

Proper Incentives?

The Economics of Spam Management by the Mobile Wireless Industry

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Introduction

Spam is the worst. Whether it is filling up your email inbox or interrupting dinner as telemarketing calls, spam is as an unwelcome intrusion as it is a pervasive one. Despite the eponymous “CAN SPAM” Act of 2003,¹ statistics show that 90% of email is spam, cheapening email as an effective communications technology.² As a result, young people, often the target of marketing campaigns, have nearly abandoned email altogether.³ The brisk decline in landline phone connections is in no small part due to telemarketing, a form of spam that even the best efforts of government has been unable to eliminate.⁴ These intrusions are not merely a nuisance: spam is an entry point for viruses, malware, cybercrime, and cyberattacks.

While your email inbox and landline phone may be cluttered with spam, when was the last time you received spam as a text message? Rarely and perhaps never, and for good reason. The mobile wireless industry diligently monitors and controls access to your text messaging services in an effort to maintain the integrity and value of the service to their customers and to manage their networks. These text messaging services include both Short Message Service (“SMS”) and the related Multimedia Messaging Service (“MMS”).

The spam-free nature of texting is what makes it a valuable service to consumers, and maintaining a spam-free experience is critical in the face of intense messaging competition from rival services like WhatsApp, Viber, Facebook, Instagram, Skype, WeChat, among many others.⁵ Consumers have great flexibility in messaging even while their mobile service provider’s texting service remains nearly spam free and limited only to those with which customers wish to communicate.

*... from our formal model of bulk messaging we are unable to find any perverse incentives on behalf of the mobile wireless industry—seller profits and consumer surplus are aligned. *** [R]egardless of the presence of absence of market power, the U.S. commercial mobile industry has proper incentives to deliver valuable messages but to block message pollution.*

The rapid sending of large quantities of text messages has a high probability of being spam or

other malicious content, so wireless carriers' management of spam is based primarily on detecting rapid-fire bulk messaging.⁶ Recognizing that there are legitimate types of bulk messaging that consumers may value, the mobile wireless industry permits entities to send bulk messages via "short codes," a five or six digit code that message senders are given upon obtaining approval from the industry's intermediary, CTIA.⁷ Thus, message filtering, while extremely effective, is not indiscriminate.

Given consumers' heightened attention to text messages due to the service's spam-free nature, marketers see bulk messaging as a high-value contact point with potential customers. Unsurprisingly, marketing companies are opposed to the mobile wireless industry's policies aimed at reducing unsolicited messages and have asked for the government to be complicit in its attempt to spam mobile accounts.

Perhaps the most pressing effort to shut down the wireless industry's anti-spam efforts can be found in the recent petition filed at the Federal Communications Commission ("FCC") by cloud-based communications provider Twilio.⁸ Twilio is asking the Commission declare that both SMS and MSS services are common carrier "telecommunications services" under Title II of the Communications Act. Presumably, the intent of Twilio's reclassification efforts is to bring SMS and MSS services under the auspices of the FCC's controversial *Open Internet Rules* which prohibit, among other things, both wireline and wireless carriers from blocking traffic.⁹ While Twilio's petition is less than artfully drafted, it appears that Twilio believes that reclassification would permit unfettered access to consumers' SMS inboxes outside of the current (and highly effective) industry filtering paradigm.

The crux of Twilio's petition hinges largely on legal distinctions, but in this PERSPECTIVE we set aside the legal questions and investigate the economic underpinnings of the issue. We view this analysis as important since one of the

arguments for opening the SMS inbox to unsolicited messages rests on the familiar claim that the carriers' filtering messages is an abuse of market power and harmful to consumers.

Even the FCC has commended the mobile wireless industry's effort to impede spam over SMS, stating (just last year) that it is "encouraged by carrier efforts to implement protections against unwanted text messages," but laments that the industry's "measures have not stemmed the tide of unwanted messages to wireless phones."

The incentives of marketers are plain enough—there's profit, whether legitimate or predatory, in sending unsolicited messages. Thus, we do not concern ourselves with their motives. Rather, we consider the incentives of the mobile wireless industry and attempt to decipher whether or not their motivations contain any anti-consumer elements. To do so, we consider the correlation between the profits of an oligopolistic industry, thus allowing for market power, and the net value of mobile wireless service to consumers (i.e., consumer surplus). Text messages, whether solicited or unsolicited, are assumed to have both positive and negative values, thereby allowing certain types of bulk messages to positively impact consumer value. Even so, from our formal model of bulk messaging we are unable to find any perverse incentives on behalf of the mobile wireless industry—seller profits and consumer surplus are aligned. We conclude that regardless of the presence or absence of market power, the U.S. commercial mobile industry has proper incentives to deliver valuable messages but to block message pollution.

Outline of the Debate

As noted above, Twilio, a cloud-based communications platform offering a variety of services—including serving as a channel for SMS spam¹⁰—filed a petition with the FCC to declare that SMS (and MMS) to be a common carrier “telecommunications” service under Title II of the Communications Act (and, presumably, be subject to the “no blocking” provisions of the FCC’s *Open Internet Order*).¹¹ Reclassification, Twilio contends, will thus end the spam-free messaging services by permitting companies to send bulk messages to consumers’ text messaging inbox without any filtering.

Given the many alternatives present in the texting market, the impact of decimating the value of carrier-provided SMS from even a relatively small amount of spam and cybercrime could be as quick as it is devastating to mobile wireless demand, leading to higher industry concentration.

Boiled down to its essence, the debate over Twilio’s reclassification petition can be summarized as follows: (a) wireless carriers, and many other independent parties to the proceeding, don’t want unsolicited bulk messages to reduce the value of their mobile services; and (b) information distribution companies, like Twilio and others, want to be able to profit from using SMS services to send unsolicited messages in bulk without any attempts by the carriers to reduce spam.

We need look no further than Twilio’s own statements to lay out the parameters of the dispute. First, Twilio’s website makes the case for the carriers’ position:

[w]hen subscribers receive messages they find objectionable, they may file complaints or report the carrier to governing bodies, seek damages, or simply stop being a customer. All of these things reduce the revenue of or increase costs for carriers. Thus, it is in the best interest of carriers to protect their subscribers from what they consider to be objectionable content,¹²

and that,

[r]ecipient carriers always reserve the right to filter out messages from certain numbers, and routinely do so to protect their users from spam.¹³

Moreover, in its petition, Twilio makes the argument that,

consumers should be able to decide with whom and how they communicate via messaging services, not the wireless carriers.¹⁴

The sentiment is echoed in the carriers’ filings, where CTIA observes,

Mobile messaging’s huge popularity is due in part to its status as a largely spam-free and trusted communications environment. But with messaging’s popularity comes the constant risk of unwanted and unlawful communications. ... Wireless providers work relentlessly to ensure that messaging benefits consumers and does not subject them to spam or otherwise harmful traffic. In the context of person-to-person (“P2P”) messages, sent using ten-digit telephone numbers, providers employ robust spam filtering software, “account fingerprinting” techniques to identify accounts that are sending high volumes of messaging traffic with little or no voice or data usage, and other tools. With P2P traffic, any genuine wireless consumer can send a message to another user without concern that the message will be denied because of its content.¹⁵

Even the FCC has commended the mobile wireless industry’s effort to impede spam over SMS, stating (just last year) that it is “encouraged by carrier efforts to implement protections against unwanted text messages,” but laments that the industry’s “measures have not stemmed the tide of unwanted messages to wireless phones.”¹⁶ Plainly, all parties seem to agree that

bulk messaging may harm consumers and risks reducing the value of SMS services.

From these statements we can formulate the motivations of the carriers. Unsolicited messages may harm consumers, which implies such messages reduce the demand for mobile wireless services. This reduced demand, in turn, harms the carriers as well. Also, Twilio's view that "consumers should choose," not those seeking profit from bulk-message marketing and cybercrime, prescribes an analysis of consumer surplus and its relation to the mobile wireless industry's profit.

On the other hand, Twilio's petition makes a mostly legal argument to force carriers via regulation to indiscriminately accept all bulk messages:

All SMS and MMS messages have at least the following in common. The sender chooses the content of the message, specifies a recipient or recipients, and hits "send." The message is the same as sent and received, and users of messaging services rightly expect service providers to carry these communications to the intended recipients, just like other calls.¹⁷

The primary "hook" for intervention rests on the fact that text messages "utilize ten-digit telephone numbers," a distinction that makes the carriers' SMS different than its rivals (like WhatsApp) in that the numbering system may implicate FCC numbering regulations established in the context of voice communications. Today, SMS is unregulated by the Commission. Twilio petitioned the FCC to reclassify SMS and MMS as a Title II Telecommunications Service which, it argues, will permit businesses to send unsolicited, bulk text messages to all customers regardless of whether or not the customer wishes to receive messages from unknown parties and expects not be bothered by nuisance, bulk messages.

An economic flavor is given to the debate when Twilio—contradicting its view that "it is in the best interest of carriers to protect their

subscribers from what they consider to be objectionable content"—claims that the filtering of bulk messages is based on the carriers' "monopoly power."¹⁸ Neither Twilio's petition, nor any of the other comments we have reviewed, provide any reasoned analysis as to why market power would cause an anti-consumer management of unsolicited messages, or even that market power exists. The "market power" claim is an assertion, nothing more, but it's also boilerplate argumentation for those seeking regulatory intervention so it's no surprise to find it here. Since market power is allegedly to blame, we believe it's worth analyzing the effect of market power more formally.

The "market power" claim is an assertion, nothing more, but it's also boilerplate argumentation for those seeking regulatory intervention so it's no surprise to find it here.

We also note that some parties have claimed that the carriers' filtering of unsolicited bulk messages violates the concept of "net neutrality." Of course, legally, it does not; the FCC's *2015 Open Internet Order* did not reclassify unregulated SMS as a telecommunications service. Moreover, net neutrality addresses the issue of a Broadband Service Provider ("BSP") favoring its own content over a rival's content. Mobile wireless carriers do not offer content over SMS services, so there is no potential for anti-competitive activities in that regard.

Most importantly, the FCC has specifically held that BSPs' use of anti-spam techniques to block both the delivery and origination of spam messages is a legitimate practice under current net neutrality regulations.¹⁹ As observed in the *2015 Open Internet Order*,

the blocking of harmful or unwanted traffic remains a legitimate network management purpose, and is permissible when pursued through reasonable network management practices

and

[t]he transmission service provided by broadband providers is functionally distinguishable from the Internet application add-ons they provide,

where these add-ons explicitly include “spam protection.”²⁰ As such, we will ignore the net neutrality claims in what follows.

... a decision that maximizes profits also services consumer interests. The decision of the carriers matches that of the consumers, and this is true regardless of the presence or absence of market power. With regard to unsolicited bulk messages, we can expect mobile wireless carriers to act in ways that protect the interest of consumers.

Economics of the Issue

We now turn to a more formal analysis of the incentives of mobile wireless carriers to manage unsolicited bulk messaging over their text messaging service, and how those incentive correlate with consumer surplus. Our review of the record suggests this PERSPECTIVE will be the first and only analysis focused on consumers, at least in any formal sense where consumer well-being is meaningfully defined and analyzed.

Given the “market power” claim in Twilio’s petition, it makes sense, then, to begin with a simple Cournot model of competition among N firms, which permits varying degrees of market power. We then modify the model to reflect the

issue of unsolicited bulk text messages that may have either positive or negative values.

To begin, assume marginal cost is zero and the service is provided at a fixed cost of f per firm. In the standard linear Cournot model, the demand curve for mobile wireless service would be

$$P = A - Q, \quad (1)$$

where P is the price of mobile wireless service, A is the intercept of the demand curve, and Q is the quantity purchased. To incorporate unsolicited bulk messaging, let’s assume that some fraction θ of customers gain some utility from receiving such messages, thereby increasing their willingness to pay for mobile wireless service by the amount g . On the other hand, the fraction $(1 - \theta)$ of consumers find unsolicited bulk text messages an irritant, which reduces their willingness to pay of mobile wireless service by the amount b . Hence, we may incorporate unsolicited messages into the model with the modified demand curve,

$$P = \tilde{A} - Q, \quad (2)$$

where

$$\tilde{A} = A + \theta g - (1 - \theta)b. \quad (3)$$

The interpretation of the demand curve is intuitive. Messages that consumers value, even if unsolicited, increases willingness to pay and thus increases the demand for mobile wireless service (by θg). Unsolicited bulk messages, like spam, are a type of information pollution and reduce the demand for wireless service, thereby making A smaller (by $(1 - \theta)b$). Some parties argue that while spam is a problem, unsolicited bulk messaging may offer value to some consumers.²¹ Our model permits the possibility of both valuable and nuisance messages. The question is what is the effect of unsolicited bulk messaging *on net* (see Eq. 3).

The Nash Equilibrium price can be expressed in a familiar form,

$$\tilde{p}^* = \frac{\tilde{A}}{N+1}, \tag{4}$$

and the equilibrium quantity is

$$\tilde{Q}^* = \frac{\tilde{A} \cdot N^*}{N^* + 1}. \tag{5}$$

Obviously, a reduction in \tilde{A} reduces both the equilibrium price and quantity (and vice versa for a rise in \tilde{A}). A decline in demand also reduces (industry) profit, which is,

$$\tilde{\pi}^* = \tilde{A}^2 \left(\frac{N^*}{(N^* + 1)^2} \right). \tag{6}$$

Equation (6) lends credence to Twilio’s statement that “it is in the best interest of carriers to protect their subscribers from what they consider to be objectionable content.”

Consumer Surplus, which is the net value of mobile wireless service, is,

$$\tilde{S}^* = \frac{1}{2} \tilde{Q}^2 = A^2 \left(\frac{N^2}{2(N+1)^2} \right). \tag{7}$$

Using a bit of algebra, we can also write consumer surplus as,

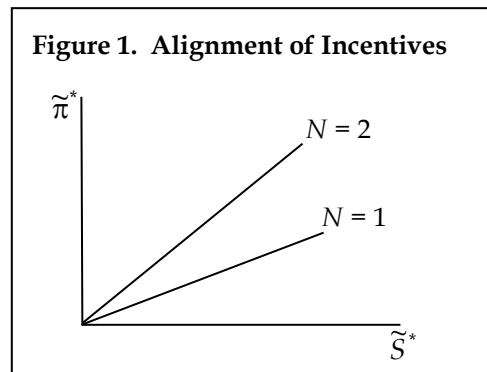
$$\tilde{S}^* = \tilde{\pi}^* (N/2). \tag{8}$$

From Equation (8), we see that industry profits are perfectly correlated with consumer surplus, since consumer surplus is just a linear transformation of industry profits. Clearly, the incentives of the firms and the consumers are perfectly aligned in terms of introducing unsolicited bulk messages into the text message service, and this is true regardless of the extent of market power.²² Thus, if permitting unsolicited bulk messages ultimately increased consumer surplus (in aggregate), then it would also increase firm profit and, hence, the firms would

be in favor of it. Alternatively, if doing so reduces consumer well-being, then the forced free flow of unsolicited bulk messages by the FCC would correspondingly decrease consumer surplus as well as consumer welfare in the aggregate.²³

If the interests of the consumer and the carriers are aligned, then the relative efficiency of the carriers in impeding unwanted messages suggests that the carriers are in the best position to manage access to messaging services.

Twilio, in its petition, makes the argument that the Commission should “let consumers decide which messages they choose to receive.”²⁴ In contrast, CTIA’s position is that “[w]ireless providers work relentlessly to ensure that messaging benefits consumers and does not subject them to spam or otherwise harmful traffic.”²⁵ Who, then, should do the choosing? If the interests of the consumer and the carriers are aligned, then the relative efficiency of the carriers in impeding unwanted messages suggests that the carriers are in the best position to manage access to messaging services. So, the obvious question is whether or not those interests are aligned? The answer, as we have already demonstrated, is *Yes*: industry profits and consumer surplus are positively correlated.



We can also see this in a figure. Figure 1 plots industry profits against consumer surplus at varying levels of \tilde{A} . As the figure clearly shows, a decision that maximizes profits also services consumer interests. The decision of the carriers matches that of the consumers, and *this is true regardless of the presence or absence of market power*: the positive correlation exists regardless of the number of competitors. With regard to unsolicited bulk messages, we can expect mobile wireless carriers to act in ways that protect the interest of consumers.

Given the many alternatives present in the texting market, the impact of decimating the value of carrier-provided SMS from even a relatively small amount of spam and cybercrime could be as quick as it is devastating to mobile wireless demand, leading to higher industry concentration.

The fact that the incentives of spammers and cybercriminals does not align with consumer interests requires no formal proof. It is plain enough that any attempt to use federal regulation to increase profits at the expense of consumers warrants no serious consideration.

Industry Structure

While we often think of a mobile wireless device as a “phone,” the fact is that voice calls are no longer a very important aspect of mobile phone service. Surveys show that text messaging is the most popular feature of mobile wireless service.²⁶ In fact, one survey indicates that 40% of smartphone users could manage without a call function on their mobile device.²⁷

Allowing the free flow of unsolicited bulk messages to destroy the value of SMS, an integral

component of mobile wireless service demand, could have serious consequences for industry structure in the mobile wireless industry. Going back to the Cournot model, the equilibrium number of firms in a market is,

$$\tilde{N}^* = \frac{\tilde{A}}{\sqrt{f}} - 1. \quad (9)$$

A reduction in \tilde{A} puts downward pressure on the equilibrium number of firms serving the market. Consequently, reducing the value of SMS through an unmanaged messaging service increases consolidation risks in the mobile wireless industry, an industry already facing significant economic pressure in that regard.²⁸ Given the many alternatives present in the texting market, the impact of decimating the value of carrier-provided SMS from even a relatively small amount of spam and cybercrime could be as quick as it is devastating to mobile wireless demand, leading to higher industry concentration.

It may also be the case that the free flow of bulk messages over wireless networks could raise the cost of constructing and operating these networks, thereby increasing f . If so, the elimination of carrier control over unsolicited bulk messages would be a double whammy on industry structure, reducing demand and increasing costs. If the goal of federal policy is to artificially maintain four national mobile wireless carriers, then granting Twilio’s petition will make such a policy much more difficult to enforce.²⁹

Type I and Type II Errors

A simple blocking of all bulk messages may catch messages that are of value to the consumer. Excessive blocking is a form of Type I error, which simply means that in the process of blocking undesirable messages some desirable messages also get blocked. This theme is observed in some of the comments filed in the

Twilio proceeding, and we model such possibilities above.

An indiscriminate filter could have a high Type I error rate. Yet, while Twilio argues that the mobile wireless carriers have imposed “arbitrary limits on the use of a technology,”³⁰ the mobile wireless carriers have not implemented an indiscriminate or arbitrary filtering mechanism. Once a bulk messenger has been detected and filtered, that’s not the end of the story. The sender is then diverted to the short-code system—a system that is far from indiscriminate.

As noted in CTIA’s SHORT CODE MONITORING HANDBOOK, “CTIA requires all short code programs to comply with a basic code of conduct that promotes the best possible user experience.”³¹ The four “Guiding Principles” of program have a clear consumer focus, making certain that consumers are in control of how unsolicited bulk messages impact their mobile wireless experience:

1. **Display clear calls-to-action.** All programs must display a clear call-to-action. Customers must be made aware of what exactly they are signing up to receive.
2. **Offer clear opt-in mechanisms.** Customers must consent clearly to opt into all recurring-messages programs. Requiring a customer to enter a mobile phone number does not constitute a compliant opt-in. Instead, customers must understand they will receive messages and consent to receive them.
3. **Send opt-in confirmation messages.** A confirmation message must be sent to customers always. For recurring-messages programs, confirmation messages must include clear opt-out instructions.
4. **Acknowledge opt-out requests.** Short code service providers must acknowledge and act on all opt-out requests. Monitoring procedures confirm successful opt-out.

Such guidelines seem eminently reasonable. These principles ensure that “Short code programs are expected to deliver sufficient value so consumers elect to participate with full transparency into the delivery conditions.”³² The Short Code process permits bulk messaging, but does so in a way, as demanded by Twilio, that will “let consumers decide which messages they choose to receive.”³³

Where there are Type I errors (blocking valuable messages), there are also Type II errors (permitted nuisance messages). While the FCC views the present Short Code system as imperfect in that existing “measures have not stemmed the tide of unwanted messages to wireless phones,”³⁴ the scarcity of unwanted, unsolicited content in SMS inboxes is testament to the effectiveness of the program, balancing Type I and Type II errors to the extent feasible.

The fact that the incentives of spammers and cybercriminals does not align with consumer interests requires no formal proof. It is plain enough that any attempt to use federal regulation to increase profits at the expense of consumers warrants no serious consideration.

Conclusion

A mobile wireless carrier has no interest in blocking messages that a consumer wishes to receive, but it has powerful incentives to block nuisance messages. In this PERSPECTIVE, we have demonstrated that the interests of mobile carriers and consumers are aligned—any profit-increasing action taken to manage unsolicited bulk messages also increases consumer well-being. Nothing in the Twilio proceeding’s record suggests otherwise. Impeding the ability of mobile wireless carriers to effectively manage

their text messaging services through regulatory action poses great risk—it will almost certainly harm carriers and consumers as well as put even more pressure in the direction of industry consolidation. The profits of marketers, spammers, and cybercriminals do not coincide with the interests of consumers.

abandon the service. As a result, the marketers get nothing and consumers get screwed. We find so saving grace of Twilio's proposal.

Impeding the ability of mobile wireless carriers to effectively manage their text messaging services through regulatory action poses great risk—it will almost certainly harm carriers and consumers as well as put even more pressure in the direction of industry consolidation. The profits of marketers, spammers, and cybercriminals do not coincide with the interests of consumers.

Any attempt to manage the vast amount of content flowing over networks is a herculean task, but the mobile wireless industry has done an effective job. Text messaging is the mobile wireless consumers most popular service, in no small part due to the near total absence of spam. Certainly, any chosen mechanism will have some warts, giving cause for complaints. But, the occasional filtering error, or the requirement to certify intent prior to sending unsolicited bulk messages, is not reason to let the (idea of the) perfect be the enemy of the good.

The marketers' and position peddlers' lust for the SMS inbox is based on the consumers' attention and high response rate to text messages, but this attention is the consequence of the spam-free nature of the service. Recognizing this fact exposes the self-defeating nature of Twilio's efforts. Once the SMS inbox is opened to unsolicited bulk messages, consumers will

NOTES:

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¹ See 15 U.S.C. §§ 7703 *et seq.*

² See, e.g., J. Soma, P. Singer, and J. Hurd, *Spam Still Pays: The Failure of the CAN-SPAM Act of 2003 and Proposed Legal Solutions*, 45 HARVARD JOURNAL ON LEGISLATION 165-66 (2008); V. Arora, *The CAN-SPAM Act: An Inadequate Attempt to Deal with a Growing Problem*, 39 COLUMBIA JOURNAL OF LAW AND SOCIAL PROBLEMS 299-330 (2006); Federal Communications Commission's CAN-SPAM Page (available at: <http://www.fcc.gov/general/can-spam>); M³AAWG *Email Metrics Program: The Network Operators' Perspective*, Report #16 – 1st Quarter 2012 through 2nd Q, Messaging, Malware and Mobile Anti-Abuse Working Group (November 2014) (available at: http://www.m3aawg.org/sites/default/files/document/M3AAWG_2012-2014Q2_Spam_Metrics_Report16.pdf); F. Donovan, *Spotlight: 80 Percent of Global E-mail Traffic is Spam, Says ITU*, FIERCEITSECURITY (November 6, 2014) (available at: <http://www.fierceitsecurity.com/story/spotlight-80-percent-global-e-mail-traffic-spam-says-itu/2014-11-06>).

³ M. RitcheI, *E-Mail Gets and Instant Makeover*, NEW YORK TIMES (December 20, 2010) (available at: <http://www.nytimes.com/2010/12/21/technology/21email.html>); *Teens Fact Sheet*, PEW RESEARCH CENTER (May 21, 2012) (available at: <http://www.pewinternet.org/fact-sheets/teens-fact-sheet>).

⁴ *Hangin' Up: Is it Time to Cut Your Landline*, Squawkfox.com (June 15, 2013) (available at: <http://www.squawkfox.com/2013/06/15/landline>). Despite the *Do Not Call* registry, telemarketing remains prevalent. See, e.g., G. Bean, *Readers Weigh in On Failure of U.S. Do Not Call Registry*, THE HUB (March 21, 2013) (available at: http://hub.gmnews.com/news/2013-03-21/Columns/Readers_weigh_in_on_failure_of_US_Do_Not_Call_Regi.html); R. Macadangang, *FCC Approves New Rules So You Can Block Robocalls and Spam Text Messages*, TECH TIMES (June 20, 2015) (available at: <http://www.techtimes.com/articles/61936/20150620/fcc-approves-new-rules-so-you-can-block-robocalls-and-spam-text-messages.htm>).

⁵ See, e.g., J. Corpuz, *10 Best Messaging Apps*, TOM'S GUIDE (December 9, 2015) (available at: <http://www.tomsguide.com/us/pictures-story/654-best-messaging-apps.html>).

⁶ Opposition of CTIA, *Petition of Public Knowledge et al. for a Declaratory Ruling Stating that Text Messaging and Short Codes Are Title II Services or are Title I Services Subject to Section 202 Nondiscrimination Rules*, WT Docket No. 08-7 (Filed November 30, 2015) (hereinafter "CTIA Comments") at p. 5 (available at: <http://apps.fcc.gov/ecfs/document/view?id=60001340126>).

⁷ D. Johnson, *SMS Short Codes – What Every Business Needs to Know*, TATANGO (January 6, 2015) (available at: <http://www.tatango.com/blog/sms-short-codes-what-every-business-needs-to-know>) ("An SMS short code is a 5-6 digit phone number that is used by businesses to opt-in consumers to their SMS programs, and then used to send text message coupons, offers, promotions, etc. to those customers that had previously opted-in. A consumer interacts with an SMS short code by composing a new text message on their mobile device, and addressing it to the businesses 5-6 digit SMS short code."); *Best Practices and Successes*, CTIA: Policy & Initiatives (July 2015) (available at: <http://www.ctia.org/policy-initiatives/common-short-codes/best-practices-successes>); CTIA SHORT CODE MONITORING HANDBOOK (October 1, 2014) (available at: <https://www.usshortcodes.com/info/static/docs/CTIA%20Short%20Code%20Monitoring%20Handbook%20v1.5.2.pdf>).

⁸ *Petition For Expedited Declaratory Ruling of Twilio Inc., In re Petition of Twilio Inc. For an Expedited Ruling Stating that Messaging Services are Title II Services*, WT Docket 08-07 (filed August 28, 2015) (hereinafter "Twilio Petition") (available at: <http://apps.fcc.gov/ecfs/document/view?id=60001324418>).

⁹ *Protecting and Promoting the Open Internet*, FCC 15-24, REPORT AND ORDER ON REMAND, DECLARATORY RULING, AND ORDER, 30 FCC Rcd. 5601 (rel. Mar. 12, 2015) (hereinafter "2015 Open Internet Order").

¹⁰ *Twilio Petition*, *supra* n. 8. D. Johnson, *SMS Spammers Exploit Twilio – Send 385,000 Spam Text Messages*, TATANGO (February 13, 2014) (available at: <http://www.tatango.com/blog/sms-spammers-exploit-twilio-send-385000-spam-text-messages>); *Twilio Continues to Send SMS Spam, Even After Lawsuit*, TATANGO (April 18, 2012) (available at: <http://www.tatango.com/blog/sms-spammers-exploit-twilio-send-385000-spam-text-messages>).

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¹¹ See, e.g., *2015 Open Internet Order*, *supra* n. 9 at ¶¶15, 105, 112-113.

¹² <https://www.twilio.com/help/faq/sms/how-can-i-prevent-my-messages-from-being-filtered-as-spam> (visited March 8, 2016).

¹³ <https://www.twilio.com/help/faq/sms/can-my-twilio-sms-messages-be-blacklisted-as-spam> (visited March 8, 2016).

¹⁴ *Twilio Petition*, *supra* n. 8 at p. 7.

¹⁵ *CTIA Comments*, *supra* n. 6 at p. i.

¹⁶ *In re Rules and Regulations Implementing the Telephone Consumer Protection Act of 1991, et al.*, FCC 15-72, DECLARATORY RULING AND ORDER, 30 FCC Rcd 7961 (2015) at ¶ 119 (hereinafter “2015 TPC Order”).

¹⁷ *Twilio Petition*, *supra* n. 8 at p. 1.

¹⁸ *Id.* at p. 4.

¹⁹ *Anti-Phishing Best Practices for ISPs and Mailbox Providers*, M³AAWG White Paper (June 2015) (available at: https://www.m3aawg.org/sites/default/files/M3AAWG_AWPG_Anti_Phishing_Best_Practices-2015-06.pdf); C. Garretson, *ISPs Pitch In to Stop Spam*, PC WORLD (July 12, 2004) (available at: <http://www.pcmag.com/article/116843/article.html>).

²⁰ *2015 Open Internet Order*, *supra* n. 9 at ¶¶ 118, 376.

²¹ See, e.g., *Comments of Callfire, Inc.*, WT Docket No. 08-07 (November 20, 2015) (available at: <http://apps.fcc.gov/ecfs/document/view?id=60001339831>).

²² As is to be expected, when N rises the correlation increases, but profits and consumer surplus are always positively correlated.

²³ Consumer welfare is the sum of profits and consumer surplus less the fixed costs required to produce those benefits.

²⁴ *Twilio Petition*, *supra* n. 8 at p. 38.

²⁵ *CTIA Comments*, *supra* n. 6 at p. i.

²⁶ *U.S. Smartphone Use in 2015*, PEW RESEARCH CENTER (April 2, 2015), at p. 33 (available at: http://www.pewinternet.org/files/2015/03/PI_Smartphones_0401151.pdf).

²⁷ *Top Ten Uses for a Mobile Phone?*, DAILYMAIL.COM (October 30, 2014) (available at: <http://www.dailymail.co.uk/news/article-2815114/Top-ten-uses-mobile-phone-Calls-come-SIXTH-40-smartphone-users-say-manage-without-call-function-device.html>).

²⁸ See, e.g., M. Dano, *Analysts: Sprint/T-Mobile Must Merge or One Will Fail*, FIERCEWIRELESS.COM (April 11, 2014) (available at: <http://www.fiercewireless.com/story/analysts-sprint-mobile-must-merge-or-one-will-fail/2014-04-11>); C. Morran, *T-Mobile CEO Sees Cable/Wireless Mergers as Inevitable*, CONSUMERIST.COM (April 29, 2015) (available at: <https://consumerist.com/2015/04/29/t-mobile-ceo-sees-cablewireless-mergers-as-inevitable>); R. Knutson, T. Gryta, and S. Ramachandran, *Dish Network in Merger Talks with T-Mobile*, WALL STREET JOURNAL (June 4, 2015) (available at: <http://www.wsj.com/articles/dish-network-in-merger-talks-with-t-mobile-us-1433383285>); J. Engebretson, *Rural Wireless Consolidation: Nsight Buys Spectrum from Three Rural Carriers*, (December 8, 2015) (available at: <http://www.telecompetitor.com/rural-wireless-consolidation-nsight-buys-spectrum-from-three-rural-carriers>);

²⁹ See, e.g., N. Patel, *Department of Justice Files to Block AT&T/T-Mobile Merger, FCC Has ‘Serious Concerns’*, THE VERGE (August 31, 2011) (available at: <http://www.theverge.com/2011/08/31/att-t-mobile-merger-doj-files-block>).

³⁰ *Twilio Petition*, *supra* n. 8 at p. 10.

NOTES CONTINUED:

³¹ CTIA SHORT CODE MONITORING HANDBOOK, *supra* n. 7 at p. 2.

³² *Id.*

³³ *Twilio Petition*, *supra* n. 8 at p. 38.

³⁴ *2015 TPC Order*, *supra* n. 16 at ¶ 119.