forgotten, in hopes of his claim being accepted and, despite rejection, of winning in a trial. Upon rejection, litigation always ensues if the petitioner's harm is fairly large; otherwise litigation still takes place with positive probability. Therefore, regardless of the size of the petitioner’s harm, there is always the possibility of lawsuits as the equilibrium outcome, which leads to broken links.

Our equilibrium results provide one interesting implication as discussed in Section 5: Even when the value of the right to remember is higher than the value of the right to be forgotten, an excessive amount of claims are brought to court and resolved by costly court-imposed judgments. That is, even if the individual’s harm from the links are relatively small compared to total social welfare lost by the broken links, a lower expected probability of the petitioner winning in court does not deter the petitioner from acting aggressively. Our model predicts that the expected number of “broken links” exceeds the socially optimum amount that arises if the court “correctly” finds against the petitioner. Thus we confirm as an equilibrium phenomenon one conspicuous concern in the debate of the right to be forgotten: Too many requests for the removal of links are processed, and thus too many links are removed from a social welfare perspective.

We give the comparative static results regarding the probability of lawsuits and the likelihood of “broken links” in Section 6. As a standard intuition might suggest, if network users’ loss from broken links (S) is higher, then more types of Google reject the petitioner’s claim and the petitioner correctly expects to win a trial less often. Surprisingly, the petitioner can still commit to litigate with probability one when rejected (for up to a sufficiently large size of S), and thus more number of cases are brought to court. Even so, less types of Google accepting the claim primarily affects the likelihood of “broken links” as a resulting equilib-
rium outcome to fall unambiguously. The intuition is as follows: The probability of Google’s rejection increases as $S$ increases, raising the probability of lawsuits (and possibly leading to more broken links when the petitioner does win); however the petitioner has no certainty of winning in court,\(^3\) and thus the effect of the increased probability of Google’s rejection is second order.

Studying the effect of changes in litigation costs on the probability of lawsuits and the likelihood of “broken links” yields two interesting results. First, an increase in Google’s litigation cost (up to a certain point) causes Google more likely to accept the petitioner’s claim, creating less probability of lawsuits but more chance of “broken links” despite a relatively low probability of the petitioner winning in court. Only when Google’s litigation cost is sufficiently high so that the petitioner chooses to litigate less often results in both a lower probability of lawsuits and less chance of “broken links.” Second, an increase in the petitioner’s litigation cost (up to a certain point) leads to exactly the same probability of lawsuits and the same likelihood of “broken links.” When the petitioner’s litigation cost is high enough, a marginal increase in the cost then leads to less types of Google accepting the claim and the petitioner proceeding to court less often upon rejection, contributing to both a lower probability of lawsuits and less chance of “broken links.” Surprisingly in this case, when the petitioner does litigate, he faces a higher expected probability of winning.

In Section 7, we relate our equilibrium results to the current situation regarding the European ruling and the debate on its expansion. In particular, we give a numerical example to explain the economics behind the European ruling and Google’s compliance; and discuss how our results offer a reasonable prediction of individuals behavior of claiming the RTBF and Google’s response in removing the links if the European ruling expands to all of Google’s global search engine domains. Interestingly, if Google applies the European ruling to non-European websites as well, then the amount of broken-links would decrease despite the fact that Google will then decline the removal requests more often.

There are a number of substantial issues that require some discussion; we mention a few in Section 8. First, we address how the right to be forgotten affects behavior of professionals who have reputational concerns. If a professional can easily delete the links to information

\(^3\)In fact, the petitioner’s expected probability of winning in court declines as $S$ increases.
pertinent to his blemished reputation, then the rent associated with clean reputation would fall because network users’ inference from information is now distorted. Each professional’s incentive to maintain clean reputation in turn would decrease, possibly generating additional social costs from reinforcing the right to be forgotten. Second, the modeling framework we have developed here is particularly amenable to suit different applications. For example, the analysis in this paper could be equally applicable under the English rule on litigation fees. Also suitable versions of the results continue to hold when uncertainty is two-sided. Lastly, we could relax or impose correlation between the players’ losses, but the logic of our analysis suggests that the main insights of the results in this paper would also apply to this extension but with some added nuances. All proofs can be found in Appendix A.

2 Literature Review

In this section, we offer a brief review on the burgeoning literature on the right to be forgotten. Many legal scholars mainly focus on describing institutional and conceptual differences in how Europeans and Americans have approached to the problem (e.g., Ambrose and Ausloos (2013); Bennett (2012); Bernal (2014); McNealy (2012); Rosen (2012a,b); and Walker (2012)).

Rosen (2012b) addresses the differences between European and American conceptions of the balance between privacy and free speech and how the right to be forgotten represents a threat to free speech. He notes that in Europe the right to be forgotten finds its intellectual root in the right to be oblivion, *le droit à l'oubli* in French law: a convicted criminal has a right to oppose the publication of his or her criminal history upon serving time; whereas in America such right would make a direct conflict to the First Amendment to the United States Constitution, which protects the freedom of speech. McNealy (2012) indicates that while some plaintiffs in the U.S. have attempted to assert a right to be forgotten through the privacy law of the U.S., the U.S. court has seldom allowed for removing certain information from the

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4This stark contrast stands out in the following case in point. Two Germans murdered a famous German actor Walter Sedlmayr and they served their time. Released from prison, they attempted to delete their names from the German Wikipedia article of the late Mr. Sedlmayr, which successfully led to the deletion. They further moved to scrub their names from the English-language version of the Wikipedia article by filing a suit against the Wikimedia Foundation, the non-profit American organization (located in San Francisco) that runs Wikipedia. However, the Foundation did not comply with the request obviously relying on the First Amendment; their names are still posted. See John Schwartz, *Two German Killers Demanding Anonymity Sue Wikipedia’s Parent*, N.Y. TIMES, Nov. 12.2009.
press. Instead the court recognized the “right to be alone,” which grants a recovery to an injured party from the public disclosure of private information under the tort of “invasion of privacy.”\textsuperscript{5} We believe that this paper accounts for both European and American approaches through our choice of the court’s decision rule: If the court’s ruling favors privacy and the right to be forgotten, our model captures the European approach to the problem; if the court’s ruling puts more weight on the freedom of speech, then it captures the American approach.

Another strand of literature elaborate on web technological solutions in implementing a right to be forgotten. This is important because any practical enforcement and implementation of the right to be forgotten must be assisted and bounded by technological solutions. According to Rosen (2012a), there is a blob machine-like solution such as X-Pire and TigerText, which allows individual users to put expiration dates on text messages or photos that are copied and reposted by others. O’Hara (2012) discusses technological solutions available to data controllers, like Facebook or Google. Under the current European regulation, the right to be forgotten applies to the takedown of the reposted content without delay. For example, Facebook is forced to delete the reposted pictures when the original owner demands the erasure; but it takes proper tech-solutions to trace, identify, and delete all relevant data. The blob machine-like solution may provide the initial owners with an immediate technological solution. While we abstract away from technological aspects in the enforcement of the right to be forgotten, our model does not rule out the interpretation that the court’s decision rule (for a practical enforcement) might be bounded by available technologies.

The contribution of our paper is that we offer a first formal model of the economics behind the right to be forgotten. We conclude this section by noting that the methodological approaches in the literature on the economic analysis of litigation is somewhat similar to that in the current paper. For example, in his seminal paper, Bebchuk (1984) models an extensive form game of two parties’ litigation and settlement decisions, in which the defendant has private information about his liability. Bebchuk (1984) shows how informational asymmetry influences the settlement amount in pretrial negotiation; whereas we focus on the relative values of various social welfare loss and their effects on the probability of lawsuits and “broken

links” as equilibrium outcomes.

3 The Model

Two risk-neutral parties are involved in a potential legal conflict regarding the right to be forgotten – the RTBF game. A petitioner, denoted as P, alleges that he suffers harm of size \( h > 0 \) from the links provided on a web search engine, say Google, denoted as G.\(^6\) Google loses \( L \geq 0 \) if the links are removed. At the heart of the debates on the right to be forgotten lies one important issue that cannot be overlooked: the effect of the broken links not only on Google but also on the general public – in particular, network users. For example, some users may need to exert more effort (or may even fail) to find the right content without the links offered by the search engine. To capture such externality, we denote by \( S \geq 0 \) any welfare, generally construed, that is lost if the links are broken. This parameter can be interpreted as the value of searched information to network users, or more broadly as the social value of the freedom of speech.

We assume that Google internalizes users’ welfare loss as her own profit loss, and thus impose a direct relationship between \( L \) and \( S \).\(^7\) In particular, let \( L = \gamma S \), where \( \gamma \in [0, \bar{\gamma}] \) measures the fraction of users’ welfare loss for which Google will internalize, possibly greater than one. The petitioner’s harm and users’ welfare loss are common and public knowledge, whereas only Google knows her true \( \gamma \).\(^8\) The petitioner believes that \( \gamma \) is drawn from a non-degenerate distribution over the interval \([0, \bar{\gamma}]\).

The game tree illustrated in Figure 1 describes the sequence of events. The petitioner first chooses either to “claim” (i.e., requests Google to remove the links) at a fee of \( c > 0 \), or to make “no claim.” This decision is made without knowing Google’s \( \gamma \).\(^9\) Once a claim is filed,

\(^{6}\)For exposition, we use male pronouns for the petitioner and female pronouns for Google.
\(^{7}\)This assumption substantially simplifies the exposition while conveying all the key insights of our model. Suitable versions of the results continue to hold when this assumption is relaxed as long as \( L \) is private information to Google. But it seems natural to impose a linear relationship between \( L \) and \( S \); for example, the broken links can lower advertising profits from users’ search. In contrast, we do not impose any deterministic relationship between \( h \) and \( S \) (nor \( h \) and \( L \)). Justification comes from the fact that the petitioner’s harm mostly depends on his own individual characteristics. For example, in the case of Google v. González, Mr. González might have relatively large harm than others in similar situations because as a lawyer he might lose some potential clients due to search results on his blemished reputation in the past. We discuss correlation between losses in Subsection 8.4.
\(^{8}\)We can extend our model with two-sided incomplete information, which will be briefly discussed in Subsection 8.3.
\(^{9}\)If \( \gamma \) is known to the petitioner, then the petitioner knows exactly when Google will accept or reject his
Google then decides whether to accept or reject the claim. If Google accepts and takes down
the links, she loses $\gamma S$ and the petitioner receives payoff of $-c$. If Google rejects, then the
petitioner will have to choose whether to “litigate” the case or “give up” (i.e., drop the case),
still not knowing Google’s $\gamma$. By giving up, the petitioner’s payoff is $-h - c$ and Google’s
payoff is zero. If the petitioner litigates, then litigation costs both parties by $C_P$ for the
petitioner and by $C_G$ for Google. Let $\beta \in [0, 1]$ denote the the likelihood of the petitioner’s
prevailing in a trial. Under the American rule on litigation fees, the expected payoffs from
litigation then are $-(1 - \beta)h - c - C_P$ for the petitioner and $-\beta \gamma S - C_G$ for Google.¹⁰

![Game Tree Diagram]

Figure 1: The game tree

It will be assumed that the petitioner’s probability of winning in court is:

$$\beta = \frac{h}{h + \gamma S + S}.$$  \hfill (3.1)

The above functional form may seem ad-hoc; however it summarizes the essential component
of the court’s decision rule – maximizing total (ex-post) social welfare – although the process

claim. If Google is expected to reject the claim, then the claim itself incurs a mere cost with no additional
expected benefit. If Google is expected to accept the claim because the litigation may be more favorable to the
petitioner, then the petitioner would proceed directly to court. Therefore, there is no reason for the petitioner
to claim at a certain fee prior to litigation under complete information.

¹⁰Adopting the English rule, these will be respectively given as $-(1 - \beta)(h + C_P + C_G) - c$ and $-\beta(\gamma S + C_G + C_P)$. We will first proceed our analysis under the American rule; we discuss other rules including the English rule in Subsection 8.2.
of which is not explicitly modeled here.\footnote{In litigation literature, “ex-post” refers to excluding any fixed cost of litigation.} Note that if the petitioner wins the trial, then the links are removed and the ex-post social welfare loss is $\gamma S + S$; whereas if Google wins, then the links remain and the ex-post social welfare loss is $h$. Then it is reasonable to assume that the court judgment depends on the relative level of $h$ against $\gamma S + S$. That is, if the total welfare saved by taking down the links ($h$) is relatively higher than the total welfare saved by not taking down the links ($\gamma S + S$), then the probability that the court rules in favor of the petitioner would increase.

Note that once the case is actually in a trial, the court would take all reasonable steps to identify any relevant parties and gather factual issues to make “correct” judgments. Google in fact possesses all relevant information in our model, however it is reasonable to presume that Google would not expect to win or lose in court with an absolute certainty. Rather, its private information allows Google to make a better assessment of the trial’s expected outcome. That is, Google estimates the likelihood of the petitioner’s prevailing in a trial to be $\beta$; while the petitioner does not know $\gamma$ and, correspondingly, $\beta$ but would form a posterior expectation of the winning probability given $F(\cdot)$. Assuming (3.1), the probability that the petitioner wins in court then represents how much the court values the right to be forgotten (or, the right of privacy) versus the right to remember (or, the right of free speech and access to information plus Google’s right to do business). In this sense, we interpret $\beta$ as the relative value of the right to be forgotten (RTBF) and $(1 - \beta)$ as the relative value of the right to remember (RTR).

\section{Equilibrium}

In this section, we characterize conditions under which court-imposed settlements (or lawsuits) may arise as an equilibrium outcome, and analyze equilibria of this game. Our model does not convey any substantial insight if all types of Google always accept the claim or if the petitioner always gives up upon rejection. For our model to capture many situations in which the court judgment plays a role in the issue of RTBF and to yield a rich set of theoretical implications, we rule out such cases with Assumptions 1 and 2 given in the text.

Let the petitioner’s strategy be represented by $(p_1, p_2)$, where $p_1$ denote the probability
that the petitioner would claim and \( p_2 \) denote the conditional probability that he litigates if Google rejected. Let us first consider the outcome after the path of play reached the decision node controlled by Google, i.e., \( p_1 = 1 \). In this continuation subgame, Google with type \( \gamma \) compares her payoff from accepting, \(-\gamma S\), with her expected payoff from rejecting, 
\[(1-p_2) \cdot 0 + p_2 \left[ -\left( \frac{h}{h+\gamma S+S} \right) \gamma S - C_G \right], \]
when she anticipated that the petitioner would behave according to \( p_2 \). Google with type \( \gamma \) is just indifferent between accepting and rejecting the claim if she believes that the probability of P’s litigation is \( p_2 \) if and only if:

\[
\gamma S = p_2 \left[ \left( \frac{h}{h+\gamma S+S} \right) \gamma S + C_G \right]. \tag{4.1}
\]

**Lemma 1.** There exists a unique \( \gamma > 0 \) that satisfies (4.1) given \( p_2 > 0 \).

Define \( \gamma_G \) be such unique value of \( \gamma \) that satisfies (4.1).\(^{12}\) Note that given \( p_2 > 0 \), it will not be the case that Google will always reject no matter what her type is.

Because G’s expected payoffs satisfy the strictly increasing differences property, i.e., the difference between her expected payoff from rejecting and her payoff from accepting is a strictly increasing function of her type \( \gamma \), no matter what P’s action may be, G’s higher types find rejection relatively more attractive than lower types do. Thus Google will always want to use a cutoff strategy.

**Lemma 2.** Google’s best response against any strategy of the petitioner, \( p_2 \), is using a cutoff strategy with the cutoff \( \gamma_G \) that satisfies (4.1), characterized as:

(i) all types with \( \gamma \geq \gamma_G \) will reject the claim; and

(ii) all types with \( \gamma < \gamma_G \) will accept the claim.

Now at the petitioner’s node after the claim has been rejected, P compares his payoff from giving up, \(-h - c\), with his expected payoff from litigation,

\[
-\left( 1 - \frac{h}{h+\mathbb{E}(\gamma|\gamma \geq \gamma_G)S+S} \right) h - c - C_P, \tag{4.2}
\]

where \( \mathbb{E}(\gamma|\gamma \geq \gamma_G) \) is P’s posterior expectation of \( \gamma \) if the claim is rejected, given by

\(^{12}\)Note that \( \frac{\partial \gamma_G}{\partial p_2} > 0, \frac{\partial \gamma_G}{\partial h} > 0, \frac{\partial \gamma_G}{\partial S} < 0, \) and \( \frac{\partial \gamma_G}{\partial C_G} > 0.\)
\(E[\gamma|\gamma \geq \gamma_G] = \int_{\gamma_G}^{\hat{\gamma}} \frac{xf(x)}{1-F(\gamma_G)}dx. \)  \hspace{1cm} (4.3)

If \(F(\cdot)\) is a Uniform distribution over the interval \([0, \hat{\gamma}]\), then (4.3) becomes \(\frac{\gamma_G + \hat{\gamma}}{2}\). It is easy to see that this is a monotonic function of \(\gamma_G\). In fact it is true for any generic distribution \(F\) as long as it is non-atomic over the interval \([0, \gamma]\), where \(\hat{\gamma}\) need not equal one.\(^{13}\)

Suppose now that all types of \(G\) reject the claim. Then \(\gamma_G = 0\), and the posterior expectation of \(\gamma\) equals the priors. As more types accept (i.e., \(\gamma_G\) increases), their expected \(\gamma\) increases and correspondingly the term (4.2) monotonically falls with \(\gamma_G\). Therefore, if \(P\)'s expected payoff from litigation is already less than his payoff from giving up under the priors, then as more types accept, litigation becomes even less profitable; in such cases, the petitioner will always give up upon rejection regardless of his posterior expectations. The following assumption rules this out by requiring that the petitioner’s case has merit – \(P\)'s expected payoff from litigation is greater than his payoff from giving up given the prior distribution of Google’s types,\(^{14}\) i.e., \(- \left(1 - \frac{h}{h+E(\gamma)S+S}\right) h - c - C_P > -h - c. \)

**Assumption 1.** \(\left(\frac{h}{h+E(\gamma)S+S}\right) h > C_P. \)

Assumption 1 implies that the petitioner’s harm should not be too small, nor its litigation cost should not be too large; or the social value of the freedom of speech, captured by \(S\), should not be too large in order for litigation to be (ex-ante) profitable to the petitioner.

Now under Assumption 1, if all types of Google reject the claim, then \(\gamma_G = 0\), the posterior expectation of \(\gamma\) equals the priors, and thus litigation is profitable compared to giving up. As more types accept, then \(\gamma_G\) increases, their expected \(\gamma\) increases, in turn lowering \(P\)’s expected probability of winning in court, and so litigation becomes less profitable.

In addition, it is of no interest if all types of Google were to always accept the claim. This happens when \(\gamma_G \geq \hat{\gamma}\). The sufficient condition in Lemma 3 ensures that \(\gamma_G < \hat{\gamma}\).

\(^{13}\)This is intuitive because when more types reject, the interval of types who reject increases (i.e., \(\gamma_G\) falls), and their expected \(\gamma\) decreases.

\(^{14}\)Bebchuk (1984) assumes that litigation has a positive expected value for the plaintiff even if the defendant is of the lowest type. Translating into our model, this assumption is equivalent as to assume that litigation is profitable against Google of the highest type \(\hat{\gamma}\). In other words, there is some minimal probability of \(P\) winning in litigation and that litigation is profitable even with this minimal probability. In this sense, Assumption 1 is a weaker version of Bebchuk (1984)'s assumption.
**Lemma 3.** If $\frac{\bar{\gamma}S^2}{h+S} > C_G$, then there is a positive probability – but no certainty – that $G$ would reject.

Throughout this paper, we make the following assumption to rule out the possibility that Google would always accept the claim no matter what her type is.

**Assumption 2.** $\frac{\bar{\gamma}S^2}{h+S} > C_G$.

Assumption 2 implies that there is some lower bound on $S$. This is intuitive because if $S$ is too small, then rejecting (and subsequent litigation by P) will cause Google to win litigation with a very small probability but with an additional litigation cost; therefore, any type of $G$ may as well accept the claim. Similarly, $G$’s litigation cost must not be too large. In addition, the above assumption implies that the petitioner’s harm should not be too large, because otherwise, if $h$ is too large compared to $S$ then even the highest type of Google may not find it in her interest to reject the claim.

Under Assumption 2, some types of Google will always reject, and so, the total prior probability of the path of play facing Google of type $\gamma$ in the rejection state is strictly positive, i.e., $(1 - F(\gamma_G)) > 0$. Therefore, Bayes’ formula completely characterizes P’s belief probabilities upon rejection. Upon rejection, the petitioner forms his posterior expectation of $\gamma$ given the posterior beliefs concentrated on $[\gamma_G, \bar{\gamma}]$, and decides whether to litigate or to give up. In doing so, the petitioner’s strategy $p_2$ must be optimal given Google’s optimal cut-off strategy $\gamma_G$. The petitioner will be indifferent between litigating and giving up upon rejection if and only if:

$$\left(\frac{h}{h + E(\gamma|\gamma \geq \gamma_G)S + S}\right) h - C_P = 0. \tag{4.4}$$

Let $\gamma^*$ be the unique value of $\gamma_G$ that solves $(4.4)$. It trivially follows that $\gamma^* > 0$; otherwise, Assumption 1 is violated.

**Lemma 4.** The petitioner’s best response upon rejection is characterized as:

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15Because of Assumption 2, Bayes’ consistency implies full consistency of beliefs (i.e., the conditional probabilities that P faces Google of type $\gamma$ given rejection). So upon rejection P determines his posterior beliefs using Bayes’ formula.

16Note that $\frac{\partial \gamma^*}{\partial h} > 0$, $\frac{\partial \gamma^*}{\partial S} < 0$, and $\frac{\partial \gamma^*}{\partial C_P} < 0$. 

---
\[ (i) \quad p_2 = 1 \text{ if } \gamma_G < \gamma^*; \]

\[ (ii) \quad p_2 \in [0, 1] \text{ if } \gamma_G = \gamma^*; \text{ and} \]

\[ (iii) \quad p_2 = 0 \text{ if } \gamma_G > \gamma^*. \]

Let \( \gamma^*_G \) be the cutoff value \( \gamma_G \) for \( p_2 = 1 \), i.e., \( \gamma^*_G \) satisfies:

\[
\gamma^*_G S = \left( \frac{h}{h + \gamma^*_S S + S} \right) \gamma^*_G S + C_G. \tag{4.5}
\]

We can now characterize a unique equilibrium to the continuation subgame following the petitioner’s claim.

**Proposition 1.** Under Assumptions 1 and 2, there is a unique Nash equilibrium in the subgame when the claim is made, in which the equilibrium strategies are characterized as follows:

1. **if** \( \gamma^*_G < \gamma^* \), **then** \( G \) of type \( \gamma \geq \gamma^*_G \) reject the claim, \( G \) of type \( \gamma < \gamma^*_G \) accept the claim, and \( P \) always choose to litigate, \( p_2 = 1 \); and

2. **if** \( \gamma^*_G \geq \gamma^* \), **then** \( G \) of type \( \gamma \geq \gamma^* \) reject the claim, \( G \) of type \( \gamma < \gamma^* \) accept the claim, and \( P \) randomizes, choosing litigation with probability \( p_2 = \frac{\gamma^* S}{h + \gamma^* S + S + C_G} \).

In addition, the posterior beliefs of \( P \) satisfy Bayes theorem upon rejection given the priors, i.e., \( \frac{f(\gamma)}{1 - F(\gamma_G)} \), where \( \gamma_G \) is the cutoff value of \( G \)'s strategy, and thus the posterior expectation of \( \gamma \) upon rejection is \( \mathbb{E}(\gamma | \gamma \geq \gamma_G) \).

Proposition 1 describes the unique equilibrium in the subgame following \( p_1 = 1 \). The equilibrium strategies described above form the unique equilibrium in behavioral strategies; Under Assumption 2, the rejection state occurs with positive probability under the unique equilibrium, and thus the equilibrium strategies are always sequentially rational for \( P \) upon rejection with the beliefs specified above.\(^{17}\)

Consider now the petitioner’s initial node in which he has to decide whether to claim or not. Because of Proposition 1, the petitioner compares his payoff from “no claim,” \(-h\), with

\(^{17}\)The beliefs are weakly consistent with the equilibrium in behavioral strategies. Because \( 1 - F(\gamma_G) > 0 \), rejection is never a zero-probability event and so weak sequential equilibrium implies full sequential equilibrium.
his expected payoff from “claim” under the prior distribution of Google’s types given the equilibrium strategies \( \gamma_G \) and \( p_2 \) in the unique equilibrium of the subgame,

\[
F(\gamma_G)(-c) + \\
(1 - F(\gamma_G)) \left[ (1 - p_2)(-h - c) + p_2 \left(- \left(1 - \frac{h}{h + E(\gamma|\gamma \geq \gamma_G)S + S}\right) h - c - C_P\right)\right].
\]  

(4.6)

Then the petitioner’s optimal strategy at his initial node would be to claim if (4.6) \( \geq -h \). This condition reduces to:

\[
c \leq F(\gamma_G)h + (1 - F(\gamma_G))p_2 \left( \frac{h}{h + E(\gamma|\gamma \geq \gamma_G)S + S}\right) h - C_P.
\]  

(4.7)

As is evident from (4.7), if the primitives of our model were such that \( \gamma^*_G \geq \gamma^* \), then given the subgame equilibrium strategies specified in Proposition 1, (4.7) becomes:

\[
c \leq F(\gamma^*)h,
\]  

(4.8)

whereas if the primitives were such that \( \gamma^*_G < \gamma^* \), then given the subgame equilibrium, (4.7) becomes:

\[
c \leq F(\gamma^*_G)h + (1 - F(\gamma^*_G)) \left[ \frac{h}{h + E(\gamma|\gamma \geq \gamma^*_G)S + S}\right] h - C_P.
\]  

(4.9)

The intuition is straightforward: the claim fee has to be small enough for “claim” to be profitable to the petitioner assuming that all moves after the claim would be determined according the strategies specified in Proposition 1.

**Proposition 2.** Under Assumptions 1 and 2, for any given \( c, h, S, C_P, \) and \( C_G \), P’s strategy \( p_1 \) such that \( p_1 = 1 \) if (4.7) holds and \( p_1 = 0 \) if otherwise, together with the strategies and beliefs described in Proposition 1, constitute a unique sequential equilibrium of the RTBF game.

The intuition simply follows: When a petitioner supposedly suffered harm from the links that are on a web search engine, then as long as the claim fee is small enough, the petitioner (regardless of the size of his harm) will act aggressively and claim his right to be forgotten, in hopes of his claim being accepted and, despite rejection, of winning in court, both of which
will lead to broken links.

5 Efficiency and the Optimal Amount of Broken Links

Our equilibrium results provide an interesting observable implication that answers the following questions: Does the number of requests for removal that are submitted exceed the socially optimal amount? Are there too many links delisted in terms of social efficiency?

Recall that the court’s judgment is assumed to be determined by maximizing (ex-post) social welfare.\(^{18}\) Once the case is brought to a trial, the court gathers all the relevant information and discovers all related stakes. Then the court weighs the total payoffs of all associated individuals less fixed costs in each of the two cases: the links are removed versus the links remain. When the links are taken down, the ex-post social welfare loss is \(\gamma S + S\), whereas when the links remain, the ex-post social welfare loss is \(h\). Thus the final court judgment would depend on whether or not the value of the right to be forgotten \((h, \text{ welfare saved by ruling in favor of the petitioner})\) is higher than the value of the right to remember \((\gamma S + S, \text{ welfare saved by ruling in favor of Google})\). Along the same lines, if \(h > \gamma S + S\) then social efficiency calls for the links to be delisted; if otherwise, the links to be remained.

We say that the equilibrium in which the petitioner chooses to claim is \(\text{ex-post efficient}\) iff the equilibrium outcome of “broken links” coincides with what social efficiency dictates.

First consider the case in which the court’s process of discovery revealed that the value of the right to be forgotten exceeds the value of the right to remember, i.e., \(h > \gamma S + S\). Then the court would find for the petitioner and Google would be required to remove the links. If the claim for removal had been accepted by Google without resorting to court, then the links would also have been removed. This implies that the petitioner was correct to file a claim. Thus when the value of the RTBF is higher than the value of the RTR, the expected number of claims coincide with the socially optimal amount and the number of broken links achieves social efficiency.

Next consider the case when the value of the RTBF is less than the value of the RTR, i.e., \(h < \gamma S + S\). In such case, social efficiency suggests that the links not to be delisted,\(^{18}\) By \(\text{ex-post}\) we mean that claim fee and litigation costs are not included in the calculation of social welfare. This restriction does not derive the result, but is in line with the litigation literature.
focusing the right of free speech, expression, and access to information over the right of privacy. This implies that the petitioner should not have requested the removal in the first place in terms of efficiency. But as long as the claim fee is reasonably small, the petitioner always claims and some types of Google immediately accepts the claim. When rejected, despite the fact that the petitioner’s expected winning probability in a trial is relatively small, he is not discouraged to litigate. The “good” news is that the court would correctly find against the petitioner when the case is proceeded to a trial, and so the links would not be removed. Nonetheless, exactly because of uncertainty the petitioner has on Google’s private information, the petitioner makes a claim hoping for acceptance or, if rejected, prevailing in court; and his threat to litigate would induce some types of Google, given her assessment of the trial’s expected outcome, to immediately accept, ultimately resulting in broken links. Thus we arrive at the following conclusion.

Proposition 3. Suppose that $c$ satisfies (4.7). If the true $\gamma$ is such that $h > \gamma S + S$, then the unique sequential equilibrium is ex-post efficient; if the true $\gamma$ is such that $h < \gamma S + S$, then the unique sequential equilibrium is ex-post inefficient.

Proposition 3 implies that even when the value of the right to be forgotten is less than the value of the right to remember, too many requests for the removal of links are processed and too many links are removed from a social welfare perspective.

6 Comparative Statics

In this section, we examine the effect of a change in users’ welfare loss $S$ (when links are removed) and litigation costs, $C_P$ and $C_G$, on the probability of lawsuits – the likelihood that the case will be settled in court once the claim has been made. This allows us to calculate the likelihood of “broken links” as a final outcome in equilibrium. In doing so, we connect the intuitions behind our comparative static results with the relative value of the RTBF captured by $\beta$. 
6.1 Higher Users’ Welfare Loss

One might naively reason that if there is a higher welfare loss to users from broken links relative to the petitioner’s harm, then the petitioner should expect to lose the trial with a higher probability and litigation becomes less likely. However this is almost surely not the case up to a sufficiently large $S$.

To see this, first note that the total prior probability that $G$ will reject the claim is $1 - F(\gamma_G)$, where $G$’s optimal cutoff value $\gamma_G$ (either $\gamma_H^*$ or $\gamma^*$) decreases in $S$. Therefore according to $G$’s optimal cutoff strategy, $(1 - F(\gamma_G))$ increases in $S$ with a kink at $\gamma_H^* = \gamma^*$. Also notice that in equilibrium the probability that $P$ litigates is $p_2 = 1$ when $\gamma_H^* < \gamma^*$, whereas $p_2$ decreases with $S$ when $\gamma_H^* \geq \gamma^*$. Otherwise in the latter case, if $P$ were to commit to litigation, then $G$ with types $\gamma \geq \gamma_H^*$ will reject, in which case $P$’s litigation becomes unprofitable and so his commitment to litigation is not credible. That is, rejection by less of high types provides more information that $P$’s case is weak. Therefore $P$ must lower his probability of choosing “litigate” so as to make more types of $G$ reject. In particular, he would litigate with a lower probability just enough to make $G$ of type $\gamma = \gamma_H^* \leq \gamma_H^*$ indifferent. His now-lower probability of litigating implies a greater chance of being rejected; but after rejection he was correct to litigate according to such probability, which confirms $P$’s indifference between litigation and give-up.

The probability of lawsuits in the unique equilibrium of the subgame following the petitioner’s claim can be calculated as follows:

$$Pr(\text{“lawsuits”}) = (1 - F(\gamma_G))p_2$$

$$= \begin{cases} 
(1 - F(\gamma_H^*)) & \text{if } \gamma_H^* < \gamma^*, \\
(1 - F(\gamma^*)) \left( \frac{\gamma^* S}{h + \gamma^* S + \gamma^* S + C_G} \right) & \text{if } \gamma_H^* \geq \gamma^*. 
\end{cases}$$

(6.1)

Define $S^*$ to be the value of $S$ such that $\gamma_H^* = \gamma^*$ given other primitives. As is evident from (6.1), there is a kink in the probability of lawsuits at $S = S^*$. Differentiation of (6.1) yields:

$$\frac{dPr(\text{“lawsuits”})}{dS} = (1 - F(\gamma_G)) \left[ \frac{\partial p_2}{\partial S} + \frac{\partial p_2}{\partial \gamma_G} \frac{d\gamma_G}{dS} \right] - f(\gamma_G)p_2 \frac{d\gamma_G}{dS}. $$

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When $S < S^*$ (or when $\gamma_G^* < \gamma^*$), $p_2 = 1$ and $\gamma_G = \gamma_G^*$; So the derivative of (6.1) for $S \in (0, S^*)$ is $-f(\gamma_G^*) \frac{d\gamma^*_G}{dS} > 0$. At $S = S^*$, it is a special case where $p_2 = 1$ and $\gamma_G = \gamma^*_G$; the left derivative evaluated at $S = S^*$ is then $-f(\gamma^*_G) \frac{d\gamma^*_G}{dS} > 0$. When $S \geq S^*$, $p_2 = \frac{\gamma^*_G}{F(\gamma_G^* + \gamma^*_G) + C_G}$ and $\gamma_G = \gamma^*$, and so the derivative of (6.1) for $S \in [S^*, \bar{S})$ is $-f(\gamma^*_G) \frac{d\gamma^*_G}{dS} + (1 - F(\gamma^*)) \frac{dp_2}{dS}$, which is less than the left derivative at $S = S^*$. We assume that $\frac{f(\gamma^*_G)}{1 - F(\gamma)}$ strictly increases in $\gamma$ to ensure $\frac{dPr(\text{"lawsuits"})}{dS} < 0$ for some $S \in [S^*, \bar{S})$. We further impose the following condition so that the probability of lawsuits achieves its unique maximum at $S = S^*$.

Assumption 3. $-f(\gamma^*_G) \frac{d\gamma^*_G}{dS} |_{S = S^*} + (1 - F(\gamma^*)) \frac{dp_2}{dS} |_{S = S^*} < 0$.

The following proposition shows the effect of an increase in $S$ on the probability of lawsuits in the unique subgame equilibrium following P’s claim.

Proposition 4. For given $h$, $C_P$, and $C_G$, the probability of lawsuits increases with a small increase in $S$ if $S < S^*$; and, under Assumption 3, the probability of lawsuits decreases with a small increase in $S$ if $S \geq S^*$.

Proposition 4 implies that the probability of lawsuits achieves its maximum at $S = S^*$. The intuition is as follows. Generally when $S$ increases, the probability of G’s rejection increases, and so P’s posterior assessed probability of winning in a trial decreases, in turn lowering P’s expected payoff of the trial with his posterior concentrated on $[\gamma_G, \bar{\gamma}]$. When $S < S^*$, even though P’s expected payoff from litigation falls by an increase in $S$, the increased $S$ is not large enough to make litigation unprofitable compared to giving up and thus P can still maintain to act aggressively – litigate with probability one. Therefore a higher $S$ in this case has a correspondingly higher chance of being rejected by Google, and the petitioner always proceeds to court.

On the other hand, if $S$ increases when $S \geq S^*$, the increased probability of G’s rejection makes P’s litigation unprofitable compared to giving up. This implies that P would no longer be able to litigate with probability one; thus upon rejection, P would have to litigate less often to compensate for his loss from litigation. Such fall in P’s probability of litigation more

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19 With a Uniform distribution $F(\cdot)$, these assumptions are not necessary.
than offsets the increased probability of rejection by G. Therefore, the overall probability of lawsuits falls.

Figure 2: The effect of $S$ on the probability of lawsuits in equilibrium

Figure 2 illustrates the effect of an increase in $S$ on the probability that G will accept the claim, the probability that P would litigate if rejected, and the overall probability of lawsuits in equilibrium after the claim, for fixed values of $h = 50$ and $C_P = C_G = 10$ with a Uniform $F(\cdot)$ on $[0, 1]$. We can easily see that when $S < S^* \approx 128.83$, the probability of lawsuits increases with $S$ because more types of Google reject; when $S \geq S^*$, more types of Google reject as $S$ increases as before, but the petitioner litigates much less often, which contributes to a decrease in the probability of lawsuits. One interesting implication is that even when the individual’s harm from the links are relatively small (e.g., $h = 50$ and $S = 120$), a higher welfare loss of users and a corresponding lower expected probability of P winning in court do not deter the petitioner from acting aggressively.

We now assess the likelihood of “broken links” as a resulting equilibrium outcome. Consider again the equilibrium path after the petitioner has made the claim. The links are removed in either of the following cases: (i) Google accepts the claim; or (ii) Google rejects, the petitioner litigates and wins. Therefore, we can compute the expected likelihood
of “broken links” as follows:

\[
Pr(\text{“broken links”}) = F(\gamma_G) + (1 - F(\gamma_G))p_2\beta
\]

\[
= \begin{cases} 
F(\gamma_G) + (1 - F(\gamma_G)) \left( \frac{h}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*_G)S + S} \right) & \text{if } \gamma^*_G < \gamma^*, \\
F(\gamma^*) + (1 - F(\gamma^*)) \left( \frac{\gamma^* S}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*_G)S + S} \right) \left( \frac{h}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*)S + S} \right) & \text{if } \gamma^*_G \geq \gamma^*.
\end{cases}
\]

(6.2)

The following proposition shows how a change in \(S\) affects the likelihood of “broken links.”

**Proposition 5.** The likelihood of “broken links” unambiguously decreases with an increase in \(S\), for given \(h\), \(C_P\), and \(C_G\).

The result is straightforward: When more welfare is lost from broken links, the outcome of broken links becomes less likely. However to understand the intuition behind the course of such effect better, we need to consider two channels through which an increase in \(S\) separately affects the likelihood of “broken links,” decomposed as follows:

\[
\frac{F(\gamma^*_G)}{1} + (1 - F(\gamma^*_G)) \left( \frac{h}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*_G)S + S} \right)
\]

(1) As \(S\) increases, less types of Google accept, i.e., \(F(\gamma^*_G)\) decreases, contributing to less chance of broken links;

(2) At the same time, more types of Google reject and the expected probability of the petitioner winning in court falls, so whether Term (2) rises or falls is ambiguous.

Regardless, the first effect is stronger than the second effect because P’s expected winning probability is less than one, so that a decrease in Term (1) more than offsets any increase in Term (2).

Similarly for the second case:

\[
F(\gamma^*) + (1 - F(\gamma^*)) \left( \frac{\gamma^* S}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*_G)S + S} \right) \left( \frac{h}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*)S + S} \right)
\]

(6.2)
As is evident from the previous discussion, both the first term \( F(\gamma^*) \) and \( \Pr(\text{"lawsuits"}) \) decrease with \( S \). Note that the expected probability of \( P \) winning (Term (*)) is constant for any \( S \). The reason is that when \( \gamma^*_G \geq \gamma^* \), \( P \) is just indifferent between litigation and give-up after rejection by the types \( \gamma \geq \gamma^* \), implying that, by construction, his (posterior-assessed) probability of winning must remain the same regardless of a change in \( S \).

In either case, an increase in \( S \) unambiguously lowers the likelihood of “broken links.” Also as \( S \) increases, the petitioner’s expected winning probability in court, \( \beta \), (weakly) decreases. Such winning probability can be interpreted as the expected relative value of the right to be forgotten. Figure 3 shows these comparative static results for fixed values of \( h = 50 \) and \( C_P = C_G = 10 \) with a Uniform \( F(\cdot) \) on \([0, 1]\).

![Figure 3: The effect of \( S \) on the likelihood of “broken links” in equilibrium](image)

An obvious implication is that if higher welfare is lost from broken links, then the court’s decision would tilt toward putting more weight on the total social welfare loss (for Google and network users) than on the individual’s harm, implying that the expected relative value of the RTBF lessens. The petitioner “correctly” expects to win the case less often, but he can still credibly “threat” to litigate with probability one even for a considerably large amount of users’ welfare loss; and as a result, an excessively more number of claims are rejected and brought to court. Nonetheless, the heightened relative value of the RTR results in the court

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\(^{20}\)Given \( G \)’s optimal cutoff strategy with the cutoff value \( \gamma^* \), \( P \)’s posterior expectation of \( \gamma \) on the interval \([\gamma^*, \bar{\gamma}]\) decreases as more types reject by an increase in \( S \).
decision to be more likely in favor of Google, which together with less Google’s immediate
acceptance of the claim primarily contribute to lower chance of “broken links.” This effect
is exacerbated when users’ welfare loss is so high such that the petitioner starts to give up
more often.

6.2 Higher Litigation Costs

Now we turn to the effect of changes in litigation costs on the probability of lawsuits and
the likelihood of “broken links.” In fact the results are closely in line with Bebchuk (1984)’s
comparative statics with a subtle difference.

Recall that the probability of lawsuits is given by (6.1). We can see that the left and
right derivatives of $Pr(\text{"lawsuits"})$ differ at $\gamma^*_G = \gamma^*$. Also note that Assumptions 1 and 2
imply upper bounds for $C_P$ and $C_G$ respectively. Denote $\bar{C}_P$ and $\bar{C}_G$ to be the corresponding
upper bounds. Because $C_P \in (0, \bar{C}_P)$ and $C_G \in (0, \bar{C}_G)$, the subsequent results will hold for
marginal changes in the parameters within the range.

Lemma 5. An increase in the petitioner’s litigation cost, $C_P$, has no effect on $\gamma^*_G$, whereas
will decrease $\gamma^*$. On the other hand, an increase in Google’s litigation cost, $C_G$, will increase
$\gamma^*_G$, whereas has no effect on $\gamma^*$. Formally,

$$\frac{d\gamma^*_G}{dC_P} = 0, \quad \frac{d\gamma^*}{dC_P} < 0; \quad \frac{d\gamma^*_G}{dC_G} > 0, \quad \frac{d\gamma^*}{dC_G} = 0.$$

Lemma 5 implies that when $\gamma^*_G < \gamma^*$, Google’s optimal cutoff value $\gamma_G = \gamma^*_G$ increases
with an increase in Google’s litigation cost $C_G$. Therefore, $Pr(\text{"lawsuits"}) = (1 - F(\gamma^*_G))$
falls with a small increase in $C_G$ when $\gamma^*_G < \gamma^*$. On the other hand, when $\gamma^*_G \geq \gamma^*$, Google’s
optimal cutoff value $\gamma_G = \gamma^*$ is not affected by a change in $C_G$. Regardless, $Pr(\text{"lawsuits"}) =
(1 - F(\gamma^*_G))p_2$ also falls with an increase in $\gamma^*_G$ when $\gamma^*_G \geq \gamma^*$, due to the direct negative
effect of $C_G$ on $p_2$. Thus an increase in $C_G$ always leads to a lower probability of lawsuits
with a kink at $\gamma^*_G = \gamma^*$.

Proposition 6. The probability of lawsuits unambiguously decreases with an increase in
$C_G \in (0, \bar{C}_G)$, for given $h$, $S$, and $C_P$. 

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Figure 4 shows the effect of an increase in $C_G$ on G’s probability of acceptance, P’s probability of litigation, and the overall probability of lawsuits in equilibrium after the claim, for fixed values of $h = 35$, $S = 50$, and $C_P = 10$ with a Uniform $F(\cdot)$ on $[0, 1]$.\footnote{For this comparative static illustration, we use $h = 35$ unlike the other examples with $h = 50$. This is because for the given values of $h = 50$, $S = 50$, and $C_P = 10$, it is always the case that $\gamma^* > 1$, which implies that $\gamma^*_G < \gamma^*$ for any $C_G \in (0, \bar{C}_G)$. So the probability of lawsuits monotonically decreases (without a kink) with an increases in $C_G$ merely due to the fact that more types of Google accept. Of note is that the comparative static with regard to $C_G$ crucially depends on the constant level of $\gamma^*$ for given values of $h$, $S$, and $C_P$. For the case of $\gamma^*_G \geq \gamma^*$ to occur, it must $\gamma^* < 1$, which may occur for a small enough $h$, a large enough $S$, and/or a high enough $C_P$.}

![Figure 4: The effect of $C_G$ on the probability of lawsuits in equilibrium](Image)

Now consider the effects of changing the petitioner’s litigation cost. Lemma 5 implies that when $\gamma^*_G < \gamma^*$, $\gamma^*_G$ is not affected by $C_P$; but when $\gamma^*_G \geq \gamma^*$, $\gamma^*$ decreases with an increase in $C_P$. We can easily observe that $Pr(\text{“lawsuits”}) = (1 - F(\gamma^*_G))$ remains constant by any small change in $C_P$ when $\gamma^*_G < \gamma^*$. However when $\gamma^*_G \geq \gamma^*$, the effect of an increase in $C_P$ on $Pr(\text{“lawsuits”}) = (1 - F(\gamma^*)) \left( \frac{\gamma^* S}{\bar{h} + \gamma^* S + \gamma^* S + C_G} \right)$ seems not obvious because we need to consider an indirect effect of $C_P$ on $Pr(\text{“lawsuits”})$ through $\gamma^*$. Let $C^*_P$ denote the value of $C_P$ such that $\gamma^*_G = \gamma^*$. Then for $C_P \in [C^*_P, \bar{C}_P]$ (or when $\gamma^*_G \geq \gamma^*$), we have:

\[
\frac{dPr(\text{“lawsuits”})}{dC_P} = \frac{\partial Pr(\text{“lawsuits”})}{\partial \gamma^*} \frac{d\gamma^*}{dC_P} = -f(\gamma^*) p_2 \frac{d\gamma^*}{dC_P} + (1 - F(\gamma^*)) \frac{\partial p_2}{\partial \gamma^*} \frac{d\gamma^*}{dC_P},
\]  

(6.3)
where the first term is positive because $\frac{d\gamma^*}{dC_P} < 0$ by Lemma 5, whereas the second term is negative because $\frac{\partial p_2}{\partial \gamma^*} > 0$. Note that the left and right derivatives differ at $C_P = C_P^*$. The left derivative evaluated at $C_P = C_P^*$ is zero (because $p_2 = 1$ and $\gamma_G = \gamma_G^* = \gamma^*$ at $C_P = C_P^*$); whereas the right derivative evaluated at $C_P = C_P^*$ is $(1 - F(\gamma^*)) \frac{\partial p_2}{\partial C_P} |_{C_P = C_P^*} < 0$. The derivative (6.3) remains negative for $C_P \in (C_P^*, \bar{C}_P)$ assuming $\frac{f(\gamma)}{1 - F(\gamma)}$ strictly increases in $\gamma$. Therefore, $Pr(\text{“lawsuits”}) = (1 - F(\gamma^*))p_2$ decreases in $C_P$ when $\gamma_G^* \geq \gamma^*$. Then we immediately obtain the following proposition.

**Proposition 7.** The probability of lawsuits weakly decreases with an increase in $C_P \in (0, \bar{C}_P)$, for given $h$, $S$, and $C_G$. In particular, the probability of lawsuits is not affected by a small increase in $C_P$ when $C_P < C_P^*$, otherwise falls.

The traditional comparative static results continue to hold for the effect of changing Google’s litigation costs; however a change in the petitioner’s litigation costs has no effect on the expected number of cases that proceed to court for a considerable range of parameter values. Figure 5 illustrates the effect of an increase in $C_P$ for fixed values of $h = 50$, $S = 50$, and $C_G = 10$ with a Uniform $F(\cdot)$ on $[0, 1]$. We can easily see that when $C_P < C_P^* \approx 18.7$, a small increase in the petitioner’s court cost leads to the same probability of “lawsuits”; when $C_P \in [C_P^*, \bar{C}_P)$, where $\bar{C}_P = 20$, lawsuits become less likely as $C_P$ increases.

![Figure 5: The effect of $C_P$ on the probability of lawsuits in equilibrium](image-url)
Similarly as in the previous subsection, we can examine the likelihood of “broken links” as a resulting equilibrium outcome and relate to the relative value of the RTBF captured by $\beta$. Recall that the likelihood of “broken links” is given by

$$Pr(\text{“broken links”}) = F(\gamma_G) + (1 - F(\gamma_G))p_2\beta$$

$$= \begin{cases} 
F(\gamma_0^*) + (1 - F(\gamma_0^*)) \left( \frac{h}{h + E(\gamma|\gamma \geq \gamma_0^*)S + S} \right) & \text{if } \gamma_G < \gamma^*, \\
F(\gamma^*) + (1 - F(\gamma^*)) \left( \frac{\gamma^*S}{h + \gamma^*S + S} \right) & \text{if } \gamma_G \geq \gamma^*. 
\end{cases}$$

(6.4)

When $\gamma_0^* < \gamma^*$, as $C_G$ increases, more types of Google accept and the expected probability of the petitioner winning in court falls; so a decrease in the second term is dominated by an increase in the first term. On the other hand when $\gamma_G \geq \gamma^*$, an increase in $C_G$ does not affect the interval of Google’s type who accept. This also implies that P’s expected probability of winning remains the same; however higher $C_G$ lowers P’s probability of choosing litigation. For illustration, see Figure 6 for fixed values of $h = 35$, $S = 50$, and $C_P = 10$ with a Uniform $F(\cdot)$ on $[0, 1]$.

Figure 6: The effect of $C_G$ on the likelihood of “broken links” in equilibrium

We might expect that when the petitioner’s litigation cost increases, he would proceed to court less often, which would lead to less “broken links.” However this is not always the
case. When $\gamma_G^* < \gamma^*$ (or $C_P < C_P^*$), Google’s optimal cutoff value of $\gamma_G^*$ is not affected by any change in $C_P$, and so both the probability of rejection by Google and P’s expected winning probability stays the same. The intuition is that the types of Google who reject are large enough so that the petitioner believes that he still has a fair chance of winning in court, enough to compensate for his higher cost. On the other hand when $\gamma_G^* \geq \gamma^*$ (or when $C_P \geq C_P^*$), if the petitioner still maintains to litigate with probability one, then the cutoff type of Google is high such that litigation becomes unprofitable; and so the petitioner must proceed to court less often to induce more types of Google to reject. As $C_P$ increases, less types of Google accept implying less “broken links” arising from Google’s immediate acceptance. At the same time, those types who reject are faced with much less probability of P’s litigation in turn lowering “broken links” arising from P’s litigating (despite his increased expected probability of winning in court). Figure 7 plots both the effects of $C_P$ on the petitioner’s expected probability of winning in court and on the likelihood of “broken links” for fixed values of $h = 50$, $S = 50$, and $C_P = 10$ with a Uniform $F(\cdot)$ on $[0,1]$.

![Figure 7: The effect of $C_P$ on the likelihood of “broken links” in equilibrium](image)

These comparative statics are summarized in the following proposition:

**Proposition 8.**

(i) For given $h$, $S$, and $C_P$, the likelihood of “broken links” increases with a small increase
in $C_G$ if $C_G \in (0, C^*_G)$; and falls with a small increase in $C_G$ if $C_G \in [C^*_G, \bar{C}_G)$, where $C^*_G$ is the value of $C_G$ such that $\gamma^*_G = \gamma^*$.

(ii) The likelihood of “broken links” weakly decreases with an increase in $C_P \in (0, \bar{C}_P)$, for given $h$, $S$, and $C_G$. In particular, the likelihood of “broken links” remains the same for any small change in $C_P$ when $C_P \in (0, C^*_P)$.

Two interesting observations arise: First, an increase in Google’s litigation cost (up to a certain point) causes Google more likely to accept the petitioner’s claim, creating more chance of “broken links” despite a relatively low value of the right to be forgotten. Only when $C_G$ is sufficiently high so that the petitioner chooses to litigate less often results in less chance of “broken links.” Second, an increase in the petitioner’s litigation cost (up to a certain point) leads to exactly the same likelihood of “broken links.” When $C_P$ is high enough, as the petitioner’s litigation cost rises, less types of Google accept and upon rejection the petitioner proceed to court less often, contributing to less chance of “broken links.” Surprisingly in this case, when the petitioner does litigate, he in fact faces a higher expected probability of winning in court (or a higher expected relative value of the RTBF).

7 The European Ruling and the Debate on Expansion

How do our model and equilibrium results describe the current situation since the European ruling? Could our results provide a reasonable prediction of individuals’ behavior (of claiming and litigating) and Google’s response (in removing the links) when the European ruling is applied to all of Google’s global search engine domains?

In answering these questions, we first simplify our model by assuming that $\gamma$ is drawn from a Uniform distribution $F(\cdot)$ over the interval $[0, \bar{\gamma}]$. This will allow us to give a clear exposition of Propositions 1 and 2. Then we give a numerical example that maps into the economics behind the European ruling; the case that initially led to the European ruling and set a major precedent over the issue of the right to be forgotten is also justified in terms of our model. Finally, under our model, we describe the effect of the expansion of the right to be forgotten to non-European websites.
### 7.1 Equilibrium under Uniform Distribution of Google’s Types

We assume that the petitioner believes that Google’s type $\gamma$ is drawn from a Uniform distribution over the interval $[0, \bar{\gamma}]$. Suppose that for given $S$, $C_P$, and $C_G$, the petitioner’s harm from the links $h$ satisfies Assumptions 1 and 2. That is,

\begin{align*}
\text{Assumption 1 : } h &> \frac{C_P + \sqrt{(C_P)^2 + 2(\bar{\gamma} + 2)S C_P}}{2} \equiv \bar{h} \\
\text{Assumption 2 : } h &< \frac{\bar{\gamma}S^2 - S C_G}{C_G} \equiv \bar{h}.
\end{align*}

(7.1) (7.2)

The lower bound $\bar{h}$ in Assumption 1 ensures that the petitioner’s case has merit (or $\gamma^* > 0$), and the upper bound $\bar{h}$ in Assumption 2 ensures Google’s positive probability of rejection.

Note that these conditions can be equivalently written in terms of $S$ or the litigation costs given other parameters.\(^{22}\) Define $h^*$ to be the value of $h$ such that $\gamma^*_G = \gamma^*$. Note that the closed form solutions of $\gamma^*_G$ and $\gamma^*$ are, respectively,\(^{23}\)

\begin{align*}
\gamma^*_G &= \frac{-(S^2 - S C_G) + \sqrt{(S^2 - S C_G)^2 + 4S^2C_G(h + S)}}{2S^2} \\
\gamma^* &= \frac{2(h^2 - C_P(h + S))}{S C_P} - \bar{\gamma}.
\end{align*}

(7.3) (7.4)

Lastly, let $\bar{c}(h)$ be the right-hand-side of (4.9), the upper bound on the claim fee for “claim” to be profitable when $\gamma^*_G < \gamma^*$ (i.e., when $h \in (h^*, \bar{h})$), and let $\bar{c}(h)$ be the corresponding upper bound when $\gamma^*_G \geq \gamma^*$ (i.e., when $h \in [h, h^*]$). Then we can describe the unique equilibrium characterized in Propositions 1 and 2 in terms of $c$ and $h$, as follows:

**Corollary 1.** Suppose that $F$ is a Uniform distribution over the interval $[0, \bar{\gamma}]$. Let $S$, $C_P$, and $C_G$ be given. The unique sequential equilibrium is one of the following types, depending on $h$ and $c$:

(i) The petitioner’s harm is high enough, i.e., $h \in (h^*, \bar{h})$:

(a) If the claim fee is low such that $c \leq \bar{c}(h^*)$, then the petitioner always claims, Google with types $\gamma < \gamma^*_G$ accept the claim, all other types reject and the petitioner

---

\(^{22}\)In terms of $S$, Assumption 1: $S < \frac{2h(h + C_P)}{\bar{\gamma}S + 2\bar{\gamma}C_P} \equiv \bar{S}$ and Assumption 2: $S > \frac{C_G + \sqrt{(C_G)^2 + 4hC_G}}{2} \equiv S$.

\(^{23}\)Note that the upper bound in (7.2) and the closed from solution of $\gamma^*_G$ in (7.3) are computed for any distribution $F$; only the lower bound $\bar{h}$ and the solution for $\gamma^*$ are simplified by assuming uniform distribution.
always litigates with the posterior expectation of $\gamma$ to be $E(\gamma|\gamma \geq \gamma^*_G) = \frac{\gamma^* + \bar{\gamma}}{2}$ upon rejection;

(a) If the claim fee is high such that $c > \bar{c}(h^*)$, then the petitioner makes no claim if $c > \bar{c}(h)$, otherwise always claims; when the petitioner has made the claim, the subgame equilibrium strategies are as in (i)(a).

(ii) The petitioner’s harm is low enough, i.e., $h \in [h, h^*]$: 

(a) If the claim fee is low such that $c \leq \bar{c}(h)$, then the petitioner always claims, Google with types $\gamma < \gamma^*$ accept the claim, all other types reject and the petitioner litigates with positive probability $p_2$ with the posterior expectation of $\gamma$ to be $E(\gamma|\gamma \geq \gamma^*) = \frac{\gamma^* + \bar{\gamma}}{2}$ upon rejection.

(a) If the claim fee is high such that $c > \bar{c}(h)$, then the petitioner makes no claim if $c > \bar{c}(h)$, otherwise always claims; when the petitioner has made the claim, the subgame equilibrium strategies are as in (ii)(a).

In what follows, we focus on the case of (i) in Corollary 1, in which the equilibrium is in pure strategies.\textsuperscript{24}

7.2 The Economics behind the European Ruling

In 2009, Mario Costeja González, a Spaniard lawyer, requested Google the removal of a link to a digitized 1998 article in La Vanguardia newspaper about the forced sale of properties arising from social security debts – one of which belonged to Costeja. His grounds were that the forced sale had been concluded years before, a debt had been paid in full, and was no longer relevant. The case was eventually elevated to the European Court of Justice (ECJ). In May 2014, the court ruled in Costeja that certain people can ask search engines to remove specific results for queries that include their name, where the interests in those results appearing are outweighed by the person’s privacy rights, and thus both Google Spain and Google Inc. were required to remove the pertinent links from Google search results on Costeja’s name.

\textsuperscript{24}In case (ii), the petitioner randomizes between litigate and give up upon rejection by Google. This case complicates some details of the analysis without adding additional insights. Focusing on case (i) substantially simplifies the exposition while conveying all the key insights.
Upon the ECJ ruling Google launched the online request process, and has complied with roughly 40 percent of more than 219,000 link-removal requests that it has received over the last nine months. When an individual makes such a request through a web-form, Google evaluates whether the results include outdated or inaccurate information about the person and weighs whether there's a public interest in the information remaining in search results. The requesting individual will need some connection to one of EU and EFTA countries, and Google removes the links from search results only in European versions of Google search services. Such restrictions are based on Google’s interpretation of the ECJ ruling that it is an application of European law that applies to services offered to Europeans and not to global in reach. Google may also decline to remove certain information, and if so an individual may request a data protection authority to review Google’s decision.

How do our model and equilibrium results connect to explaining the initial European ruling on Costeja case and the subsequent launch of Google’s online request process within Europe? To see this, let us assume that Costeja (petitioner) suffers harm of size \( h = 150 \) from the defamatory links remained on Google’s search results. So Costeja first requested Google Spain that the links to be removed; Google Spain then forwarded the request to Google Inc. When that was unsuccessful, Costeja eventually brought the case to court. The court considered the scope of removal to be all Google domains on a global basis. To capture this situation, suppose that if the links are delisted from all Google domains, then network users’ welfare loss is \( S = 100 \) and Google Inc. also loses some of its profit by \( \gamma S \). Let us assume that Google does not lose by more than users’ welfare, and Costeja believes that Google’s profit-loss rate is uniformly distributed on \([0, 1]\). Finally suppose that litigation costs for both parties are \( C_P = C_G = 10 \). Then our model yields the following equilibrium strategies of Costeja and Google depicted in Figure 8.

The above equilibrium result conforms with the actual sequence of events in the Costeja case if we assume that Costeja’s initial request (claim) fee was reasonably less than 81.84 and Google’s loss from broken links were greater than 22 (\( = 0.22 \cdot 100 \)) but less than 50 (\( = 150 - 100 \)). Then the Costeja case would resort to the court-imposed judgment as the equilibrium strategies imply. In such case, the petitioner’s expected relative value of the right to be forgotten (or the expected probability of winning in court) is \( \beta = \frac{h}{h+E(\gamma|\gamma \geq 0.22) \cdot S + S} \)
0.48, whereas Google with type $\gamma \geq 0.22$ assesses $\beta = \frac{h}{h+\gamma S+S} \in [0.43,0.55]$ and type $\gamma < 0.22$ assesses $\beta \in (0.55,0.6]$. The ex-ante likelihood of “broken links” is 0.60 ($= 0.22+0.78\cdot 1 \cdot 0.48$). However once the case is actually proceeded to a trial, the court would gather all the relevant information and the process of discovery would reveal Google’s true loss. If the court found that Google’s $\gamma < 0.5$, then it would rule in favor of the petitioner because the ex-post social welfare loss from the broken links ($\gamma S+S = (\gamma +1)100$) is less than the ex-post social welfare loss from the links ($h = 150$). That is, the court efficiently rules in favor of the petitioner when it discovers the relative value of the RTBF to be $\beta \in (0.5,0.55]$. Then we can ex-post expect the chance of “broken links” to be 0.50 ($= 0.22 + (0.5-0.22)\cdot 1 \cdot 1 + (1-0.5)\cdot 1 \cdot 0$).\(^{25}\)

Now since its first day of compliance, Google received more than 219,000 claims and has accepted about 40% of the total URLs requested for removal, delisting more than 795,000 URLs. A notable aspect in Google’s immediate acceptance without being brought to legal authorities or to court over the past few months is that Google in fact restricted its compliance to its local subsidiary for which the requester is associated with. Therefore when Google evaluates whether to remove the links, it will assess network users’ welfare loss pertaining only to the local domain. Then if users’ welfare loss from the broken links in all Google domains on a global basis were $S = 100$ (as in the Costeja case), the broken links only in Google Spain domain, for example, would result in a lower welfare loss than a hundred, say $S = 75$. Figure 9 shows the equilibrium strategies of the petitioner and Google.

Then our model predicts that even the petitioner with a fairly high claim fee (up to 97.88)

\(^{25}\)In terms of efficiency, the petitioner should not have filed the claim against Google with type $\gamma \geq 0.5$, which implies that in such case the equilibrium ensues inefficiency and that 10% of the requests are excessive.
would request the removal, and Google would immediately accept the request as long as its assessment of profit loss is less than $25 (= 0.33 \cdot 75)$. In this case, the petitioner would expect Google to accept his request with probability $0.33$ and the ex-ante likelihood of “broken links” is $0.7$, with the petitioner’s expected relative value of the right to be forgotten calculated to be $\beta = 0.55$. Those types of Google who accept ($\gamma < 0.33$) estimates $\beta \in (0.6, 0.67]$ and those types who reject ($\gamma \geq 0.33$) estimates $\beta \in [0.5, 0.6]$. When the case is actually in a trial, an “efficient” court judgment would find for the petitioner against any type of Google who is brought to court. Thus the ex-post likelihood of “broken links” is one.

Figure 10 plots the petitioner’s expected likelihood of winning in court and Google’s assessments of the petitioner’s likelihood of winning for types $\gamma \in \{0, \gamma^*_G, 1\}$ in relation to $S$. Also it shows the court’s efficient decision rule (when $G$ rejects and $P$ litigates) depending on its discovery of the true relative value of the RTBF, above which the court rules in favor of the petitioner and below which in favor of Google. We can see that when $S \geq 75$, too many claims are filed and eventually brought to costly litigation in terms of efficiency, the observation of which confirms our claim in Proposition 3.

The above example illustrates our equilibrium prediction regarding Google’s removal request process: Google’s acceptance of about 33% of the requests given our assumptions on the parameter values. There are two points to note in this observation. First, the question of whether the remaining 67% of rejection has been resolved by a data protection authority or court is unanswered. However we can expect a priori about 70% of the links would be...

\footnote{Efficiency calls for the links to be broken for any relative value of the RTBF $\beta \in (0, 1)$.}
delisted if every requester appeals against Google’s rejection decision; if the court correctly rules in favor of the requester, then every claim will result in broken links.

Second, note that Google has actually processed 40.4% of removal requests according to its recent transparency report. One explanation involves chilling effects due to one of the features in the Principles of European Tort Law (PETL): the European ruling essentially puts the burden of proof on data controllers under the provision of PETL. That is, the data controllers must prove that the retention of the links is necessary for exercising the right of free speech and falls under the category specified as an exemption from the duty to remove. What this means is that a data controller, upon receiving requests, must take every possible means to evaluate each case; and if the requester confronts a rejection decision, then the data controller is fined a considerable amount of penalty if it did not comply with the rules in the RTBF standards. Thus data controllers may more often opt for removal of the links than otherwise would have.27 In our example in Figure 9, although the equilibrium strategy of Google demands only the types $\gamma < 0.33$ should accept, higher types – say $\gamma \in [0.33, 0.4]$  

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27Rosen (2012b) mentions that “the prospect of ruinous monetary sanctions for any data controller that does not comply with the right to be forgotten or to erasure” – a fine up to 1,000,000 euros or up to two percent of Facebook’s annual worldwide income – could lead data controllers to opt for deletion in ambiguous cases, producing a serious chilling effect” (pp.90-91).
might as well immediately accept the request in fear of monetary sanctions rather than fighting for the retention of potentially ambiguous contents.

7.3 The Expansion of the European Ruling

Here we briefly discuss how the global expansion might affect the expected chance of “broken links.” The emerging debate regarding the right to be forgotten is on whether the European ruling should apply far more broadly than originally understood. Should Google impose the right to be forgotten decision on all of its global search results? The central issue at hand is a clash between European and American conceptions of privacy rules. Privacy watchdogs in the European Union have already issued guidelines in September 2014 calling on Google to apply the European ruling to its entire search engine. However the guidelines are not binding, and Google’s independent advisory council is expected to recommend that Europe’s privacy standards should only apply within Europe.

In the midst of the battle over whether people have the right to be forgotten online, our model may provide an interesting prediction of what would happen if Google expands the scope of link removals to all of its domains. As noted earlier, our key presumption is that if the European ruling is imposed also on sites that operate outside Europe, then network users’ welfare loss from globally delisted links would become larger. This implies that Google would reject more removal requests while it already rejects about 60%. If the requester disagrees with Google’s initial decision and resort to national data regulators, then more number of cases would proceed to costly litigation. At the same time, because the relative value of the right to be forgotten would lessen, the court would be more likely to find for Google. Thus our model predicts that the expansion of the European ruling would actually contribute to less number of links delisted.\footnote{This discussion relates to the comparative static results in Subsection 6.1 and numerical examples in Subsection 7.2.}

The advocates for freedom of speech and access to information stress that the European legal decision unjustly limits what can be published online. The expansion of European privacy rights may certainly allow increasingly more individuals to take Google and other search engines to court to force them to remove links from global search results; However the concern that the right to be forgotten is a threat to free speech on the internet is superfluous.
Our analysis of the underlying economics implies that the expansion might actually strike an optimal balance between privacy and free speech: empowering individuals to manage and control their persona data while protecting freedom of speech, expression, and access to information by optimally retaining disclosure of information that is of public interest. In fact, individuals can simply use a non-European web address whatsoever if only the links on European sites are removed, while the expansion allows less of the overall links delisted in the first place.

8 Discussions

8.1 Reputational Incentives and Information Distortion

8.2 Comparison under Different Litigation Rules

8.3 Two-sided Private Information

8.4 Correlation between Losses

9 Concluding Comments

We are living in a world where an individual’s online activity can leave behind “digital footprints” that can never be forgotten and other users can generate “data shadows” by spreading the digital footprints without permissions. The Big Data is built upon digital footprints and data shadows, and the right to be forgotten is becoming an extremely important issue. Threats to privacy in the era of open internet are far more ubiquitous than the threats from back-then new technologies of Kodak camera and the tabloid press. In the canonical article on the right to privacy, Warren and Brandeis (1890) made the following warning: “The press is overstepping in every direction the obvious bounds of propriety and of decency. Gossip is no longer the resource of the idle and of the vicious, but has become a trade, which is pursued with industry as well as effrontery” (pp.195-96). At the heart of the current issue of the right to be forgotten, a deeper stake is found: how to protect a personal dignity from easier exposure and more difficult erasure.

\[29\text{See Koops (2011).}\]
The right to be forgotten is to protect the private dignity by making the erasure easier. However, this right may well make a fundamental conflict with the right to remember—free speech and access to information. The value of dignity is a socially constructed value, so much so that the values of the right to remember. Consequently, it is not surprising to see wide variations in evaluating the right to be forgotten, as is highlighted in the diametrical positions between the European Union and the U.S. on the scope of privacy rights. Not only across countries but also over time, the socially constructed values may change, which implies that the debate over the right to be forgotten is expected to intensify.

In this paper, we pioneer an economic analysis of the right to be forgotten. Our model captures rich spectrum of the right to be forgotten in a way that it not only formalizes the precedent case of Mr. González and AEPD vs. Google but also offers a novel framework to examine the effects of the expansion of the European standards on the right to be forgotten. In any case, it is the authors’ opinion that our paper should be taken as only a first step in an attempt to build the economics behind the right to be forgotten, and we hope other works would follow and complement ours.

REFERENCES


Koops, B.-J. (2011): “Forgetting footprints, shunning shadows: A critical analysis of the’right to be forgotten’in big data practice,”.

See Rosen (2012a).


### A Appendix A: Proofs

*Proof of Lemma 1.* When $\gamma = 0$, the left-hand-side of (4.1) is zero; the right-hand side is $p_2 C_G > 0$. Both the left-hand-side and the right-hand-side are increasing in $\gamma$, with slopes $S$ and $\frac{p_2 S h (h + S)}{(h + \gamma S + S)^2}$, respectively. Note that the LHS slope is strictly greater than the RHS slope for any $\gamma$; Otherwise,

\[
p_2 (h^2 S + h S^2) \geq h^2 S + (\gamma + 1)^2 S^3 + 2 h \gamma S^2 + 2 h S^2
\]

\[
> h^2 S + h S^2,
\]

which is a contradiction for any $p_2 \in [0, 1]$. Therefore by the single crossing property, there exists a unique $\gamma > 0$ that satisfies (4.1).

*Proof of Lemma 2.* Follows from the proof of Lemma 1 and the previous discussion in the text.

*Proof of Lemma 3.* We want $\gamma^*_G < \bar{\gamma}$ to have some types of Google reject. Note that $\gamma^*_G$ is defined by (4.1), and is increasing in $p_2$. Therefore, it suffices to have $\gamma^*_G < \bar{\gamma}$ at $p_2 = 1$. Define $\gamma^*_G$ such that it satisfies:

\[
\gamma^*_G S = \left(\frac{h}{h + \gamma^*_G S + S}\right) \gamma^*_G S + C_G
\]
Then $\gamma^*_G < \bar{\gamma}$ is equivalent to:

$$C_G < \left(1 - \frac{h}{h+\gamma^*_G S + S}\right) \bar{\gamma} S. \quad (A.1)$$

Note that as $\gamma^*_G$ approaches $\bar{\gamma}$, the term $(\ast)$ increases. Suppose that for $\gamma^*_G = 0$, the condition (A.1) holds. Then for any $\gamma^*_G > 0$, this condition will hold. Therefore if $C_G < \left(1 - \frac{h}{h+S}\right) \bar{\gamma} S$, then $\gamma^*_G < \bar{\gamma}$, which implies $\gamma_G < \bar{\gamma}$. Also note that by Lemma 1, $\gamma_G > 0$. Therefore Google will neither accept no matter what her private information is nor reject not matter what her private information is, assuming the petitioner’s case has merit (Assumption 1). Rather the petitioner’s claim will be accepted by Google whose type is sufficiently low and rejected by Google for whom this is not the case. 

Proof of Lemma 4. The petitioner’s expected payoff from litigation (if the claim is rejected) depends on the posterior expectation of $\gamma$ on the interval $[\gamma_G, \bar{\gamma}]$. If $\gamma_G$ increases, then $E[\gamma|\gamma \geq \gamma_G]$ increases (or the expected probability of winning in litigation decreases), and thus the expected value of litigation falls. Note that by construction, the posterior expectation of $\gamma$ concentrated on $[\gamma^*, \bar{\gamma}]$ makes $P$ just indifferent between litigation and give-up (i.e., (4.4) holds for $\gamma_G = \gamma^*$). For (i): When $\gamma_G < \gamma^*$, then $P$’s expected payoff from litigation (when a posterior expectation of $\gamma$ is concentrated on $[\gamma_G, \bar{\gamma}]$) is greater than that when it is concentrated on $[\gamma^*, \bar{\gamma}]$. Therefore when $\gamma_G < \gamma^*$, the left-hand-side of (4.4) becomes strictly positive, and so $P$ must always litigate, i.e., $p_2 = 1$. For (iii): When $\gamma_G > \gamma^*$, $p_2 = 0$ by the similar logic. For (ii): Lastly when $\gamma_G = \gamma^*$, $P$’s expected payoff from litigation following rejection by the types $\gamma \geq \gamma_G = \gamma^*$ is exactly the expected value when the posterior is concentrated on $[\gamma^*, \bar{\gamma}]$. By construction of $\gamma^*$, $P$ is indifferent between litigation and give-up after rejection by the types $\gamma \geq \gamma_G$, and so $P$ follows a randomized strategy $p_2 \in [0, 1]$. 

Proof of Proposition 1. Consider the subgame following the claim. Under Assumption 2, the petitioner uses Bayes’ theorem to compute his posteriors on $G$’s type when the claim is rejected.

(1) $\gamma_G$ is defined by (4.1). We can easily see that $\gamma_G$ is increasing in $p_2$ and $p_2 \leq 1$, so that $\gamma_G \leq \gamma^*_G$. Therefore if $\gamma^*_G < \gamma^*$, then $\gamma_G < \gamma^*$. Given $G$’s cutoff strategy $\gamma_G < \gamma^*$, upon
rejection, P’s best-response strategy must be \( p_2 = 1 \) by Lemma 4 (because litigation has a higher expected payoff under the posterior concentrated on \([\gamma_G, \tilde{\gamma}]\) than giving up). Against P’s strategy \( p_2 = 1 \), G’s best response is to use the cutoff strategy given by \( \gamma_G \) which equals \( \gamma^*_G \) when \( p_2 = 1 \). Therefore G of types \( \gamma \geq \gamma^*_G \) reject the claim and otherwise accept, believing that P will litigate with probability one. This in turn justifies P’s optimal strategy to be \( p_2 = 1 \). This is the only subgame-perfect Nash equilibrium after P’s claim.

(2) If \( \gamma^*_G \geq \gamma^* \), then \( \gamma_G \geq \gamma^* \) depends on P’s strategy \( p_2 \). (i) First suppose that \( p_2 = 0 \). Then it must be \( \gamma_G = 0 \); i.e., any type of Google will reject the claim because they expect P to give up for sure and thus earning zero instead of \(-\gamma S\) by accepting the claim. Because \( \gamma_G = 0 < \gamma^* \), it must be \( p_2 = 1 \) by Lemma 4, which is a contradiction. (That is, upon rejection by any type, P learns nothing additional about G’s type, which implies that his posterior expectation of \( \gamma \) equals his priors; however by Assumption 1, P will prefer to litigate than to give up and so \( p_2 = 1 \).) (ii) Now suppose that \( p_2 = 1 \). Then \( \gamma_G = \gamma^*_G (\geq \gamma^*) \). If \( \gamma_G > \gamma^* \), then it must be \( p_2 = 0 \) also by Lemma 4, which is again a contradiction. (That is, if \( \gamma_G > \gamma^* \) and \( p_2 = 1 \), upon rejection, P’s expected payoff from litigation when his posterior is on \([\gamma_G, 1]\) is less than that when his posterior is on \([\gamma^*, 1]\); therefore it must be \( p_2 = 0 \) contradicting \( p_2 = 1 \).) Therefore if \( p_2 = 1 \), then it must be \( \gamma_G = \gamma^*_G \) and \( \gamma^*_G = \gamma^* \). (Note that \( p_2 \) can be computed by plugging in \( \gamma^* \) in (4.1): \( p_2 = \frac{\gamma^* S}{(h + \gamma^* S + S)} \gamma^* S + C_G = \frac{\gamma^*_G S}{(h + \gamma^*_G S + S)} \gamma^*_G S + C_G \) (by \( \gamma^* = \gamma^*_G \)) = \( \frac{h}{h + \gamma^*_G S + S} \gamma^*_G S + C_G \) (by (4.5)), which confirms the petitioner’s strategy to litigate with probability one. (iii) Lastly suppose that \( p_2 \in (0, 1) \). Then it must be \( \gamma_G = \gamma^* \) by Lemma 4. Given such cutoff strategy of G, P is in fact just indifferent between litigation and give-up (See (4.4)), justifying that P uses a randomized strategy \( p_2 \in (0, 1) \). Now P’s strategy should confirm that G uses the cutoff \( \gamma^* \). Plugging \( \gamma^* \) in (4.1), we have:

\[
\gamma^* S = p_2 \left( \frac{h}{h + \gamma^* S + S} \right) \gamma^* S + C_G ,
\]

which implies that \( p_2 \) is uniquely determined by:

\[
p_2 = \frac{\gamma^* S}{(h + \gamma^* S + S)} \gamma^* S + C_G .
\]
Therefore, believing P randomizes between litigation and give-up with probability given in (A.2), G’s best response is to use the cutoff $\gamma^*_G = \gamma^*$. (Note that when $\gamma^* \leq \gamma^*_G$, $p_2 < 1$ implies $\gamma^* S < \left( \frac{h}{h + S + S} \right) \gamma^* S + C_G \leq \gamma^*_G S \leftrightarrow \gamma^* < \gamma^*_G$.) Thus if $\gamma^*_G \geq \gamma^*$, G’s cutoff strategy given by $\gamma^*_G = \gamma^*$ and $p_2$ given by (A.2), where $p_2 = 1$ iff $\gamma^* = \gamma^*_G$, is the only subgame-perfect Nash equilibrium following the claim. □

Proof of Proposition 2. Suppose that $\gamma^*_G < \gamma^*$ for given $h$, $S$, $C_P$, and $C_G$, then $\gamma_G = \gamma^*_G$ and $p_2 = 1$ form a unique equilibrium in the subgame when $p_1 = 1$, where P’s posterior expectation of Google’s types is given by $\mathbb{E}(\gamma|\gamma \geq \gamma^*_G)$. Using backward induction, given the unique subgame equilibrium, if $c$ is such that

$$c \leq F(\gamma^*_G)h + (1 - F(\gamma^*_G)) \left[ \left( \frac{h}{h + \mathbb{E}(\gamma|\gamma \geq \gamma^*_G)S + S} \right) h - C_P \right],$$

then P will always prefer “claim” to “no claim.” Therefore, P’s strategy profile $(p_1, p_2) = (1, 1)$, G’s cutoff strategy with $\gamma_G = \gamma^*_G$, and P’s posteriors $\mathbb{E}(\gamma|\gamma \geq \gamma^*_G)$ upon rejection form a unique sequential equilibrium of this game. If $c$ is larger than the right-hand-side of the above inequality, then $(p_1, p_2) = (0, 1)$, $\gamma_G = \gamma^*_G$, and P’s posteriors $\mathbb{E}(\gamma|\gamma \geq \gamma^*_G)$ upon rejection form a unique sequential equilibrium. That is, the specified strategies are sequentially rational given the posterior beliefs $\frac{f(\gamma)}{1 - F(\gamma^*_G)}$ and these beliefs are consistent with such strategies. Sequential equilibrium implies subgame perfection; so if there were multiple sequential equilibria, then there would also be multiple subgame perfect equilibria, contradicting the uniqueness of Nash equilibrium in the subgame specified in Proposition 1. A similar argument proves that there is a unique sequential equilibrium in the case of $\gamma^*_G \geq \gamma^*$ for given $h$, $S$, $C_P$, and $C_G$, except that now $p_1 = 1$ if $c \leq F(\gamma^*)h$ and $p = 0$ if otherwise. □

Proof of Proposition 3. Directly follows from the discussion in the text together with Propositions 1 and 2. □

Proof of Proposition 4. For given values of $h$, $C_P$, and $C_G$, Assumption 2 can be rewritten in terms of $S$ such that $S > S$ for some $S > 0$; and suppose $S < S^*$. These two conditions are in strict inequality and so continue to hold for a small change in $S$. Total differentiation of (4.1) shows that $\gamma^*_G$ falls as $S$ increases. The probability of “lawsuits” $(1 - F(\gamma^*_G))$ thus increases with an increase in $S$. For the second case, Assumption 1 can also be rewritten in
terms of $S$ of strict inequality such that $S < \bar{S}$; and so for $S \in [S^*, \bar{S})$, the conditions still hold for a small increase in $S$. Differentiation of (4.4) for $\gamma_G = \gamma^*$ with respect to $S$ shows that $\gamma^*$ falls as $S$ increases. (The derivative of the left-hand-side of (4.4) with respect to $S$ is negative holding $\gamma_G = \gamma^*$ fixed. Thus a decrease in the value of the left-hand-side of (4.4) will decrease the borderline type $\gamma^*$. Assumption 3 implies that the right derivative of $dPr(\text{"lawsuits"})/dS|_{\gamma_G=\gamma^*} < 0$, and continues to be negative for $S \geq S^*$.)

Proof of Proposition 5. Inspection of (6.2) and Proposition 4 confirms this.

Proof of Lemma 5. $\gamma^*_G$ is defined by (4.5), in which we can easily see that $\gamma^*_G$ is not affected by $C_P$; Differentiation of (4.5) with respect to $C_G$ shows that $\frac{d\gamma^*_G}{dC_G} > 0$ holding other variables fixed. On the other hand, $\gamma^*$, defined by (4.4) for $\gamma_G = \gamma^*$, is not affected by $C_G$ while differentiation of (4.4) with respect to $C_P$ shows that $\frac{d\gamma^*}{dC_P} < 0$.

Proofs of Propositions 6, 7, and 8. Immediately follow from the discussion.

Proof of Corollary 1. Follows from Propositions 1 and 2, assuming a Uniform distribution $F(\cdot)$.